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26th Part of Report No. AAEE/919

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26th Part of Report No. AAEE/919

MINISTRY OF AVIATION

**AEROPLANE AND ARMAMENT
EXPERIMENTAL ESTABLISHMENT**

BOSCOMBE DOWN

SCIMITAR F. MK.1 AIRCRAFT

SERVICE CLEARANCE TRIALS OF BULLPUP ASM-N-7A MISSILES

PRESENTED BY

ENG. SUB. LT. N.F. CURNOW R.N.
ARMAMENT DIVISION

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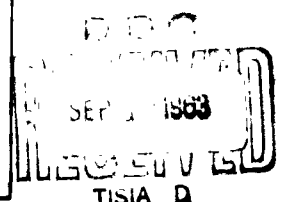
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AEROPLANE AND ARMAMENT EXPERIMENTAL ESTABLISHMENT
BOSCOMBE DOWN

21 MAY 1963

Scimitar F. Mk.1 Aircraft

Service Clearance Trials of Bullpup ASM-N-7A Missiles

Presented by

Eng. Sub. Lt. N.F. Curnow R.N.
Armament Division

A. & A.E.E. Ref: Arm F.6
M.O.A. Ref: AV/99/029
Period of Trial: October 1961 to October 1962

Summary

This Report deals with the trials to determine the suitability of the Bullpup ASM-N-7A Air to Surface missiles for Service use on the Scimitar F. Mk.1 Aircraft.

It is recommended that the Bullpup ASM-N-7A Air to Surface missile be cleared for Service use on the Scimitar F. Mk.1 Aircraft subject to the incorporation of certain modifications listed in paragraph 6(b) of the Report within the following limitations and restrictions:-

(a) Carriage Max. I.A.S. 625 knots or Mach 1.1
Max. indicated 'g' 6
Max. indicated 'g' in rolling pullouts 5
No rapid rates of roll.

Release Max. launch speed Mach .95
Dive angles up to 45 degrees
Slant range 8,000' to 30,000'.

Jettison by Kick Back

Up to 568 knots in straight and level flight

Jettison by firing (Unarmed and Unguided)

Up to max. launch speed Mach .95.

(b) The satisfactory completion of Electro-magnetic Compatibility Trials on a fully representative aircraft.

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Air Commodore,
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/1. Introduction ...

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1. Introduction

Trials to determine the suitability of the Bullpup ASM-N-7A missile and associated equipment for Service use on the Scimitar F. Mk.1 aircraft have not been completed. Ministry of Aviation trials performance A/Arm 2(a)/149 dated 10th November, 1960 refers.

2. Object of Trial

The object of the trial was to determine whether the Scimitar aircraft installation and special to type equipment is suitable for Service use and compatible with the Bullpup ASM-N-7A weapon system.

3. Description of the Installation

The installation is designed to carry and release four Bullpup missiles, two from each mainplane. Each missile is carried on an Aero 5A launcher enclosed in a fairing. The launcher is attached to an adapter by two transverse bolts and the whole assembly is carried on a Mod. 5072 pylon in the normal way except that the Ejector Release Unit in the pylon should not be loaded. (Figures 1 and 2).

3.1 The Adapter

The adapter is handed port or starboard and is common to Sidewinder and Bullpup installations. It mates the existing suspension components and electrical services of the pylon with those of the launcher.

3.2 The Launcher

At the front of the launcher is a channel section which accepts the missile forward lug. At the rear a slide accepts the two rear lugs. A detent mechanism, which can be disengaged by a lever to allow for loading and unloading, locks the missile to the launcher.

Jettison is achieved either by firing the missile unarmed and unguided or by forcing the missile from the launcher in a rearward direction, by an electrically operated cartridge situated in the rear of the launcher. ("Kick-Back"). The cartridge operates a kicker mechanism which, by means of mechanical linkages unlocks the missile and forces it to the rear. A ramp at the rear of the missile forward lug channel section imparts downward movement to the missile which then falls free.

Electrical services are supplied to the launcher from the main aircraft supply through the pylon and adapter, and thence by the forward and rear umbilical cords to the missile.

