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14th Part of Report No. AAEE/861/2.



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MINISTRY OF SUPPLY

AEROPLANE AND ARMAMENT EXPERIMENTAL ESTABLISHMENT

BOSCOMBE DOWN

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EXECUTIVE ORDER

CANBERRA P.R. MK.3 VX.181
(2 X AVON 1)

FUNCTIONAL TRIALS OF 8 INCH LOW TERMINAL VELOCITY
PHOTOGRAPHIC FLASH

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ARMY ATTACHE, LONDON.

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REPORT NUMBER R-1250-54	FROM OARMA-London	PREPARED BY JOHN L. ATKINS, SciCons	SOURCE Min of Supply	DATE OF REPORT 23 June '54
SUBJECT Pyrotechnic Tests (U)		REFERENCES	EVALUATION	DATE OF INFO Mar/Apr 1954
SUMMARY Transmitted are the following Aeroplane and Armament Experimental Establishment reports: AAEE/861/2(14th Part) "Functional Trials of 8 inch low terminal velocity photographic flash" reports trials of subject equipment in a Canberra P.R.Mk 3 aircraft. AAEE/861/2(15th Part) "Carriage and Release of Flashes, Photographic Aircraft, 4.5 in Fuzed M11-A2" reports trials of subject equipment in a Canberra P.R.Mk 3 aircraft. COMMENT: Copies of the inclosures are marked for transmittal to ORDTA to whom they will be of interest. Dist by Orig: None 2 Incis - 5 copies of each 1-AAEE/861/2(14th Part) 2-AAEE/861/2(15th Part) APPROVED FOR THE ARMY ATTACHE: Ernest C. McINNIS Lt. Colonel, GS Acting Executive Officer Downgraded to UNCLASSIFIED when separated from the inclosures.				
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AEROPLANE AND ARMAMENT EXPERIMENTAL ESTABLISHMENT
BOSCOMBE DOWN

Canberra P.R. Mk.3 VX.181
(2 x Avon 1)

Functional Trials of 8 inch Low Terminal Velocity
Photographic Flash

A.& A.E.E. Ref: AAEE/5935/2/7.

M. O. S. Ref: 7/Armts/784.

Period of Trial: February - October, 1953.

Progress of issue of Report

Report No.	Title
9th Part of AAEE/861/2	VX.181 Night Photographic Trials.
10th - do -	WE.137 Cockpit Appraisal.
11th - do -	WE.137 Brief Handling Tests on a Production Aircraft with Special Reference to Lateral and Direction Behaviour.
12th - do -	VX.181 Acceptance Trials of Armament Installation and 16½ inch Photo Flash.
13th - do -	WE.135 Jettisoning of Wing-Tip Tanks in Flight.

Summary

1. Functional trials of the 8 inch L.T.V. photoflash including carriage and release from a Canberra P.R.3 aircraft have been completed.
2. It is recommended that the 8 inch photoflash be accepted for Service use from a functional aspect.
3. It is further recommended that, subject to the essential modifications in para. 7.3 being incorporated, the Canberra P.R.3 be cleared for the carriage and release of three 8 inch photoflashes within the limitations detailed in M.O.S. Trials Pro-forma 1/53 R.D.Arm.2, viz:-

3.1 Carriage

3.1.1 Bomb Bay Doors Closed. To maximum permissible speed and height of the aircraft through normal manoeuvres to the maximum G limitations of the aircraft.

3.1.2 Bomb Bay Doors Open. Up to and including 350 knots I.A.S. or 0.75 I.M.N., whichever is the lesser value, to 20,000 feet in straight and level flight and in angles of climb and dive of 10°, through normal manoeuvres to the maximum G limitations of the aircraft.

3.2 Release. Up to and including 350 knots I.A.S. or 0.75 I.M.N., whichever is the lesser value, in straight and level flight from 6,000 feet to 20,000 feet inclusive.

This Report is issued with the authority of

[Signature]

Air Commodore
Commanding A.& A.E.E.

