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APGC-TDR-63-11

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**Preliminary Fit Tests of U.S.,
British, and French Rocket Launchers
on F-100D and F-105D Aircraft**

by D. G. Cox

APGC Technical Documentary Report No. APGC-TDR-63-11

FEBRUARY 1963 • APGC Project No. 0014W

DEPUTY FOR AEROSPACE SYSTEMS TEST

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FOREWORD

This test, APMC Project 0014W, was conducted under the authority contained in letter from Hq USAF, Subject: Installation Test of French and British Rocket Launchers, dated 5 June 1961, and 1st Indorsement thereto from Hq AFSC, dated 16 June 1961. Testing was initiated on 8 August 1962 and was completed on 29 September 1962.

The following personnel were responsible for the testing accomplished under this project and/or for the preparation of this report:

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ABSTRACT

This test was conducted as the first phase of part of an overall program to determine the interchangeability of the various rocket launchers used by the NATO nations and to provide suitable electrical adapters for the launchers and aircraft of these nations. The purpose of the test was to conduct preliminary fit tests of selected U. S., British, and French rocket launchers on the F-100, F-105, and F-104G aircraft. Tests were conducted using the LAU-10/A rocket launcher, the British rocket launcher No. 1, Mk 2, and the French rocket launcher MATRA 116 with the F-100D and F-105D aircraft. Since previous tests had been conducted at APGC to determine the compatibility of the LAU-3/A and LAU-18/A launchers with the F-100 and F-105 aircraft, no further testing of these launchers was accomplished. No tests could be conducted using the F-104G aircraft due to the non-availability of an aircraft of this type during the test period.

From the results of the test it was determined that the LAU-10/A rocket launcher is physically compatible with the F-100D and F-105D aircraft when suitable electrical adapters are used. The British rocket launcher No. 1, Mk 2, with the modifications described in the report, can be installed on the F-100D and F-105D aircraft; however, it was not possible to conduct complete electrical functioning tests of this launcher since the ripple firing unit for the launcher had not been furnished. The French rocket launcher MATRA 116 is incompatible with both aircraft because it has no provision for mounting on aircraft equipped with standard bomb racks. Previous testing conducted with the LAU-3/A and LAU-18/A launchers indicated that these launchers would be completely compatible with the F-100 and F-105 aircraft if certain modifications were made. These modifications have since been accomplished.

PUBLICATION REVIEW

This technical documentary report has been reviewed and is approved.



A. T. CULBERTSON
Brigadier General, USAF
Vice Commander

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SECTION 1 - INTRODUCTION

In lieu of provision for a standardized rocket launcher for use by the NATO forces, or even by the individual nations of NATO, an effort is being made by the United States, Great Britain, and France to achieve interchangeable carriage of the various rocket launchers used by the individual NATO nations and to provide suitable electrical adapters for the launchers and aircraft of these nations.

The purpose of this project was to conduct preliminary fit tests of selected U. S. , British, and French rocket launchers on the F-100, F-105, and F-104G aircraft.

The specific objectives of the project were to:

1. Review the drawings and technical manuals on the British rocket launchers No. 1, Mk 2, and No. 3, Mk 1; the French rocket launchers MATRA 116 and JL-100; and the U. S. rocket launchers LAU-3/A, LAU-10/A (Navy), and LAU-18/A for compatibility of these launchers with the F-100, F-105, and F-104G aircraft.
2. Design and fabricate the necessary electrical adapters to enable use of the above rocket launchers on the above aircraft.
3. Perform trial installation and electrical functioning tests on the above rocket launchers, aircraft, and electrical adapters.
4. Prepare a report on the findings of the test, together with applicable design drawings, for transmission to the Military Agency for Standardization, Hq USAF, and the U. S. Navy.

All testing was conducted using the F-100D and F-105D aircraft. No testing with the F-104G aircraft could be conducted since an aircraft of this type was not available during the test period.

Inasmuch as the LAU-3/A and the LAU-18/A launchers had been previously tested on the F-100 and F-105 aircraft at APGC, no further testing of these launchers was accomplished. The previous tests indicated that, with certain modifications, the LAU-3/A and LAU-18/A launchers would be completely compatible with the F-100 and F-105 aircraft. These modifications have since been accomplished. The detailed results of the previous testing of these launchers are contained

in APGC-TR-59-3, Compatibility Test of the LAU-3/A Launcher with the F-100D Aircraft, ASTIA document number AD208233, dated February 1959, and APGC-TR-60-37, Engineering Evaluation of the LAU-18/A Rocket Launcher, ASTIA document number 318407L, dated August 1960. (NOTE: Results of the testing of the LAU-3/A launcher on the F-105 aircraft, conducted at APGC in 1958, were published in a report that did not receive distribution outside APGC; therefore, this report is not included in the above references.)

