AD NUMBER
AD337223
CLASSIFICATION CHANGES
TO: unclassified
FROM: confidential
LIMITATION CHANGES
TO: Approved for public release, distribution unlimited
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DSTL, AVIA 18/2041, 17 Nov 2008; DSTL, AVIA 18/2041, 17 Nov 2008

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Report No. AAEE/Tech/230/Nav.

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CATALOGED BY DDC
AS AD No. 337223

MINISTRY OF AVIATION

AEROPLANE AND ARMAMENT EXPERIMENTAL ESTABLISHMENT

BOSCOMBE DOWN

INVESTIGATION INTO THE DRIFT ACCURACY OF BLUE JACKET

[C]

BY

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NAVIGATION & RADIO DIVISION

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AAEE Form I.

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23 APR 1963

AEROPLANE AND ARMAMENT EXPERIMENTAL ESTABLISHMENT
BOSCOMBE DOWN

Investigation into the Drift Accuracy of Blue Jacket

by

Flt.Lt. R. F. Saunders R.A.F.
Navigation & Radio Division

Summary

In late 1961 A. & A.E.E. accepted a further commitment to investigate the drift accuracy of Blue Jacket which earlier had been found unsatisfactory, as reported in A. & A.E.E. Tech/210/Nav. The trial of a modified equipment took place between May and August 1962 and involved a total of 53 hours flying during which 40 assessable accuracy runs were completed. The accuracy of the equipment under test proved satisfactory (mean across track error 0.20° R (SD ± 0.30°), mean along track error 0% (SD ± 0.30%)), although the number of suspect sorties due to equipment unserviceabilities was high.

It is recommended that the modification (No. 6914) embodied in this equipment be incorporated in all Blue Jacket equipments.

This Report is issued with the authority of

Air Commodore,
Commandant, A. & A.E.E.

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/Introduction

1. Introduction

A Blue Jacket (ARI 5880) doppler navigation system was assessed by A. & A.E.E. between April and September, 1960. Report No. AAEE/Tech/210/Nav., dated 14th November, 1961 giving the results of this trial drew attention to a serious error in drift measurement. This error was proportional to (approximately 20% of) the actual drift experienced. No other serious fault was found in the equipment.

Blue Jacket is a fixed aerial (data stabilised) system, drift being computed and not directly measured. Investigation of the drift error showed that one of the computer constants (the broadside angle of the beam pattern) had been defined incorrectly. This is illustrated in fig.1. After adjustment of this constant in the computer network (Mod. No. 6914) A. & A.E.E. were required to re-assess the drift accuracy of the system.

The equipment was installed in Hastings C. Mk.2 WD.496 in April/May 1962, and flight trials were completed in August, 1962.

2. The Aim of the Trial

The trial had a limited objective namely to establish the accuracy of the basic doppler and computer over land.

3. Aircraft Installation and Instrumentation

3.1 Aircraft Installation. The Blue Jacket installation is fully described in A. & A.E.E. Tech/210/Nav. It consists of an aerial system, transmitter/receiver unit (T/R), navigational computer, and indicator unit. For the trial the whole of the Blue Jacket installation, with the exception of the aerial system, was positioned in the passenger compartment of Hastings C. Mk.2 WD.496. The aerial was mounted in a bay aft of the rear access panel and was fed by a flexible waveguide from the T/R unit which, along with the computer, was rack mounted in the passenger compartment. The indicator was fitted in the No.1 auto-observer.

In normal operation the following inputs are required by Blue Jacket:-

(i) A synchro input of heading for position, track, and wind velocity computations.

(ii) T.A.S., as an analogue voltage from an air data computer, for wind velocity computations.

(iii) A synchro input of pitch information, normally provided by a Master Reference Gyro, for the pitch stabilisation of the doppler aerial.

However in this trial, to control the computer trial more closely and simplify the installation and analysis, a constant heading of North and a manually controlled T.A.S. value were fed to the computer. The T.A.S. was manually set on a potentiometer sited in No.1 observer. The errors introduced by feeding in these constant values affected only the wind velocity computations which were not under analysis.