3.3 Cockpit Controls

Situated on the starboard console are the following switches:-

(a) Master Armament Switch. This is a rotary switch with positions - OFF, GUNS/S., BOMBS, R.P./B.P.

(b) Fuzing Switch. This is a rotary switch which can be selected A (instantaneous), B (6 milli-secs.), C (12 milli-secs.) or D (spare), depending on fuzing requirements.

(c) Weapon Station Switch. A five way rotary switch with positions B, M1, M2, M3 and M4. for selecting Bombs, Starboard Outer, Port Outer, Starboard Inner or Port Inner missiles respectively.

(d) Missile Armed - Unarmed Switch. This is a two way selector switch. When the missile is fired with the switch to "Unarmed" it is launched unfused and cannot be guided.

/3.3 Pilot's ...

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3.4 Pilot's Control Switch

This switch is mounted on the port side of the cockpit and is used by the pilot to give guidance commands to the missile after launch. Only the four cardinal commands, up, down, left and right can be given, and only one command at any one time.

3.5 Radio Installation

3.5.1 The Radio Transmitter mounted on an anti-vibration tray, is sited in the Port ammunition bay. Power supplies are obtained through the multi-socket at the aft end of the bay and the aerial feeder cable from the wing root on the inboard side of the bay.

3.5.2 The Bullpup Aerial is sited on the starboard forward underside of the fuselage.

4. Method of Trial

4.1 Ground Examination

4.1.1 Fitment of the Bullpup Installation to the aircraft.

4.1.2 Electrical Tests.

4.1.3 Electro-Magnetic Compatibility Test.

4.1.4 Radio Trials

4.1.5 Loading

4.2 Flight Test

4.2.1 Carriage and Handling

4.2.2 Jettison

4.2.3 Release

5. Result of Trials

5.1 Ground Examination

5.1.1 The Bullpup Installation was fitted by Vickers-Armstrong (South Marston) Ltd., and examination revealed no installation faults.

5.1.2 Electrical Tests of the system were carried out in accordance with Vickers-Armstrong's Design Department's Report No. V/544/T5/MD0/02 on receipt of the aircraft at A. & A. S., Boscombe Down. During these tests a deflection was noted on the Electrical Continuity Test Set (USA-75). Investigation showed the deflection was due to pick up caused by:-

- (i) Voltage induced in the firing lines from the 115 volt 400 cycles A.C. leads in the launcher. This was minimised by the introduction of Mod. 5216 (See 5.1.3).
- (ii) Induced voltage in the special purpose cable CX-4857/USA 75 which is part of the USA-75 Test Set. As a result of investigation it was recommended that this cable is an integral part of the Test Set, it must be used to check the correct function of the overall system. Any volts indicated on the Test Set must be ignored and separate no-volts checks with the set disconnected should be carried out. (A. & A. S. Report reference Arm. P.6 dated 19th January, 1962 refers.).

/5.1.3 Electro ...

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5.1.3 Electro-Magnetic Computability. A short trial was carried out to ascertain the Electro Magnetic pickup of the firing lines of the Scimitar/Bullpup installation. The provision of a relay, screened cables and positive earths in the Adapter Beam/Launcher/Pylon assembly (Mod. 5216) was found necessary to reduce the pickup to a safe level. This trial only investigated pickup due to electro-magnetic induction from internal electrical sources. No attempt was made to measure or investigate pickup on the firing lines due to internal or external radio frequency induction. The results of this trial are the subject of A. & A.E.E. Report Ref. Arm. F.6 dated 19th January, 1962. The aircraft used for this trial was Scimitar F. Mk.1 XD.268 which was not a fully representative aircraft.

5.1.4 Radio Trials revealed that the polar diagram was not acceptable with the aerial sited on the Nose Wheel door, and the Volt Standing Wave Ratio was not within the specification laid down. The re-siting of the aerial (Mod. 5219A) gave an acceptable polar diagram and fitting a matching stub to the aerial coaxial feeder (Mod. 5219B) brought the V.S.W.R. within specification.

5.1.5 Loading was satisfactorily carried out in accordance with the A.P. (N) 1023(9) and AP 4646A Vol. 5 Pt. 2 using the Vickers-Armstrong Loader (G.E. Mod. 8064) and Hoist Attachment Extensions (26DH/612) in conjunction with two Type 'C' Hoists (4GC/3360) and a Type 'E' Sling (4GC/2873). (See Figure 3.).