The British Air Ministry furnished only the rocket launcher No. 1, Mk 2, for testing and the French government furnished only the MATRA 116 launcher. Since the ripple firing unit for the British launcher was omitted from the shipment, a complete electrical check of this launcher could not be accomplished. At the NATO armament conference held in London, England, in March 1961, the French representatives stated that the MATRA 116 launcher could be adapted to U. S. aircraft by removal of the ejection pylon and replacing it with an adapter equipped with 14-in. lug suspension and necessary electrical components. The French representatives stated that a launcher modified in this manner would be furnished for test in the United States; however, since the launcher received had not been modified, complete tests could not be conducted with this launcher.

Due to the preliminary nature of this evaluation, testing was limited to determining the physical compatibility of the launchers and the test aircraft. Only static tests were conducted. No evaluation was made of the capability of the fire control systems of the test aircraft to accept the ballistic coefficients of the rockets used in the launchers tested.

SECTION 2 - DESCRIPTION

Presented in the following paragraphs is a description of the rocket launchers which were tested during this project:

LAU-10/A ROCKET LAUNCHER

The LAU-10/A is a dual-purpose unit for shipping the rocket motors and for launching the 5-in. Zuni rocket. When attached to the aircraft ready for flight, it weighs approximately 105 lb empty and 533 lb loaded. It can carry four Zuni rockets.

The major structures of the launcher are a center section, containing four 5-in. diameter aluminum firing tubes, and streamlined interchangeable fairing assemblies which are attached at each end of the launcher. The primary structural member of the launcher body is an extruded aluminum hardback which provides for 14-in., 30-in., and single-point suspension. The four 5-in. -diameter aluminum tubes are clustered parallel to the launcher centerline. These tubes are supported by extruded aluminum spacers and ribbed aluminum stiffeners. These parts, which are held rigidly together by steel bands, are covered by an aluminum skin which is welded to the bulkheads both fore and aft. The fairings are made of treated paper that will shatter readily from rocket impact or rocket blast. Each fairing has a metal band at the base equipped with lugs and a leaf-spring for attaching it to the launcher center section. The lugs engage grooves in the center section retainer rings and, as each fairing is rotated clockwise, the spring clip drops into position to lock the fairing securely in place. The fairings fit flush with the outside surface of the center section of the launcher to form an aerodynamically smooth surface.

Electrical connection to the launcher is accomplished through either of two five-pin receptacles located on top of the launcher. A positive connection to each rocket is made through a spring-loaded contact screw which protrudes into the firing tube and contacts the contact band of the rocket. Detents in the firing tubes provide the ground connection to the rockets and retain them in place. Power is supplied to the individual contact screws through a rotary solenoid-operated intervalometer. A selector switch mounted on the aft bulkhead of the launcher provides for either "single" or "ripple" fire. Selection must be made on the ground. In "single" position, one rocket is fired each time the firing button is depressed. In "ripple" position, all four rockets are fired in sequence, with approximately 259 milliseconds required for the salvo.

BRITISH ROCKET LAUNCHER NO. 1, MK 2

The British rocket launcher No. 1, Mk 2, can be installed as a complete unit on an aircraft bomb pylon and carries thirty-seven 2-in. rockets. The overall length of the launcher with the fairings installed is 84 in., and the diameter is 16-1/2 in. The empty weight of the launcher with the fairings installed is 150 lb. The loaded launcher weight, including the 37 rockets and the fairings, is 540 lb.

The launcher consists of a cylindrical matrix molded from glass fibre bonded with resin. A top beam, molded from glass cloth and resin, is attached to the top of the matrix, and three metal inserts are molded into the beam. The metal inserts provide housings for two anti-yaw spigots and a suspension lug. The matrix, including the top beam, is covered with a skin of glass cloth and resin.

Six fasteners at each end of the launcher provide for the fitting of a nose and a tail fairing. A blast plate is fitted to the front end of the launcher, and nine studs are molded into the rear end. The exposed ends of these studs are threaded for nuts which retain a firing and retention bar.

The launcher may be electrically connected to the carrying aircraft either through a 12-pole fixed plug or a 2-pole butt connector housed in the top beam of the launcher.

A metallized hinged door in the side of launcher, which can be secured in the closed position by screw fasteners, gives access to a fuze and resistance unit and a ripple firing unit. The housing also contains a multi-selection/single-firing conversion switch which is operated by a shaft. Access to the head of the shaft is obtained through a hole adjacent to the side of the hinged door. The appropriate switch selection is made by aligning the screwdriver slot in the top of the shaft with the desired position engraved on the housing cover.

FRENCH ROCKET LAUNCHER MATRA 116

The French rocket launcher MATRA 116 can be installed as a complete unit on French aircraft and carries nineteen 68mm SNEB rockets equipped with either explosive, inert, or practice heads. The overall length of the launcher with the fairings installed is 85.59 in. The diameter is 16.41 in. The empty weight of the launcher with the fairings installed is 59.47 lb and the loaded weight, including 19 rockets with explosive heads, is 236 lb.