The doppler aerial was pitch stabilised by a synchro input of aircraft pitch provided by a locally constructed pendulous unit.

/For

For trials purposes the following additional items were included in the Blue Jacket installation:-

(i) Two synchronous repeaters were fitted to the Blue Jacket phonic wheel shafts to drive a pair of veeder counters, thus providing a direct read out of the phonic wheel count. The drive to the veeder counters could be interrupted by the two phonic wheel 'on/off' switches, enabling the displays to be frozen. This was an asset on ground accuracy runs.

(ii) A desyn transmitter was attached to the aerial to indicate the pitch angle between the aerial and fuselage.

(iii) A doppler A.G.C. meter was incorporated to supplement the "magic-eye" A.G.C. level display on the indicator unit.

(iv) A blower motor supplied cooling air around the computer unit.

3.2 Aircraft Instrumentation. The following items were installed in an auto-observer to record datum information and the performance of Blue Jacket:-

(i) Blue Jacket indicator

(ii) Phonic wheel veeder counters

(iii) Phonic wheel counters' 'ON/OFF' switches

(iv) Doppler A.G.C. meter

(v) Aerial pitch indicator (desyn repeater)

(vi) T.A.S. potentiometer graduated in 50 knot calibrations

(vii) Aircraft pitch and roll displayed on micro-ammeters

(viii) 200 v. A.C. supply meter

(ix) Red, green and purple Decca Mk.8 decometers

(x) Decca Mk.8 lane identification meter

(xi) Three Decca Mk.8 "No Torque" lamps

(xii) Watch

(xiii) Film frame veeder counter

(xiv) Doll's eye to indicate periscopic sextant operation

(xv) Doll's eye to indicate F.49 survey camera operation

(xvi) G4B master indicator

(xvii) Mk.XIV altimeter

Outside and to the right of the auto-observer were the Mk.4 artificial horizon (supplying aircraft pitch and roll readout information), and the 200 V. A.C. frequency meter.

Two further datum instruments, a periscopic bubble sextant and a F.49 survey camera, were fitted at their usual stations.

/The

The cameras could be fired from two alternative sources:-

(i) The T.35 camera control unit could operate the auto-observer camera (A4) and F.49 survey camera separately or in synchronism.

or

(ii) The sextant operator could operate the sextant camera and A4 camera simultaneously.

4. Trials Procedure

4.1 Establishment of Azimuth Datum. Before the flight trials it was necessary to establish a single datum on the aircraft to which all azimuthal alignments could be made. The line joining the aircraft's compass sighting rods was selected.

4.2 Ground Calibrations. The following ground calibrations and alignments were made:-

(i) Doppler Aerial Azimuthal Alignment. The azimuthal alignment of the doppler aerial was checked by photographic methods similar to those described in Appendix C to AAEE/TECH/210/NAV. The aerial mis-alignment was 0.46°P. $\pm 0.05^{\circ}$.

(ii) Periscopic Sextant Alignment. The periscopic sextant alignment error was determined by comparing simultaneous bearings of a distant spire taken on both the periscopic sextant and the Watts datum compass. The sextant under-read by $7.22^{\circ} \pm 0.10^{\circ}$.

(iii) F.49 Survey Camera. The F.49 survey camera's azimuthal mis-alignment from the aircraft's datum, was determined by the standard A. & A.E.E. photographic method. The mis-alignment was zero $\pm 0.05^{\circ}$.

(iv) G IV B Compass Calibrations. Prior to flight tests a standard 12 point compass calibration plus Fouriers analysis was carried out using a Watts datum compass. Corrections were made for co-efficients 'A', 'B' and 'C'. During the trial, after 3 months had elapsed, a further compass swing was completed; corrections were made for co-efficients 'A' and 'B'.

(v) Doppler Aerial Pitch Alignment. With the aircraft levelled and the doppler and pendulous device switched on, the aerial synchronous control transformer was rotated until the aerial was assessed as level against a clinometer and than locked in position.