5.2 Flight Tests

5.2.1 Carriage and Handling. Three carriage and handling flights were carried out during the trial with symmetrical and asymmetrical loadings in varying configurations at speeds up to Mach 1.1. The weapons and launchers remained secure throughout the flights and no damage occurred to the Bullpup installation or aircraft. (A. & A.E.E. Report APF/2B1 dated 28th November, 1961 refers.).

5.2.2 Jettison

(a) Prior to airborne jettison flights simulated flight in the take-off configuration was carried out in the Blower Tunnel at A. & A.E.E. to ensure that no damage would be caused to aircraft flaps or wheels during the jettison. The trajectory of the missile was well clear of the aircraft and no damage was recorded (AAEE/6195/A/DAG/Engineering Test Note No.294 dated 28th November, 1961, refers.).

(b) Five Kick-Back jettison flights were carried out in straight and level flight and small angles of dive and climb at speeds up to 568 knots. From the photographic records all missiles left the aircraft cleanly and no damage or handling problems were reported. (See Fig. 4.).

(c) Two jettison flights by firing the missile unarmed and unguided were carried out at speeds of 365 knots and 425 knots in angles of dive at 15 and 20 degrees respectively. On inspection of the aircraft after firing it was observed that the channel of the launcher firing had been slightly scored. Investigation showed that the forward umbilical cord was tight in this channel. The launcher firing (Mod. 5175) was cut back to provide clearance and subsequent firings were carried out without recurrence of this fault.

5.2.3 Release Flights. Eighteen release flights were carried out, seven of which were abortive. Four of these were due to adverse weather at the range, one when the pilot could not identify a temporary target, one when the target was destroyed by a previous attack, and one misfire caused by a contact failure in the butt connector. The successful firings were carried out at speeds between 370 knots and Mach .95, in dive angles up to 45 degrees, using slant ranges of 3,000 to 40,000 feet. The minimum (8 secs) to maximum (30 secs.) flight times were incorporated in these firings.

From the photographic and range records of the air firings the following observations were made:-

(a) All missiles left the aircraft cleanly (Fig. 5).

/(b) Command ...

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(b) Command of the missiles at ranges in excess of 30,000' was sluggish, missiles being slow to respond.

(c) One flare burnt out before the expected life of 30 seconds.

6. Conclusions

From the results of the trial it is concluded that:-

(a) An Electro-Magnetic Compatibility Trial on a fully representative Service Aircraft and missile under Aircraft Carrier Deck conditions is essential.

(b) The following modifications are essential for correct functioning and safe use of the Scimitar/Bullpup installation:-

- | | |
|-----------------------------------|--|
| (i) Mod. 5216 | The provision of a relay, screened cables and positive earths in the Adapter Beam/Launcher/Pylon assembly. |
| (ii) Mod. 5219A | Repositioning of Bullpup Aerial. |
| (iii) Mod. 5219B | Fitting a matching stub to aerial coaxial feeder. |
| (iv) Launcher Pairing (Mod. 5175) | Cutting away of the channel |

(c) Subject to the incorporation of the modifications listed in para. 6(b), the Scimitar F. Mk.1 aircraft is suitable for Service use for the carriage, jettison and release of the Bullpup ASM-N-7A Air to Surface Missiles.

7. Recommendations

It is recommended that the Bullpup installation fitted to the Scimitar F. Mk.1 Aircraft be cleared for Service use for the carriage, release and jettison of the Bullpup ASM-N-7A Air to Surface Missiles subject to the following restrictions and limitations:-

- | | |
|---|---|
| (i) <u>Carriage</u> | Maximum I.A.S. 625 kts. or Mach 1.1
Maximum indicated 'g' 6
Maximum indicated 'g' in rolling pullouts 5
No rapid rates of roll |
| (ii) <u>Release</u> | Maximum launch speed Mach .95
Dive angles up to 40 degrees
Slant Range 8,000 ft. to 30,000 ft. |
| (iii) <u>Jettison by Kick-Back</u> | Speeds up to 568 kts. in straight and level flight. |
| (iv) <u>Jettison by Firing (Unarmed and unguided)</u> | Up to max. Launch Speed Mach .95 |
| (v) <u>E.M.C.</u> | The satisfactory completion of Electro-magnetic Compatibility Trials on a fully representative aircraft. |

/(vi) Modifications ...