AD-033159

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1. Introduction

1.1 Acceptance trials of the 8 inch low terminal velocity photoflash, including carriage and release from a Canberra P.R.3 aircraft, have been completed as requested by Ministry of Supply Trials Pro-forma 1/53 R.D.Arm.2 dated 7th February, 1953.

2. Object of Trial

2.1 The object of the trial was to determine that the 8 inch photoflash was:-

2.1.1 Acceptable for service use.

2.1.2 Suitable for carriage and release from a Canberra P.R.3 aircraft.

3. Description of Installation

3.1 Aircraft Bombing Installation. The bombing installation of the Canberra P.R.3 aircraft is described in para. 3 of the 12th part of this report.

3.2 Multi-Store Carrier. The No.1 Mark 1 Multi-Store Carrier is a Naval store; it is described in A.P. 1664 A, Vol. 1, Sect. 1, Chapter 19. A photograph of the carrier adapted for three 8 inch photoflashes is shown at Figure 1.

4. Method of Trial

4.1 Ground Tests. The ground tests consisted of:-

4.1.1 Checking the aircraft bombing installation.

4.1.2 Adapting the No. 1 Mark 1 Carrier for three 8 inch photoflashes.

4.1.3 Fitting the carrier on the aircraft.

4.1.4 Examining and preparing the photoflashes.

4.1.5 Loading three photoflashes on the aircraft.

4.1.6 Measuring clearance angles.

4.1.7 Taking photographs.

4.2 Air Tests

4.2.1 Carriage. Sorties were flown up to and including the maximum permissible height and speed of the aircraft to ensure that the stores and installation remained rigid and safe. The installation was examined after each flight.

4.2.2 Release. Inert and live photoflashes were released at heights from 6,000 feet to 20,000 feet and at speeds from 250 to 350 knots I.A.S. to ensure that the stores would release cleanly from the aircraft and would function. All releases were photographed by cameras fitted at the aircraft wing tips and in the flare bay. Ground and air observers noted, where possible, how the stores functioned. The luminosity of the photoflashes was not tested as vibration trials with the camera mountings were still in progress. Releases were restricted to 350 knots I.A.S. as this covered the operational requirements with the present photographic equipment.

5. Results of Trial

5.1 Ground Tests

5.1.1 Aircraft Bombing Installation. Examination of the Canberra P.R.3 bombing installation showed that a number of modifications were necessary

/for.....

for the satisfactory carriage and release of 8 inch photoflashes. These modifications which are the same as those recommended during a previous trial on the Canberra P.R.3 with 16 $\frac{1}{2}$ inch photoflashes, are enumerated in para. 7.1.1 of the 12th Part of this Report. They are:-

- (i) A new type of manual de-bombing system for the No.3 Release Unit i.e. bowden cable.
- (ii) Anchoring the 9/16" nuts of the flare beam front suspension bolts to the inside of the beam brackets.
- (iii) Repositioning the seven pole socket on the flare beam in a horizontal position.
- (iv) Fitting "FLASHES GONE" indicators in all three crew positions.
- (v) Making the pilots emergency jettison switch selective i.e. "SAFE" or "LIVE".

5.1.2 Adapting the Multi-Store Carrier for three 8 inch Photoflashes.

By altering the position of the components the No.1 Mark 1 Multi-store carrier can be adapted for various stores. To make it suitable for the carriage and release of three 8 inch photoflashes the components had to be repositioned and the electric wiring modified as detailed at Appendix A.

5.1.3 Fitting the modified Carrier to the Aircraft

(i) The multi-store carrier was suspended from the No.3 Release Unit on the flare beam. The carrier could not be crutched satisfactorily using the flare beam crutching pads which were too long and, on the port side, did not fit the carrier crutching brackets. Two reaction screws (11A/3375) of the 100/1000 lb. Carrier Unit were used on the starboard side and two multi-store carrier reaction screws on the port side. These were satisfactory, the carrier being crutched rigid and parallel to the flare beam.

(ii) The seven pin and five pin plugs were fitted into the appropriate sockets on the flare beam and the auto-selector switch set to "1". Functioning tests of the release, jettison and fuzing circuits were made; these were satisfactory, the order of release being centre, port and starboard.