(vi) Aerial Desyn Indicator Calibration. After the aerial had been levelled in pitch and with the doppler and pendulous device still 'on', the position of the pointer on the desyn indicator was marked. The aircraft pitch indicator reading and the clinometer reading on the aerial were also noted at this time. With the pendulous device 'off', the aerial was displaced either side of the horizontal in 2° steps measured by the clinometer. The desyn indicator was calibrated accordingly, the range being from 10° nose up to 4° nose down.

At the end of the trial the alignments of the periscopic sextant and the doppler aerial, in pitch and azimuth, were repeated. The calibration of the aerial pitch indicator was also checked. No significant changes were noted.

/4.3

4.3 Flight Planning. In planning the accuracy runs the following requirements were considered:-

(i) Tracks were to be overland, approximately 100 nms in length and in class '.' Decca coverage.

(ii) Tracks were to be orientated to give maximum drift compatible with preventing the sun's azimuth falling between 040° - 110° (Rel.), within this sector it is impossible to take astronomical observations in Hastings WD.496.

(iii) The timing of the trip to be such that class 'A' Decca fixing accuracy could still be achieved with the sun's altitude below 40°. Altitudes below 40° were required to give good astronomical heading checks.

4.4 Trials Methods. Throughout the trial the aircraft was flown on a constant magnetic heading for each accuracy run. Astro heading checks, in groups of ten observations over two minutes, were taken at intervals of 5 minutes - averaging six checks per leg. From each astro check a correction was calculated to convert magnetic headings to true. To obtain maximum compass performance, at least three minutes were allowed to elapse having settled on heading, before starting the accuracy run. The compass, along with all other instruments in the auto-observer, was photographed at ten second intervals.

On all accuracy runs the Blue Jacket computer was used in the grid mode with the "land/sea" bias switch set to "land".

It was intended to use a limited amount of survey photography as a source of datum heading on this trial. However weather conditions prevented this, since at suitable heights (above 12,000') lower cloud was always in excess of 4/8.

4.5 Trials Analysis. A similar method of analysis to that used on the previous Blue Jacket trial was employed. From the Decca co-ordinates at the time of the sextant check, and the G.H.A. and declination of the sun, the sun's azimuth was computed. This was added to the corrected sextant bearing to give true heading, from which corrections to compass heading could be obtained (see para. 4.4).

Each accuracy run was split into two or three sections in which the heading and drift remained sensibly constant. For each section the following information was extracted and fed into a Pegasus computer programme:-

(i) Mean true heading

(ii) Phonic wheel counts

(iii) Mean latitude

(iv) Height

(v) Elapsed time

The Decca fix at the start of the run was also included. For each section the following were computed:-

(i) Miles along and across heading (uncorrected for height).

(ii) Doppler distance

(iii) Average drift angle and track

/(iv)

(iv) Doppler nautical miles N/S and E/W

(v) Change of latitude and longitude

(CH.LAT. = Doppler nms N/S x Ht. correction x Lat. conversion factor)

(CH.LONG. = Doppler nms E/W x Ht. correction x Long. conversion factor)

(The latitude and longitude conversion factors change units of 6080 ft. into minutes of latitude and longitude, allowing for the shape of the earth and convergency).

(vi) The computed Blue Jacket position, in geographical co-ordinates, at the end of the period (by summing (v) and the Decca start position).

Mean heading and drift, weighted for the duration of each section, along with total doppler distance were also calculated.

The basic doppler accuracy analysis was made by plotting the final computed doppler position and the final Decca fix to a large scale on graph paper. The basic along, across and radial errors were then measured.

As the computer received a fixed true North heading the grid nms N/S and E/W on the indicator should have corresponded to nms. along and across heading ((i) above). Thus computer errors were found by a simple comparison.

5. Sorties and Hours Flown

18 sorties, totalling 53 hrs. 25 mins., were flown during the Blue Jacket trial from May - August, 1962.

The breakdown of the 18 sorties flown was as follows:-

(i) 6 sorties suspect due to equipment unserviceabilities (18 hrs. 10 min.)

(ii) 1 sortie suspect due to fault on aircraft power supplies (4 hrs. 10 mins.)

(iii) 3 sorties abandoned owing to bad weather (5 hrs. 20 min.)