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(vi) Modifications

The incorporation of the essential modifications listed in para 6(b) above.

It is further recommended that the special to type equipment, i.e. Vickers-Armstrong Loader (G.E. Mod. 8064) and Hoist Attachment Extension (26DH/612) are suitable for Service use and compatible with the Bullpup ASM-N-7A missile installation.

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Appendix I

Flight Record

Date	Flight No.	Type of Flight	Speed	Height	Slant Range	Attitude	Station	Remarks
11. 7.61	1	Handling						Symmetrical and asymmetrical loading in varying configurations APF/2B1 dated 28th November, 1961, refers.
11. 7.61	2	Handling						
17. 7.61	3	Handling						
27.10.61	4	Jettison	153 kts	1,800'	3,510'	S & L	P.I.	Initial Jettison - Successful
30.10.61	5	Jettison	220 kts	10,000'	14,750'	5° Climb	P.I.	Jettison small climb - Successful
30.10.61	6	Jettison	300 kts	20,000'	31,000'	5° Dive	S.I.	Jettison small dive - Successful
27.10.61	7	Jettison	350 kts	10,000'	19,520'	S & L	PO/SO	Jettison salvo - Successful
31.10.61	8	Jettison by firing	365 kts	5,000'	12,500'	15° Dive	S.I.	Jettison unguided/unarmed - slight damage to launcher fairing (Mod. 5175)
31.10.61	9	Jettison by firing	425 kts	4,800'	12,000'	20° Dive	P.I.	Jettison unguided/unarmed - Slight damage to launcher fairing (Mod. 5175)
6.12.61	10	Firing	Mach .8	20,000'	30,000'	20° Dive	P.I.	Proving modification to fairing after flights 8 and 9 - Successful
6.12.61	11	Firing	370 kts	5,200'	11,000'	15° Dive	S.I.	Proving modification to fairing after flights 8 and 9 - Successful
7.12.61	12	Firing	400 kts	4,000'	-	S & L	P.O.	Programmed flight to check range and pattern of weapon system - Successful
7.12.61	13	Firing	400 kts	4,000'	-	S & L	S.O.	As above
12.12.61	14	Firing	400 kts	13,000'	37,500'	20° Dive	S.O.	Abortive - weather at range
12.12.61	15	Firing	400 kts	13,000'	37,500'	20° Dive	S.O.	Abortive - Pilot did not see target
19.12.61	16	Firing	505 kts	10,000'	53,000'	20° Dive	P.O.	20° Dive band - Successful

/19.12.61

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Appendix I (Cont'd)

Date	Flight No.	Type of Flight	Speed	Height	Sight Range	Altitude	Station	Remarks
19. 1. 61	17	Firing	450 kts	3,900'	20,500'	10° Dive	P.O.	10° Dive Band - Successful
19. 1. 61	18	Firing	400 kts	3,000'	19,000'	10° Dive	S.O.	Abortive - Weather at Range
19. 1. 62	19	Firing	400 kts	3,000'	19,000'	10° Dive	S.O.	Abortive - Weather at Range
22. 1. 62	20	Firing	400 kts	3,000'	19,000'	10° Dive	S.O.	Successful firing - Flare burnt out
22. 1. 62	21	Firing	300 kts	25,500'	41,000'	30° Dive	S.O.	30° Dive Band - Successful
27. 2. 62	22	Firing	375 kts	17,800'	25,250'	40° Dive	P.O.	Abortive - Target destroyed before attack
2. 7. 62	23	Firing	Each .95	2,000'	22,000'	5° Dive	P.O.	Abortive - Misfire
3. 7. 62	24	Firing	Each .95	2,000'	22,000'	5° Dive	P.O.	Abortive - Weather at Range
7. 9. 62	25	Firing	Each .95	2,000'	22,000'	5° Dive	P.O.	Missile Launch Limit - Successful
7. 9. 62	26	Firing	375 kts	17,800'	25,250'	40° Dive	P.O.	40° Dive Band - Successful
13. 9. 62	27	Firing	395 kts	23,500'	46,000'	30° Dive	S.O.	Max. flight time - Successful
*15. 2. 62	28	Jettison	568 kts	1,200'	-	S & L	P.I.	High speed jettison - Successful

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FIG. 1. PYLON, ADAPTOR, LAUNCHER AND FAIRING.