5.1.4 Examination of the 8 inch Photoflash. The body of the flash is cylindrical with a blunt nose, the nose fuze pocket being closed with a No. 28 plug. A No. 29 suspension lug fits into the body of the flash for suspension on a No. 1 Release Unit. The tail unit is conical with fixed cylindrical fins, it is secured to the flash body with four Allen screws. The flash is nose fuze with a M111-A.2 Fuze. The measurements of the photoflash fitted with a M111-A.2 fuze are:-

Length	59 $\frac{1}{2}$ inches approx.
Diameter	8 inches approx.
Weight	145 pounds approx.

5.1.5 Fuzing the 8 inch Photoflash. Fuzing the 8 inch photoflash is similar to fuzing a 4.5 inch photoflash fitted with a M111-A.2 fuze. Details of fuzing the 4.5 inches photoflash are contained in A.P. 1661 E, Col. 1 (2nd Edition) Section 11, Appendix 3, paras 4 to 12.

5.1.6 Loading the Aircraft. Three 8 inch photoflashes were loaded nose forward on the multi-store carrier which had been fitted to the flare beam, these were crutched rigid and parallel to the pylons. No difficulty was experienced during loading. For most of the loading an ALVIS low loader trolley was used to lift the three stores to within a few inches of the release slips, the photoflashes were then fitted manually.

5.1.7 Clearance Angles Clearance angles of the three stores fitted with M111-A.2 fuzes are:

/(i).....

(i) Roll	Starboard 17° Port 15°
(ii) Dive	42°
(iii) Climb	63°

5.1.8 Photographs. Photographs of the photoflashes fitted to the multi-store carrier are at Figures 1 and 2.

5.2 Air Tests

5.2.1 Carriage. The handling of the aircraft loaded with three 8 inch photoflashes, with flare bay doors open and closed, was satisfactory. Details of the sorties flown are at Appendix "B".

5.2.2 Release

(i) A total of 21 sorties was flown during which 42 inert and 20 live stores were released. Details of the sorties are at Appendix 'C'. All stores released cleanly from the aircraft and 18 live stores functioned in the air. Although the other two live stores were released "SAFE", these functioned on impact. Sortie No. 21 was completed at the request of R.A.E.

(ii) A number of inadvertent multiple releases occurred during the earlier part of the trial at speeds over 300 knots I.A.S. In each case the auto-selector switch had rotated as though the release button had been operated more than once. This indicated that the circuit was making and breaking during the time the release button was pressed. The circuit and all components were checked for faults which would cause intermittent contact but no faults were found. Replacing the auto-selector switch, the release button, and the flare bay door micro-switches did not prevent further inadvertent releases. By gradually increasing the speed of the aircraft from 250 knots I.A.S., with the flare bay doors open and the release button pressed, it was established that the inadvertent releases occurred at speeds over 300 knots I.A.S., the probable cause being vibration. The flare bay door micro switches were suspected as being the most susceptible to vibration, so this test was repeated with them shorted out; no inadvertent releases occurred. The micro switches were reconnected and a sluggish relay (Stores Ref. 5D/1412) fitted into the circuit to damp the intermittent contacts, thereafter no further inadvertent releases occurred.

(iii) Because of low cloud it was not possible to measure accurately from the ground the heights at which the live photoflashes functioned. The heights, which were estimated by observers in the aircraft, were consistent with the settings which had been set on the M111-A.2 fuzes.

6. Conclusions

6.1 It is concluded that:-

6.1.1 The 8 inch photoflash is acceptable for Service use from a functional aspect.

6.1.2 Further trials may be necessary to test the efficiency of the photoflash as a photographic illuminant.

6.1.3 Subject to the modifications enumerated in para. 7.3 being incorporated, the Canberra P.R.3 aircraft is suitable for the carriage and release of three 8 inch photoflashes within the limitations given in paras. 7.2.1 and 7.2.2.

7. Recommendations

7.1 Acceptance. It is recommended that the 8 inch low terminal velocity photoflash be accepted for service use from a functional aspect. Photographic

/trials.....

trials may be necessary to test the efficiency of the photoflash as a photographic illuminant.