The major structures are a center section, containing 19 bakelite firing tubes, an ejection pylon as an integral part of the launcher, and streamlined interchangeable fairing assemblies which are attached at each end. The firing tubes are held in position by fore and aft bulkheads. The bulkheads and center support are connected to each other by a support girder. The entire assembly is inclosed in a steel casing. The pylon suspension system consists of a single snap coupler and two alignment pins. The fairings are made of a fiber material and are attached to the center section by four bolts.

Electrical connection to the launcher is made through a four-pole plug housed in the ejection pylon. A pyro-mechanical distributor, or stepping switch, is also housed in the ejection pylon. This distributor controls the firing of the rockets at regular intervals.

SECTION 3 - TEST PROCEDURES, RESULTS, AND DISCUSSION

LAU-10/A ROCKET LAUNCHER

The LAU-10/A was installed at all wing stations of the F-100D and F-105D aircraft (Figs. 1 and 2). The launcher was visually inspected for proper suspension and sway bracing. Clearances were measured between the launcher and the following areas: (1) the underside of the wing, (2) the flap in the full down position, (3) the ground, and (4) the landing gear. All clearances on both aircraft were satisfactory.

Electrical connection for the F-100D was made through the aft receptacle on the launcher using the aircraft chemical circuit for power. A special adapter was required. This adapter consisted of a five-pin plug (MS 3106-14S-5S, SN 5935-501-7682) to which two 16-gauge wires approximately 12 in. long were attached. The hot lead contained a 5-ohm, 10-watt, wire-wound resistor to prevent a high surge current when the circuit is energized. The chemical circuit was used instead of the rocket circuit because only the outboard stations of the F-100D are equipped with a rocket circuit and uniformity was desired. A special low-profile Cannon plug was required for the inboard pylon because there is a clearance of only 11/16 in. between the launcher and the bottom of the pylon. A hole in the bottom of the intermediate and outboard pylons permits the Cannon plugs to extend up into the pylons. Shown in Fig. 3 is the electrical adapter with the standard Cannon plug that was fabricated for connecting the launcher to the intermediate and outboard pylons of the F-100D aircraft. An engineering drawing of the adapter which can be used with all pylons is shown in Fig. 4.

The electrical connection used to adapt the LAU-10/A launcher to the F-105D aircraft was the same as that used to adapt the LAU-3/A launcher to the F-105D. This connection is made with an adapter cable consisting of two 8-in. 16-gauge wires connected on one end to a 16-pin plug (MS 3101-24-7P, SN 5935-276-9319) and on the other end to a five-pin Cannon plug (MS-3106-14S-5S, SN 5935-501-7682). The cable is connected between the aft adapter on the launcher and the rocket circuit on the aircraft. A view of this adapter is shown in Fig. 5 and an engineering drawing is shown in Fig. 6.

Electrical functioning tests of the LAU-10/A launcher with the F-100D and F-105D aircraft were accomplished by installing the launcher on the test aircraft using the adapter for each aircraft. Power to the test aircraft was supplied by a ground power unit. Current flow was measured through the contact screws and detents of the launcher using an



Fig. 1: LAU-10/A Rocket Launchers Installed at Inboard, Intermediate, and Outboard Stations of F-100D Aircraft.