(iv) 8 sorties successful (25 hrs. 45 min.)

6. Flight Trials Results

6.1 Reliability. After 12 hrs. 20 mins. flying the magnetron was found to be below standard as were both signal crystals. On investigation further faults were discovered. The phonic wheel switching relay and the computer easting synchro were intermittent in operation and the one phonic wheel was not tracking accurately. One month later the equipment was returned serviceable and the trial re-started. All previous results were discarded.

For the remainder of the trial a full test set check was carried out before and after each sortie. On an after-flight check when a further 8 hrs. 30 mins. had been completed, one phase of the 200 v. supply was found to be low. Although the cause of this was not traced, it was attributed to an intermittent aircraft fault. The results from this sortie were treated as suspect.

After a further ten hours an after flight check showed that the A.F.C. was losing lock at intervals of ½ sec.. This was traced to faulty connections between the T/R unit and the rack back plate. The results from this sortie were regarded as suspect.

A further fault occurred eleven hours later when the symptoms of A.F.C. losing lock at ½ sec. intervals again appeared in an after flight check. On inspection an oil filled capacitor in the T/R unit was found to be leaking. The T/R unit was replaced for the last four sorties.

6.2 Number of Results. Results prior to the magnetron failure were discarded and a further 40 accuracy runs were flown. The results are tabulated at Appendix I. However 12 of these runs were suspect, yet it may be seen from para. 6.3 that their inclusion does not significantly alter the overall results. The final analysis is based on the 40 accuracy runs.

6.3 Basic Accuracy - Land

	Along Track Error % (O/U)	Across Track Error ° (R/L)	Radial Error
Mean of 40 runs	0.0%	0.20°R	0.60%
S.D. of 40 runs	± 0.30%	± 0.30°	± 0.40%
Mean of 28 runs	0.0%	0.20°R	0.50%
S.D. of 28 runs	± 0.20%	± 0.20°	± 0.30%

(O: over-read R: Right)
(U: under-read L: Left)

6.4 Computer Accuracy. The results of the 40 accuracy runs flown with Blue Jacket computer in the grid mode and "land/Sea" switch to "land" are:-

	Along Track Error (% O/U)	Across Track Error (° R/L)	Radial Error
Mean	0.40% (O)	0.10° (R)	0.50%
S.D.	± 0.30%	± 0.20°	± 0.30%

7. Conclusions

7.1 Accuracy. It is concluded that:-

(i) **The embodiment of modification number 6914 in this equipment has overcome the drift error reported in AAEE/Tech/210/Nav.**

(ii) **The Mean Blue Jacket basic along track error overland was zero (S.D. ± 0.30%).**

(iii) **The Mean Blue Jacket basic across track error overland was 0.20°R (S.D. ± 0.30°).**

(iv) **The Mean Blue Jacket radial error was 0.60% (S.D. ± 0.40%)**

(v) **The computer errors were 0.40% (over read) along track in the 'land' mode (S.D. ± 0.30%); 0.10°(R) (S.D. ± 0.20°) across track and a radial error of 0.50% (S.D. ± 0.30%).**

/7.2

7.2 Reliability. In spite of the able technical backing provided by R.R.E. during this trial, the units under test proved disappointingly unreliable during flight trials.

8. Recommendations

It is recommended that modification number 6914 be incorporated in A.R.I. 5880. This modification is considered essential.