7.2 Carriage and Release Clearance. Subject to the modifications in para. 7.3 being incorporated, it is recommended that the Canberra P.R.3 be cleared for the carriage and release of three 8 inch photoflashes on and from the top three positions of a No.1 Mark 1 Multi-store carrier within the limitations detailed in M.O.S. Trials Pro-forma 1/53 R.D.Arm.2, viz:-

7.2.1 Carriage

(i) Flare Bay Doors Closed, to maximum permissible speed and height of the aircraft through normal manoeuvres to maximum G limitations of the aircraft.

(ii) Flare Bay Doors Open, up to and including 350 knots I.A.S. or 0.75 I.M.N. whichever is the lesser value, to 20,000 feet in straight and level flight and in angles of climb and dive of 10° through normal manoeuvres to the maximum G limitations of the aircraft.

7.2.2 Release. Up to and including 350 knots I.A.S. or 0.75 I.M.N. whichever is the lesser value, in straight and level flight from 6,000 feet to 20,000 feet inclusive.

7.3 Modifications. It is recommended that the following modifications be incorporated in the 8 inch photoflash installation of the Canberra P.R.3 aircraft.

7.3.1 Those modifications enumerated in the 12th Part of A.& A.E.E. Report No. 861/2 para. 7.1.1 and in para. 5.1.1 of this Report.

7.3.2 Modification of the No. 1 Mark 1 Multi-store carrier to make it suitable for the carriage and release of three nose fuze 8 inch photoflashes.

7.3.3 Replacement of the existing flare beam crutching pads with reaction screws.

7.3.4 Modification of the flare bay door switch installation so that the switches are unaffected by small movements of the flare bay doors in flight.

7.4 Jettison. As the 8 inch photoflash fitted with a M111-A.2 fuze will function on impact even if released "SAFE", it is recommended that they should be jettisoned "LIVE" over friendly territory.

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Proposed Modification to No. 1 Mark 1 Multi-store Carrier

1. This modification is necessary to adapt the No. 1 Mark 1 Multi-store Carrier for the carriage and release of three 8 inch photoflashes from Canberra aircraft.

2. Parts required

<u>Section</u>	<u>Reference No.</u>	<u>Nomenclature</u>	<u>Quantity (per carrier)</u>
5D	1478	Fuzing Units No. 2 Mk. 1	3
-	-	Mounting Brackets (see Fig.3)	3
11A	2329	Fuzing Slide 4" long	3
28S	2766	Screws m/s Cheese head 2BA x $\frac{1}{2}$ "	4
28M	6057	Nuts, Simmonds 2BA	4
28W	13378	Washers, 2BA	4
5D	1733	Plugs, seven pole	1
5D	512	Plugs, five pole	1
5E	2108	Cable, duvin	As required
5E	2116	Cable, septuvin	As required

3. The estimated time per carrier is eight man hours.

4. Sequence of operations

4.1 Remove the electrical plugs "A" and "B" from their sockets in the junction box.

4.2 Disconnect the lower pylon jettison links from the bell crank levers on the rear cross member of the carrier frame.

4.3 Remove the eight crutch pads from the cross members adjacent to the lower pylon points of attachment.

4.4 Remove the bolts securing the pylons to the attachment brackets and take out the two lower pylons.

4.5 Replace the eight crutch pads in the front and rear cross members of the carrier frame.

4.6 Remove the release unit housing securing bolts and reposition the housings in the intermediate position.

4.7 Remove the fuzing units from the rear cross member.

4.8 Fit the fuzing units on the front cross member using the brackets shown in figure 3. The outer brackets are secured in position by the bolts holding the upper outer pylons. The centre bracket is held in position by four 2BA bolts attaching it to the plate carrying the junction and link boxes, the position can be seen in Figures 1 and 2.