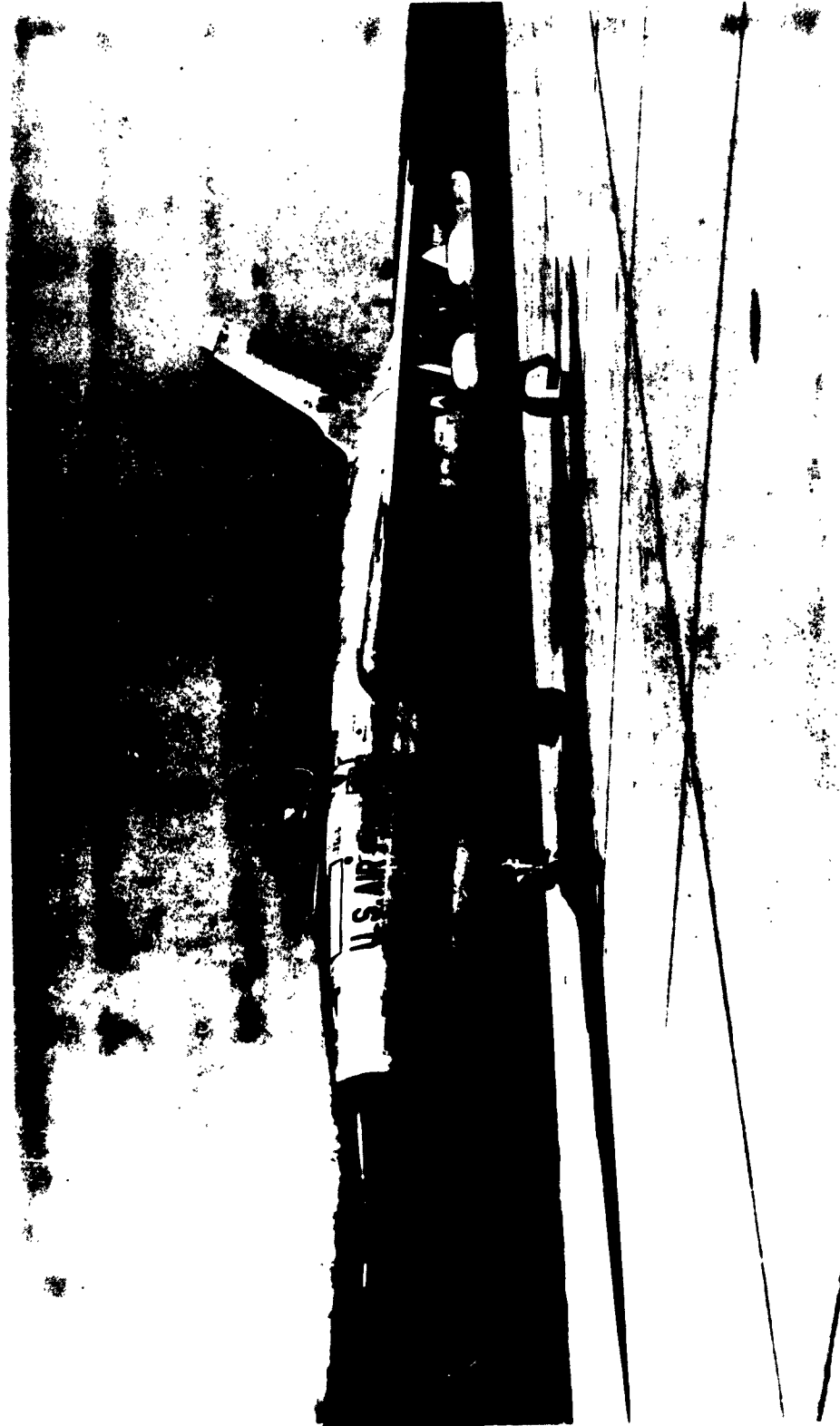


Fig. 2: LAU-10/A Rocket Launchers Installed at Inboard and Outboard Stations of F-105D Aircraft.

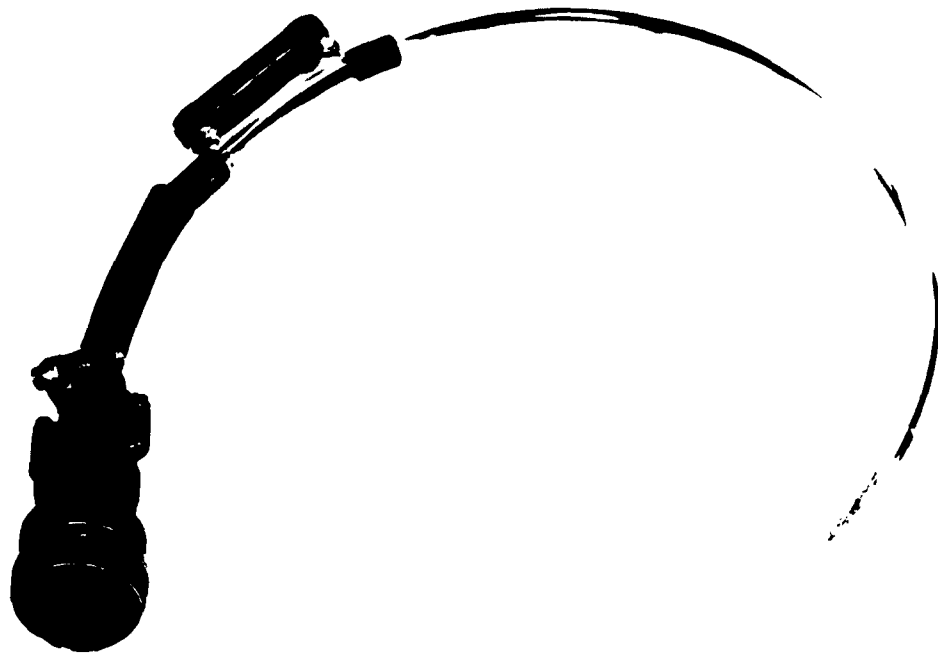


Fig. 3: Electrical Adapter for Connection of LAU-10/A Rocket Launcher to Intermediate and Outboard Pylons of F-100D Aircraft.

AN/PSM-6 tester. The electrical system of the LAU-10/A launcher functioned satisfactorily when it was connected to either test aircraft using the appropriate adapter.