Circulation List

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Appendix I

Date	Height	Mean Heading	Dist	Basic Results			Mean Drift	Computer			
				% O/U	R/L°	Radial Error		%(O)/(U)	R/L°	Radial Error	
3 July	7,950 9,000 8,000 9,000	266.98 069.99 267.18 071.53	104.83 78.16 94.97 92.23	0.09(U) 0.01 (U) 0.10 (U) 0.08 (O)	0.37° (R) 0.09° (R) 0.36° (R) 0.06° (R)	0.57% 0.19% 0.64% 0.13%	9.46° P 9.35° S 8.89° P 9.11° S	0.19 (U) 0.31 (O) 0.19 (U) 0.65 (O)	0.14° (R) 0.26° (R) 0.06° (R) 0	0.31% 0.54% 0.21% 0.65%	
19 July	13,850 13,900 14,900 13,900 13,000 12,000	250.73 269.41 079.32 259.07 079.25 259.10	49.77 57.86 101.82 95.47 93.15 94.40	0.36 (U) 0.26 (U) 0.08 (U) 0.09 (U) 0.51 (O) 0.71 (U)	0.23° (R) 0.12° (R) 0.06° (R) 0.71° (R) 0 0.82° (R)	0.54% 0.31% 0.12% 1.28% 0.51% 1.61%	0.29° P 5.83° S 0.07° S 3.71° S 1.39° P 4.83° S	0.20 (O) 0.28 (O) 0.18 (O) 0.35 (O) 0.24 (O) 0.64 (O)	0.40° (R) 0.50° (R) 0.15° (R) 0.19° (R) 0.09° (R) 0.05° (R)	0.72% 0.90% 0.31% 0.47% 0.26% 0.65%	Fault (1 phase of 3 phase supply down) discovered after this exercise.
23 July	9,750 14,750 13,750	075.66 005.45 229.06	98.78 103.97 81.21	0.10 (U) 0.19 (U) 0.10 (U)	0.46° (R) 0.37° (R) 0.29° (R)	0.81% 0.66% 0.52%	1.30° S 8.48° S 5.66° P	0.40 (O) 0.69 (O) 0.31 (O)	0.09° (L) 0.10° (R) 0.08° (L)	0.43% 0.72% 0.32%	
25 July	15,800 17,300 15,900 16,800	253.67 088.39 250.50 087.74	83.24 97.60 96.48 120.64	0.26 (O) 0.15 (U) 0.16 (U) 0.14 (U)	0.55° (R) 0.61° (L) 0.27° (R) 0.59° (L)	0.98% 1.07% 0.59% 1.03%	8.19° S 7.48° P 6.98° S 7.16° P	0.83 (O) 0.18 (O) 0.12 (O) 0.14 (O)	0.28° (R) 0.11° (R) 0.06° (R) 0.18° (L)	0.95% 0.24% 0.12% 0.35%	A.F.C. losing lock at intervals of $\frac{1}{2}$ sec.
27 July	11,950 11,000 11,900	259.68 075.31 259.71	108.96 94.05 100.43	0.14 (U) 0.75 (O) 0.30 (O)	0.07° (L) 0.34° (R) 0.01° (L)	0.19% 0.98% 0.30%	2.68° P 2.72° S 2.41° P	0.30 (O) 0.32 (O) 0.40 (O)	0.25° (R) 0.06° (R) 0.04° (R)	0.58% 0.35% 0.41%	) Memory light on momentarily) Pitch on aerial.
31 July	14,800 14,800 14,900 13,800	002.85 220.71 019.28 221.69	100.64 76.90 92.16 94.92	0 0.27 (U) 0.25 (O) 0.20 (U)	0.55° (R) 0.57° (R) 0.63° (R) 0.30° (R)	0.95% 1.05% 1.13% 0.57%	12.01° S 11.64° P 9.44° S 10.82° P	0.17 (O) 0.12 (U) 0.65 (O) 0.25 (O)	0.42° (R) 0.05° (L) 0.01° (L) 0.09° (L)	0.73% 0.14% 0.66% 0.30%	
13 Aug	14,800	009.90	115.66	0.24 (U)	0.10° (R)	0.30%	7.52° S	0.60 (O)	0.15° (R)	0.65%	
17 Aug	12,900 13,400 12,500 13,450	009.11 060.11 272.66 083.52	102.33 74.75 84.80 75.83	0.05 (O) 0.20 (O) 0.07 (O) 0.21 (O)	0.01° (R) 0.11° (L) 0.07° (L) 0.17° (L)	0.05% 0.25% 0.14% 0.37%	3.75° S 5.06° S 4.89° P 4.99° S	0.63 (O) 0.51 (O) 0.25 (O) 0.47 (O)	0.39° (R) 0.19° (R) 0.11° (R) 0.12° (R)	0.94% 0.61% 0.28% 0.53%	