4.9 Alter the wiring of the multi-store carrier to conform to the wiring diagram shown at Figure 4.

Flight Carriage Table

Sortie No. (a)	Details of Test (b)	Speed (c)	Height (d)	Observations (e)	
1	Carriage of Three Eight inch Photoflashes. Bomb Doors Closed.	350 knots	16,000 ft.	Stores and Carrier Rigid. Satisfactory. Normal Manoeuvres to + 4 G. Climbs and Dives of 15°.	
2	As for Sortie 1 - To Maximum Speed and Payload of Aircraft.	0.78 I.M.N.	35,000 ft.	Stores and Carrier Rigid. Satisfactory. Speed was highest obtainable in Straight and Level Flight.	
3	Carriage of Three Eight inch Photoflashes - Bomb Doors Open. 15° Climbs and Dives. Normal Manoeuvres to + 4 G.	300 knots.	6,000 to 20,000 ft.	Stores and Carrier Rigid. Satisfactory. Doors opened at 6,000, 10,000, 13,000 and 20,000 ft. Normal Manoeuvres to Plus 4G Carried out.	
4	As for Sortie 3.	350 kts. or 0.75 I.M.N.	6,000 to 35,000 ft.	Stores and Carrier Rigid. Satisfactory. Doors opened at 6,000, 10,000, 20,000 and 35,000 feet. Normal manoeuvres to Plus 4 G carried out.	

/Appendix C....

Flight Release Table - Three Eight Inch Photoflashes

Appendix 'C' to 14th Part of AAFEE/861/2

Sortie No. (a)	Details of Test (b)	Store No. (c)	Release Height (ft.) (d)	I.A.S. (knots) (e)	Fuze Setting (f)	Observations (g)
1	Release of three 8 inch photoflashes in level flight. Single Releases.	1 2 3	6,000 6,000 6,000	250 250 250	Inert Inert Inert	(i) Stores left aircraft cleanly and satisfactorily. (ii) Fuzing wires retained on carrier.
2	- do -	1 2 3	10,000 15,000 18,000	250 250 250	Inert Inert Inert	(i) Stores released satisfactorily. (ii) Fuzing wires retained on carrier.
3	- do -	1 2 3	20,000 6,000 13,000	250 300 300	Inert Inert Inert	(i) Stores released satisfactorily. (ii) Slight fore and aft pitching at 300 knots I.A.S. - No lateral movement.
4	- do -	1 2 3	20,000 20,000 20,000	310 310 310	Inert Inert Inert	(i) All three stores released when release button was pressed. once - Stores left aircraft cleanly - auto selector moved to "4". (ii) No fault found in aircraft or carrier.
5	- do -	1 2 3	6,000 6,000 6,000	350 350 350	Inert Inert Inert	(i) All three stores again released on 1st Pressure of release button. (ii) No fault found in aircraft or carrier. (iii) Auto-selector switch changed.
6	- do -	1 2 3	6,000 6,000 13,000	350 350 350	Inert Inert Inert	(i) Two stores released on 1st Pressure of Release Button - 3rd stores released on 2nd Pressure - Auto Selector moved to "4". (ii) No fault found in aircraft or carrier - Release button changed.
7	- do -	1 2 3	20,000 20,000 13,000	.75IDN .75IDN 350	Inert Inert Inert	(i) Two stores released on 1st pressure - 3rd store on 2nd pressure (ii) No fault found in aircraft or carrier - Bomb bay door micro switches changed.
8	- do -	1 2 3	6,000 6,000 6,000	300 300 300	Inert Inert Inert	(i) Two stores released on 1st Pressure - 3rd Store on 2nd Pressure (ii) No fault found in aircraft or carrier - carrier stripped and thoroughly checked.
9	- do -	1 2 3	20,000 20,000 20,000	350 350 350	Inert Inert Inert	(i) Two stores released on 1st Pressure - 3rd Store released on 2nd Pressure - Auth selector moved to "4". (ii) Complete check of aircraft and carrier wiring made - No fault found.
10	- do -	1 2 3	5,900 5,900 5,900	350 350 350	Inert Inert Inert	(i) All three stores released on 1st pressure of release button. (ii) Check made for intermittent contact with aircraft running up on ground - No fault found.
11	Stores loaded on Stations 2 & 3 only. Speed of aircraft increased from 250 kts. I.A.S. with release button pressed once.	1 2 3	- 3,500 3,500	- 320 330	- Inert Inert	(i) 2nd and 3rd stores released whilst button was pressed on 1st pressure when speed reached 320 knots I.A.S.