BRITISH ROCKET LAUNCHER NO. 1, MK 2

The British rocket launcher No. 1, Mk 2, was installed on each wing pylon of the F-100D and F-105D aircraft. The launcher was adapted to the 14-in. lug suspension of both aircraft by replacing the two anti-yaw spigots with Mk 6 Mod 0 suspension lugs. Shown in Figs. 7 and 8 is the launcher installed on the left inboard pylon of each aircraft.

The same clearances checked during the installation test of the LAU-10/A launcher were measured during this test and were found to be satisfactory.

The electrical connection between the launcher and the F-100D aircraft was made by using two 16-gauge wires approximately 24 in. long (Fig. 9). The two-pole connector on the forward end of the launcher

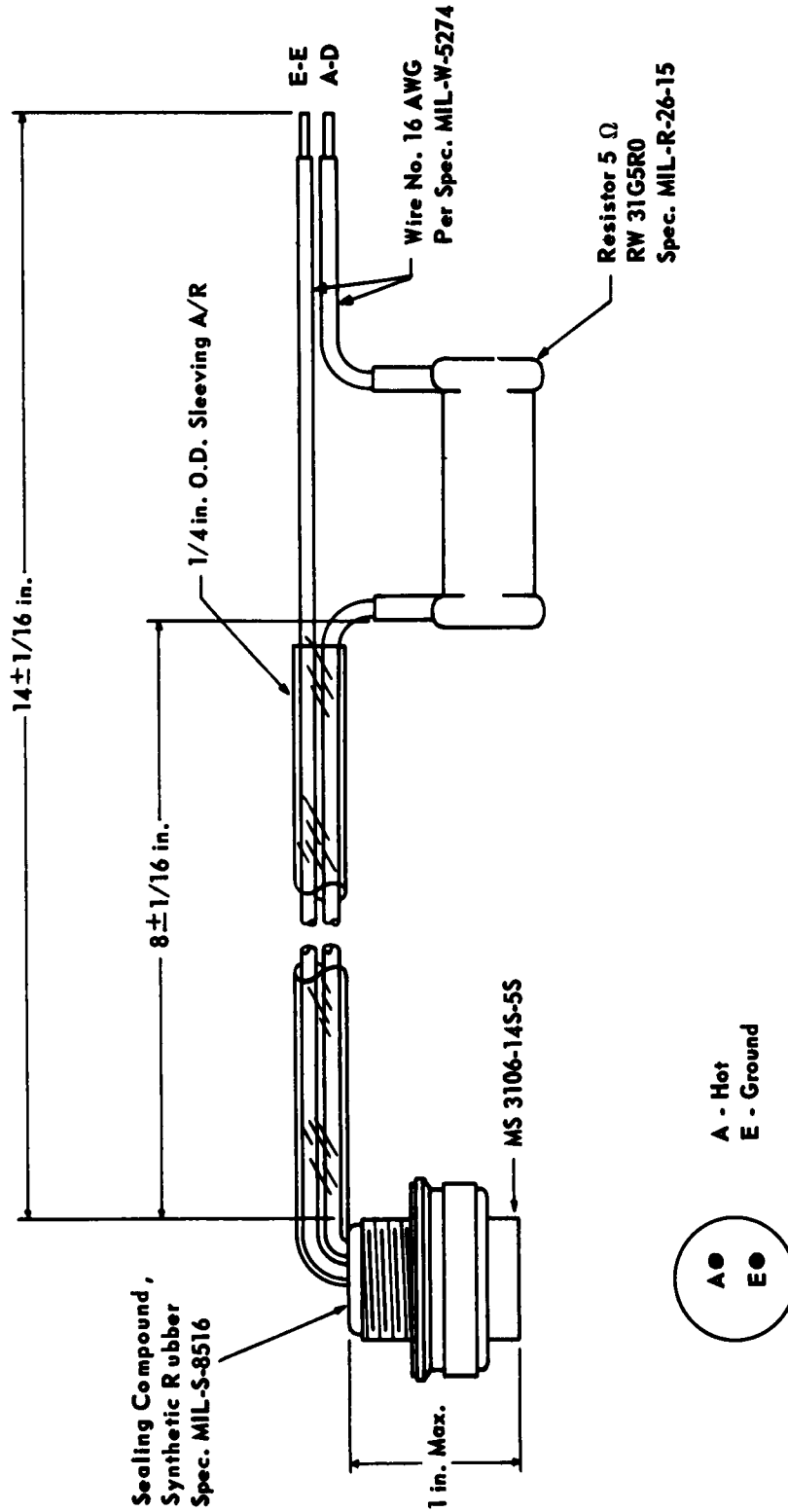


Fig. 4: Engineering Drawing of Wiring Harness for Adapting LAU-10/A Rocket Launcher to F-100D Aircraft (Drawing No. X63B1248).