FIG. 2. MISSILE LOADED TO PORT OUTER PYLON.



FIG. 3. LOADING ARRANGEMENTS.

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FIG. 4.
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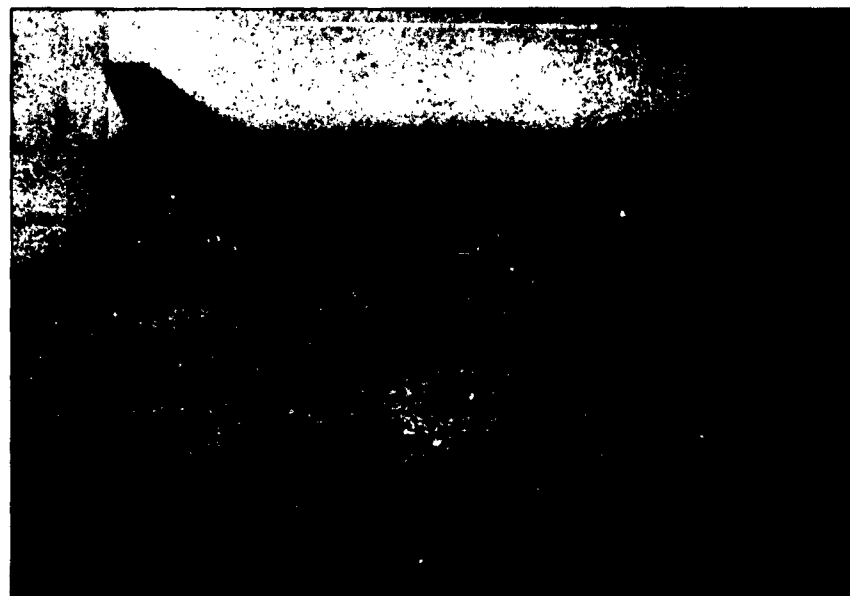


FIG. 4.
SALVO JETTISON.

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FIG. 5.
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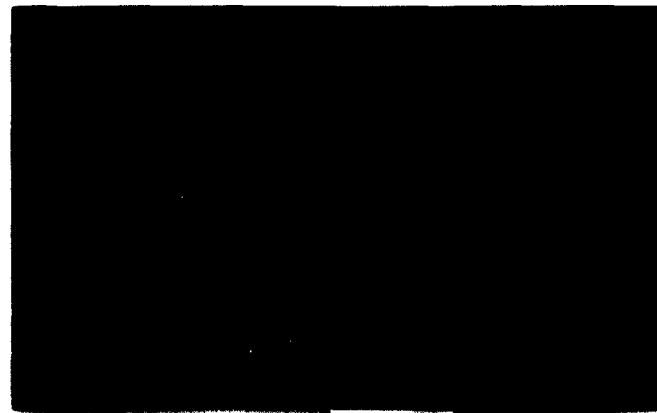
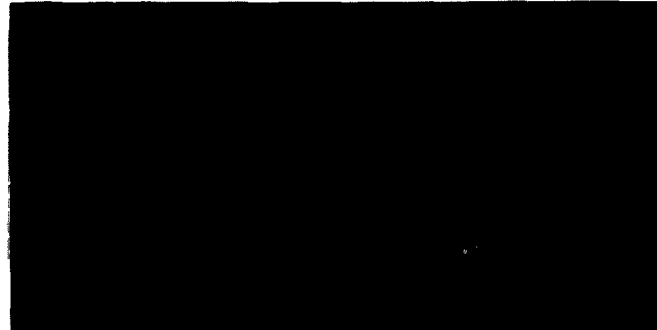


FIG. 5.
BULLPUP FIRING.

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