/continued.....

12	Bomb Bay Door Micro Switches Cut Out of Circuit. Sortie 10 Repeated.	1	3,500	350	Inert	(i) Stores Released correctly and satisfactorily. (ii) Release button held on each pressure for approx. 2 secs.
		2	3,700	350	Inert	
		3	4,000	350	Inert	
13	Micro Switches Reconnected and Slugged. Relay fitted in circuit. Sortie 10 repeated.	1	5,400	350	Inert	(i) All stores released correctly and satisfactorily.
		2	5,500	350	Inert	
		3	5,800	350	Inert	
14	Release of three live eight inch photoflashes fuze M111-A2. Single releases.	1	6,000	250	11 secs.	(i) All stores released correctly and satisfactorily. (ii) Releases made by radar through cloud - bursts not observed from ground, (iii) Stores observed to burst at approx. 4,000 feet by air observers
		2	6,000	300	11 secs	
		3	6,000	350	11 secs	
15	- do -	1	10,000	250	15 secs	(i) All stores released correctly and satisfactorily. (ii) Stores burst at approx. 4,000 feet.
		2	10,000	300	15 secs	
		3	10,000	350	15 secs	
16	Release of two eight inch Photoflashes fuze "Safe".	1	10,000	300	Safe	(i) Stores exploded on impact.
		2	15,000	300	Safe	
		3	15,000	300	Safe	
17	Release of three live eight inch Photoflashes fuze M111-A2. Single releases.	1	10,000	250	15 secs	(i) All stores released correctly and satisfactorily. (ii) Stores burst at approx. 4,000 feet.
		2	10,000	300	15 secs	
		3	10,000	350	15 secs	
18	- do -	1	15,000	250	20 secs	(i) Stores released correctly and satisfactorily. (ii) Stores burst at approx. 4,000 feet.
		2	15,000	300	20 secs	
		3	15,000	350	20 secs	
19	- do -	1	6,000	250	11 secs	(i) Stores released correctly and satisfactorily. (ii) Stores burst at approx. 4,000 feet.
		2	6,000	300	11 secs	
		3	6,000	350	11 secs	
20	- do -	1	20,000	250	28 secs	(i) Stores released correctly and satisfactorily. (ii) Stores burst at approx. 4,000 feet.
		2	20,000	300	28 secs	
		3	20,000	350	28 secs	
21	Release of three inert eight inch Photoflashes from max. height of aircraft at request of R.A.E.	1	35,000	250	Inert	(i) Height of aircraft limited by u/s pressurisation system. (ii) Stores released satisfactorily.
		2	35,000	300	Inert	
		3	35,000	350	Inert	