Fig. 5: Electrical Adapter for Connection of LAU-10/A Rocket Launcher and F-105D Aircraft.

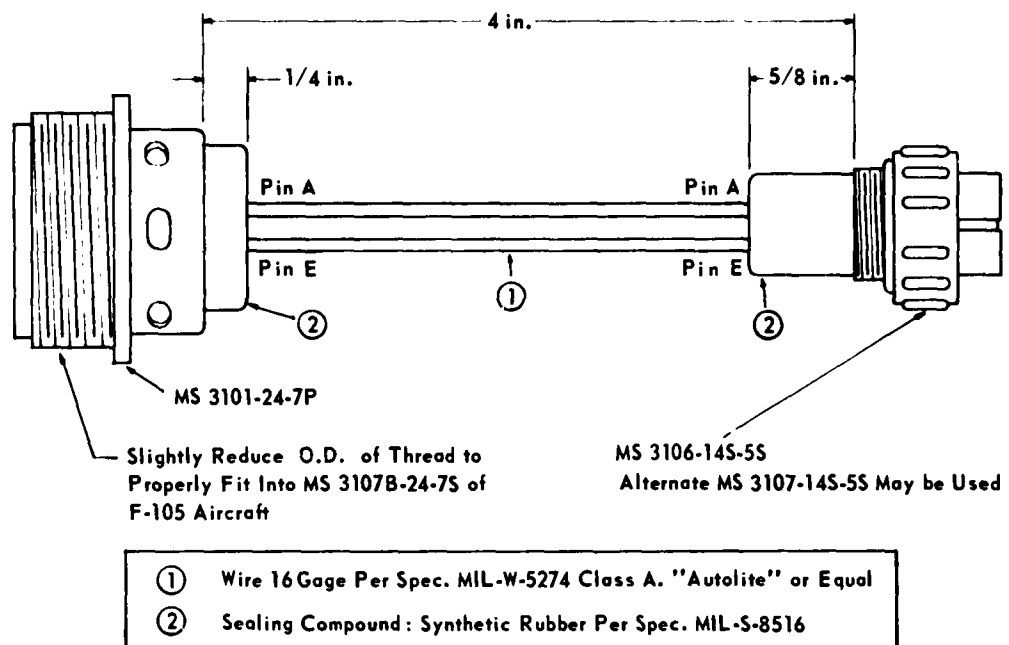


Fig. 6: Engineering Drawing of Wiring Harness for Adapting LAU-10/A Rocket Launcher to F-105D Aircraft (Drawing No. 61B100007).

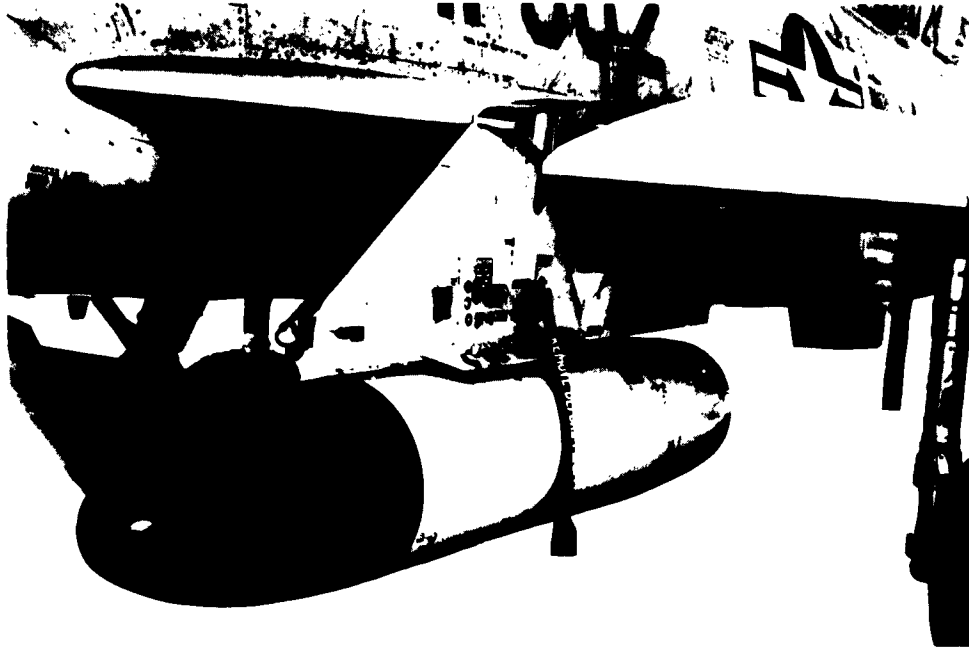


Fig. 7: British Rocket Launcher No. 1, Mk 2, Installed at Left Inboard Station of F-100D Aircraft.



Fig. 8: British Rocket Launcher No. 1, Mk 2, Installed at Left Inboard Station of F-105D Aircraft.