23 July	9,750 14,750 13,750	075.66 005.45 229.06	98.78 103.97 81.21	0.10 (U) 0.19 (U) 0.10 (U)	0.46° (R) 0.37° (R) 0.29° (R)	0.81% 0.66% 0.52%	1.30° S 8.48° S 5.66° P	0.40 (0) 0.69 (0) 0.31 (0)	0.09° (L) 0.10° (R) 0.08° (L)	0.43% 0.72% 0.32%	
25 July	15,800 17,300 15,900 16,800	253.67 088.39 250.50 087.74	83.24 97.60 96.48 120.64	0.26 (0) 0.15 (U) 0.16 (U) 0.14 (U)	0.55° (R) 0.61° (L) 0.27° (R) 0.59° (L)	0.98% 1.07% 0.59% 1.03%	8.19° S 7.48° P 6.98° S 7.16° P	0.83 (0) 0.18 (0) 0.12 (0) 0.14 (0)	0.28° (R) 0.11° (R) 0.06° (R) 0.18° (L)	0.95% 0.24% 0.12% 0.35%	A.F.C. losing lock at intervals of $\frac{1}{2}$ sec.
27 July	11,950 11,000 11,900	259.68 075.31 259.71	108.96 94.05 100.43	0.14 (U) 0.75 (0) 0.30 (0)	0.07° (L) 0.34° (R) 0.01° (L)	0.19% 0.98% 0.30%	2.68° P 2.72° S 2.41° P	0.30 (0) 0.32 (0) 0.40 (0)	0.25° (R) 0.06° (R) 0.04° (R)	0.58% 0.35% 0.41%	)Memory light on momentarily)Pitch on aerial.
31 July	14,800 14,800 14,900 13,800	002.85 220.71 019.28 221.69	100.64 76.90 92.16 94.92	0 0.27 (U) 0.25 (0) 0.20 (U)	0.55° (R) 0.57° (R) 0.63° (R) 0.30° (R)	0.95% 1.05% 1.13% 0.57%	12.01° S 11.64° P 9.44° S 10.82° P	0.17 (0) 0.12 (U) 0.65 (0) 0.25 (0)	0.42° (R) 0.05° (L) 0.01° (L) 0.09° (L)	0.73% 0.14% 0.66% 0.30%	
13 Aug	14,800	009.90	115.66	0.24 (U)	0.10° (R)	0.30%	7.52° S	0.60 (0)	0.15° (R)	0.65%	
17 Aug.	12,900 13,400 12,500 13,450	009.11 080.11 272.66 083.52	102.33 74.75 84.80 75.83	0.05 (0) 0.20 (0) 0.07 (0) 0.21 (0)	0.01° (R) 0.11° (L) 0.07° (L) 0.17° (L)	0.05% 0.25% 0.14% 0.37%	3.75° S 5.06° S 4.89° P 4.99° S	0.63 (0) 0.51 (0) 0.25 (0) 0.47 (0)	0.39° (R) 0.19° (R) 0.11° (R) 0.12° (R)	0.94% 0.61% 0.28% 0.53%	
20 Aug.	12,450 13,350 12,400 13,450	255.82 090.44 256.35 093.64	94.85 94.46 70.01 87.00	0.05 (U) 0.05 (U) 0.03 (U) 0.13 (0)	0.58° (R) 0.00° (R) 0.19° (R) 0.11° (L)	0.61% 0.16% 0.34% 0.24%	7.85° S 7.58° P 6.84° S 7.17° P	0.67 (0) 0.07 (0) 0.53 (0) 0.41 (0)	0.51° (R) 0.06° (L) 0.24° (R) 0.13° (L)	1.11% 0.11% 0.69% 0.83%	
22 Aug	12,800 11,900 12,900 13,950	003.63 213.68 013.73 222.09	100.25 82.39 74.57 92.31	0.11 (0) 0.04 (0) 0.27 (0) 0.05 (U)	0.39° (R) 0.10° (L) 0.21° (R) 0.16° (R)	0.70% 0.18% 0.46% 0.28%	10.16° S 10.20° P 10.85° S 9.09° P	0.71 (0) 0.04 (0) 0.72 (0) 0.27 (0)	0.32° (R) 0.10° (L) 0.08° (L) 0.35° (L)	0.91% 0.18% 0.74% 0.67%	
27 Aug.	12,900 13,850 14,900	001.44 225.28 021.49	113.70 77.99 74.93	0.18 (0) 0.09 (U) 0.40 (0)	0.09° (R) 0.24° (R) 0.72° (R)	0.22% 0.44% 1.31%	14.99° S 12.65° P 12.87° S	0.88 (0) 0.05 (0) 0.67 (0)	0.33° (R) 0.07° (L) 0.02° (L)	1.05% 0.14% 0.67%	)1 heading check only for)each of these 2 runs,)so results doubtful.