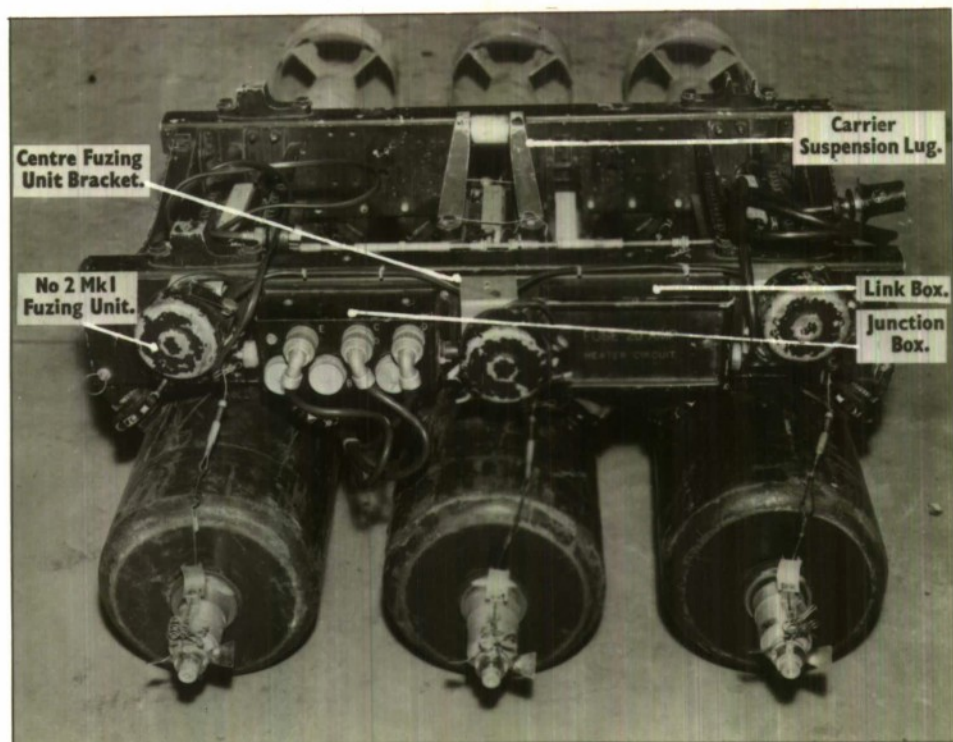


FIG.1. Three 8" Photoflashes on No.1. Mk I Multi - Store Carrier.

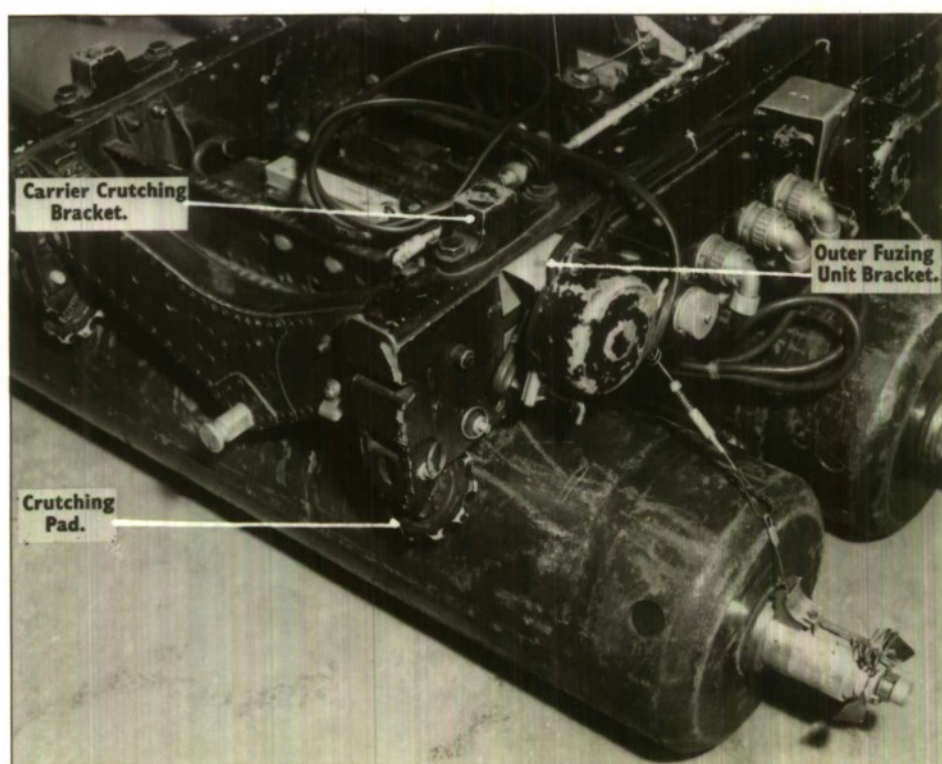
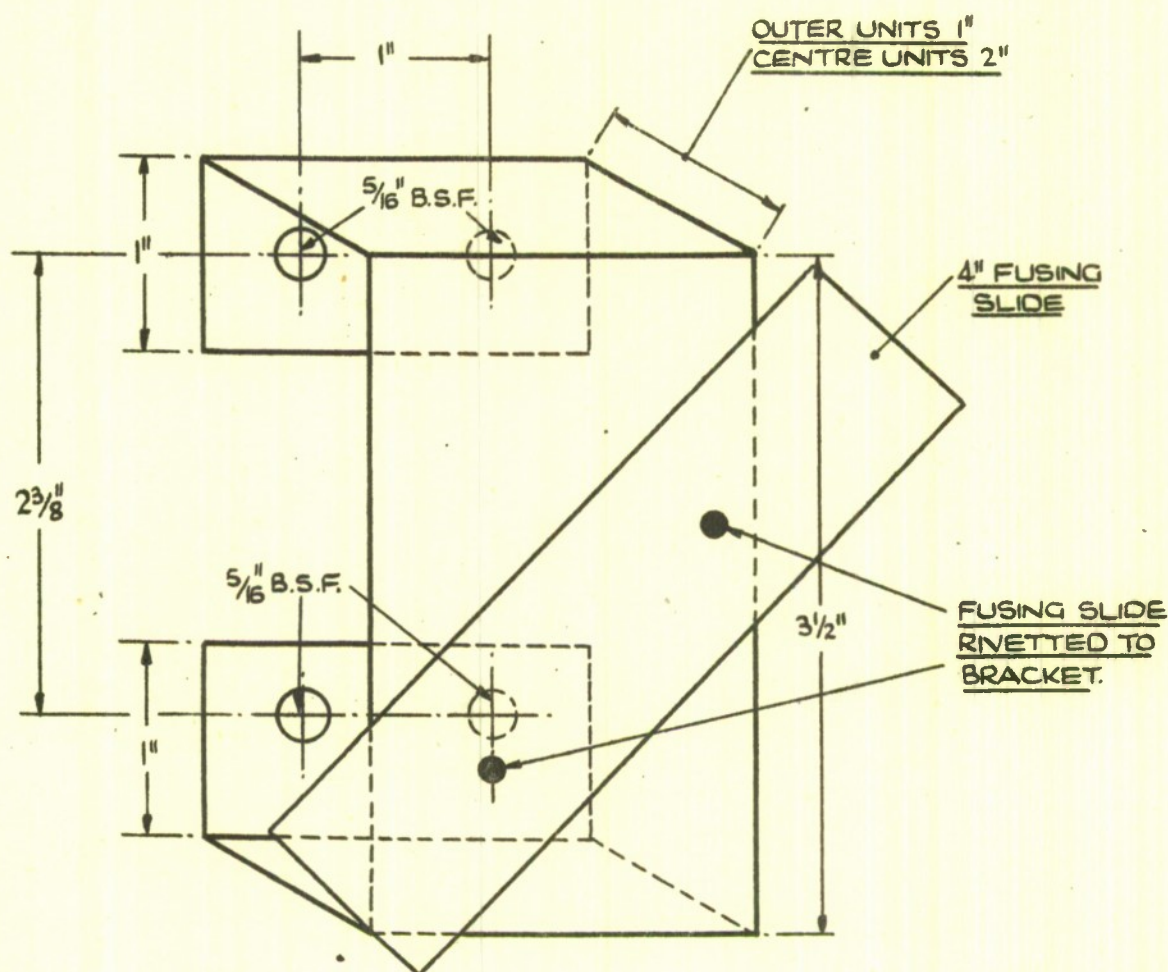


FIG.2. Fuzing Arrangements for 8" Photoflashes.

FIG.3.



MATERIAL USED BY A&A.E.E. :- 16 S.W.G. ALUMINIUM.

QUANTITY REQUIRED :- THREE (TWO OUTER & ONE CENTRE)

4 INCHES OF FUSING SLIDE TO BE RIVETTED TO FRONT OF BRACKET
AT 45°

HOLES FOR SECURING BOLTS ON CENTRE BRACKET TO BE 2B.A.

BRACKET FOR FITTING FUSING UNITS TO FRONT OF
Nº1 MK.I. MULTI-STORE CARRIER.



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AD#:

Date of Search: 13 February 2007

Record Summary:

Title: Canberra PR Mk 3 VX.181 (2 x Avon 1): functional trials of 8 inch low terminal velocity photographic flash
Covering dates 1954 Jan 01 - 1954 Dec 31
Availability Open Document, Open Description, Normal Closure before FOI Act: 30 years
Former reference (Department) 861/2 Pt 14
Held by The National Archives, Kew

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SE 2