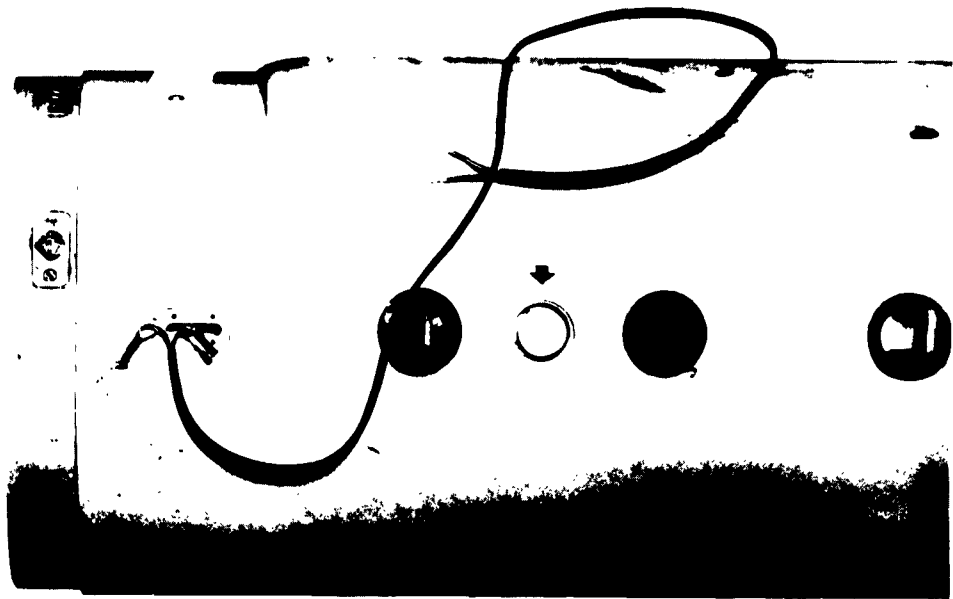


Fig. 9: Electrical Adapter for Connection of British Rocket Launcher No. 1, Mk 2, and F-100D Aircraft.

was removed and a direct connection to the electrical system of the launcher was made. The aircraft chemical circuit was used for power because only the outboard stations of the F-100D are equipped with rocket circuits.

Electrical connection between the launcher and the F-105D was made by removing the forward two-pole connector and attaching two 24-in. 16-gauge wires directly to the electrical system of the launcher and the other ends to a 16-pin Cannon plug (MS 3101-24-7P, SN 5935-276-9316). (See Fig. 10.) This connection enabled the launcher to be connected to the rocket circuit of the F-105D.

A complete launcher electrical system check could not be made with either aircraft because the ripple firing unit of the launcher was not furnished. Without the ripple firing unit it was impossible to determine if the electrical adapters designed for connection of the launcher to the F-100D and F-105D aircraft would operate the launcher. Since complete electrical functioning tests were not conducted, no drawings were made of the adapters designed for this launcher.

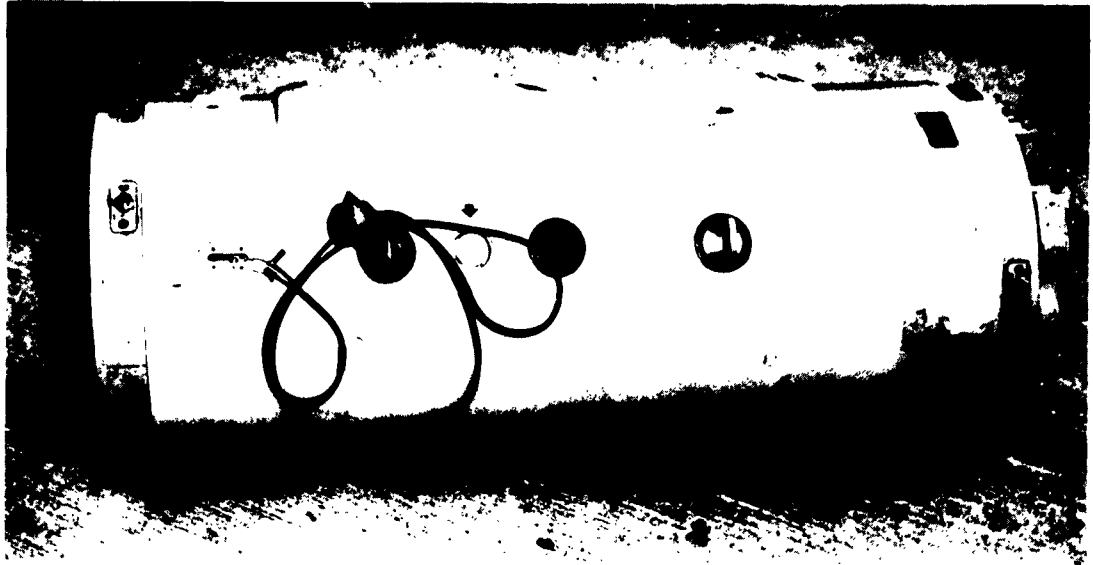


Fig. 10: Electrical Adapter for Connection of British Rocket Launcher No. 1, Mk 2, and F-105D Aircraft.