	Basic Along Track Error (0)/(U)	Basic Across Track Error ° P/S	Computer Along Track Error (0)/(U)	Computer Across Track Error ° P/S	Basic Radial Error	Computer Radial Error
Mean 40 runs	0.00.	0.20° R	0.40% (0)	0.10° R	0.60%	0.50%
Mean 28 runs	0.00%	0.20° R	0.40% (0)	0.10° R	0.50%	0.60%
S.D. 40 runs	±0.30%	±0.30°	±0.30%	±0.20°	±0.40%	±0.30%
S.D. 28 runs	±0.20%	±0.20°	±0.30%	±0.20°	±0.30%	±0.30%

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FIG. I.

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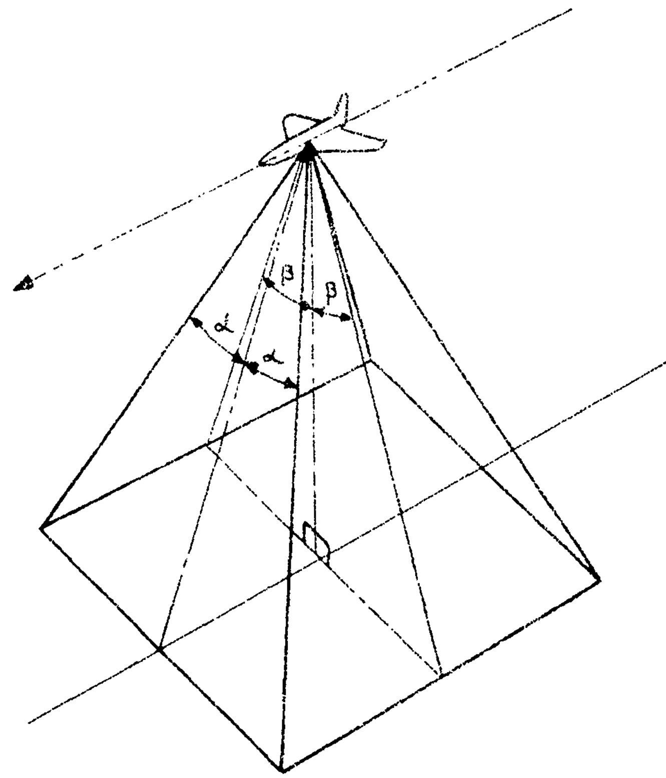

α = AERIAL BROADSIDE ANGLE AS FOUND IN POLAR DIAGRAM MEASUREMENTS.

β = AERIAL BROADSIDE ANGLE AS DEFINED IN AERIAL GEOMETRY & DRIFT CALCULATION EQUATION.

IN THE FIRST BLUE JACKET TRIAL THE ANGLE α WAS USED INSTEAD OF β, MAKING THE COMPUTER CONSTANT 'b' = 0·3704. USING ANGLE β THE 'b' VALUE IS 0·4010.

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BLUE JACKET BEAM CONFIGURATION.

SK. No. B1515 — TECH./230/NAV. — TR S.J.H — CH. S/LDR SAUNDERS — APP.

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Date of Search: 17 November 2008

Record Summary: AVIA 18/2041

Title: Investigation into the drift accuracy of Blue Jacket
Availability Open Document, Open Description, Normal Closure before FOI Act: 30 years
Former reference (Department) AAEE/TECH 230/N
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