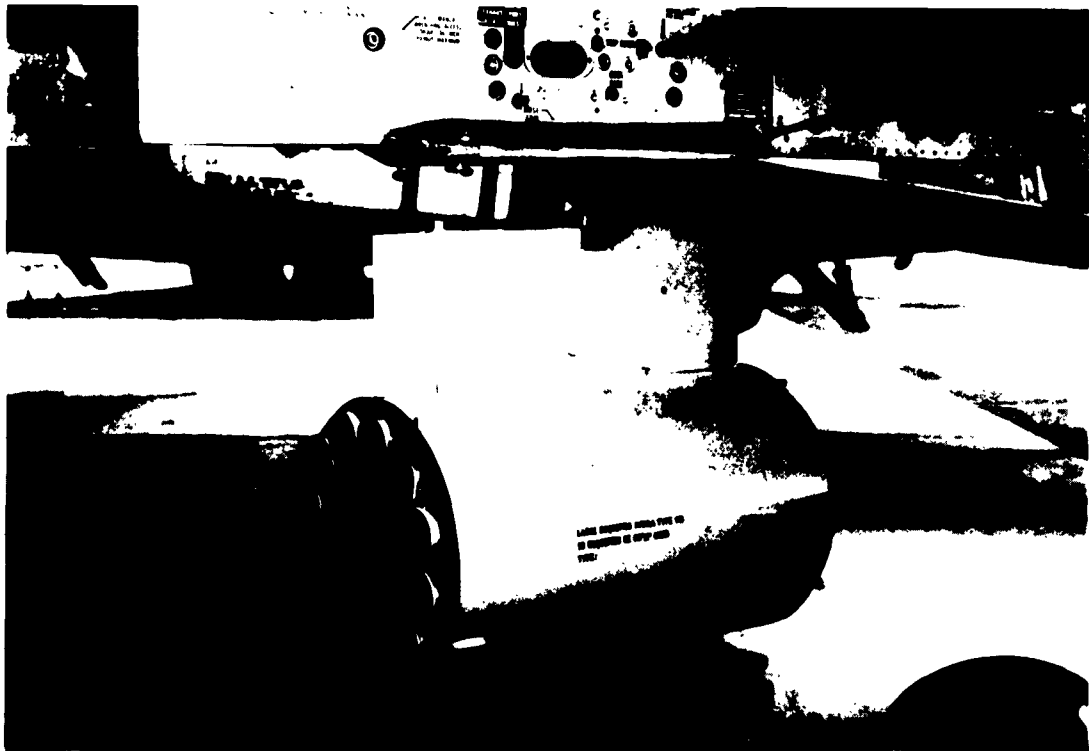


Fig. 11: French Rocket Launcher MATRA 116 and F-100D Aircraft (Fairings not Installed).

FRENCH ROCKET LAUNCHER MATRA 116

The French rocket launcher MATRA 116 was found to be incompatible with either the F-100D or F-105D aircraft in its present configuration. This is attributable to the fact that the launcher includes an ejection pylon as an integral part of the launcher, and the pylon suspension system has no provision for lug suspension required for installation of the launchers on the F-100D or F-105D. The pylon suspension, as presently designed, consists of a single snap coupler and two adjustment pins. The launcher is shown with the F-100D and F-105D aircraft in Figs. 11 and 12.

To adapt this launcher to the standard 14-in. suspension for USAF aircraft, it would be necessary to remove the integral launcher pylon, move the electrical equipment therein to the launcher proper, and install standard bomb lugs.



Fig. 12: French Rocket Launcher MATRA 116 and F-105D Aircraft (Fairings not Installed).

SECTION 4 - CONCLUSIONS

It is concluded that:

1. Mechanical and electrical compatibility of the LAU-10/A rocket launcher with the F-100D and F-105D aircraft can be achieved through use of the electrical adapters described in this report.

2. The British rocket launcher No. 1, Mk 2, with the modifications described in this report, can be installed on the F-100D and F-105D aircraft; however, a complete electrical functioning test of this launcher could not be conducted due to the fact the ripple firing unit was not furnished with the launcher.

3. The French rocket launcher MATRA 116, in its present configuration, is incompatible with both the F-100D and F-105D aircraft; however, compatibility with these aircraft may be achieved through modification of the pylon suspension system as described in this report.

4. Previous tests revealed that the LAU-3/A and LAU-18/A rocket launchers would be compatible with the F-100 and F-105 aircraft if certain modifications were incorporated. Incorporation of these modifications has been accomplished.

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