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OPERATIONAL TEST AND EVALUATION

MODIFICATION OF B-37K1 BOMB RACK ON F-105 AIRCRAFT

FOR

MARK 6 MOD 6 FLARES



FEBRUARY 1963

HEADQUARTERS
TACTICAL AIR COMMAND
United States Air Force
Langley Air Force Base, Virginia

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⑥ Operational Test and Evaluation
Modification of B-37K1 Bomb Rack
on F-105 Aircraft for Mark 6 Mod 6
Flares

Publications Review

This report has been reviewed and is approved.

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⑮ TAC

⑰ TR 62-75

⑳ NH

[27] NH

13 thru 17 NH


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Major General, USAF
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United States Air Force ③⑤ 853 300
Langley Air Force Base, Virginia

FOREWORD

This test was directed by Hq TAC message DMEMAA 12 0966 dated 8 December 1962, under authority of AFR 80-1. The test was conducted by the USAF Fighter Weapons School, TR&D Division, Nellis AFB, Nevada.

Personnel responsible for the conduct of the test and preparation of the final report are:

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ABSTRACT

This test was conducted to evaluate the capability of the F-105 to carry a B-37K1 Bomb Rack modified for Mark 6 Mod 6 flare carriage. No F-105 sorties were flown during this development program. Numerous ground tests of this rack, flare, combination demonstrated 100% reliability of this modification. Inflight evaluation during William Tell, 1962, with F-100 type aircraft, indicated completely satisfactory operation of the B-37K1 rack modified for Mark 6 Mod 6 flare carriage and delivery. This report provides modification instructions for the B-37K1 rack, loading procedures for the rack and Mark 6 Mod 6 flares in check list form, and required cockpit settings for expending the subject flares.

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1. BACKGROUND

This project was initiated in an effort to increase the effectiveness of F-105 aircraft by providing a capability for the accurate night delivery of high explosive ordnance. Headquarters TAC message DMEMAA 12 0966 dated 8 December 1962 directed the TR&D Division of the USAF Fighter Weapons School to prototype a B-37K1 Bomb Rack on F-105 aircraft and develop modification and operational instructions for Mark 6 Mod 6 flare carriage and delivery. No sorties were to be flown during this development program.

2. DESCRIPTION OF TEST ITEM

The B-37K1 aircraft bomb container is WRAMA fabricated, and normally used for dropping training bomblets. The container, commonly called a bomb rack, is 46 inches long, 9-1/8 inches wide, 6 inches deep and the empty weight is approximately 80 pounds. The carrying lug spacing is 14 inches and the power requirements are 24 to 28 V.D.C. with a current demand of 6 amperes at 20°C.

The complete flare ready for release weighs 30 pounds. The chipboard case, containing an integral variable time delay fuze, parachute, auxiliary parachute, and illuminant charge (candle), is 35.75 inches in length and has a diameter of 5.37 inches. One or two metal support bands which are shipped with the flare can be mounted on the flare (as indicated on the case) so that the flare can be suspended from bomb racks and bomb shackles. There are two metal steadying bands fastened to the case, against which the steadying forks or sway bracing of a bomb rack rests. The setting of the fuze is made by turning the indicator on the metal firing mechanism housing to the desired delay. The delay is shown on the fuze setting ring and indicates the vertical distance the flare will drop before igniting. The delay distance can be varied from 300 to 12,000 feet. A rip cord is connected to the firing lever of the fuze by a snap cord. The fuze end of the flare case is closed by a metal cover, and the parachute end of the flare case is closed by several layers of chipboard held in place by gummed cloth and sealed with paraffin. The parachute is connected to the illuminant charge (candle) by a steel suspension cable. The flare, as issued, is water resistant but should be kept sealed in the shipping container when not installed on an airplane.

3. PURPOSE OF THE TEST

This test was conducted to determine the feasibility of adapting the B-37K1 Bomb Rack to the F-105 for carriage and delivery of the Mark 6 Mod 6 flare. All necessary modifications were to be confined to the bomb rack.

4. SCOPE OF THE TEST: The scope of this test was directed toward the following specific objectives:

a. To develop a wiring diagram and instructions for modifications of the B-37K1 rack for Mark 6 Mod 6 flares.

b. To develop loading procedures for the B-37K1 rack and Mark 6 Mod 6 flares.

c. To develop cockpit setting procedures for expending Mark 6 Mod 6 flares.

5. CONCLUSIONS AND RECOMMENDATIONS

a. Conclusions:

(1) The subject modification is feasible and can be performed at base level.

(2) The wiring diagram and instructions contained in the report will provide a simple, effective means for carriage and delivery of the Mark 6 Mod 6 Flares with the F-105 aircraft utilizing the B-37K1 Bomb Rack.

b. Recommendations:

(1) Recommend instructions in section 7 of this report be authorized for modification of AF/B37K1 bomb containers as necessary to obtain a Mark 6 Mod 6 flare capability.

(2) Recommend the loading procedures in Annex 1 be used as a guide in preparation and verification of an approved check list.

(3) Recommend the cockpit setting procedures in Annex 2 be followed when expending the Mark 6 Mod 6 flares from B-37K1 Bomb Racks suspended from F-105D aircraft.

6. TEST RESULTS AND DISCUSSION

a. Test Environment and Procedures:

This test was conducted on the Nellis Air Force Base Flight Line, utilizing an F-105D assigned to the TR&D Division of the USAF Fighter Weapons School.

After material requirements had been determined, the necessary modifications were made on the B-37K1 Bomb Rack and it was suspended from the right outboard wing pylon. Four Mark 6 Mod 6 flares were installed utilizing the check list in Annex 1. The Mark 6 Mod 6 flares were released utilizing the cockpit setting procedures in Annex 2. All flares released satisfactorily and numerous functional checks demonstrated that bomb rack operation was normal at all times.

b. Test Discussion:

The information presented here was gathered from interviews with the pilots of the F-100 aircraft that expended the subject flares during William Tell 1962, and subsequent to that, on two (2) night sorties on Range I of the Nellis Air Force Base range complex.

The initial sorties were those flown in support of the Fire Power Demonstration presented during William Tell 1962. Twenty-six (26) flares were dropped during this period. Of those dropped only fifteen (15) were effective. This is a disappointing ratio, however, it should be noted that the flares were manufactured in 1953.

Flares dropped during the William Tell Demonstration were made at 160 knots IAS and set to ignite approximately 2.5 seconds after release. On the two night sorties flown on Range I, a total of twelve (12) flares were dropped. Drops were from an altitude of 3000 feet above ground level at an airspeed of 180 knots. Flares were set to ignite 1500 feet below the aircraft. Eight (8) flares ignited properly and burned for approximately

three minutes. Detailed instructions for the operation of the flares may be found in T.O. 11A10-1-1.

7. MODIFICATION INSTRUCTIONS

a. Parts Required: (Reference: T.O. 11B29-3-17-3 Page 3 Fig 1)

- (1) Eight (8) each, brace-sway, bomb container, part #59C9158.
- (2) Sixty-four (64) each, washer, part #AN960516, SN 5310-167-0820 or equivalent.
- (3) Eight (8) each, bolt, SN 5306-680-6504, or equivalent.
- (4) Four (4) each, wire, 43 inches long, 16 gage, SN 6145-578-6605.
- (5) One (1) each, #6 clear sleeving, 43 inches long, SN 5970-629-6254.
- (6) One (1) each, connector, part #MS3108E20-29P.

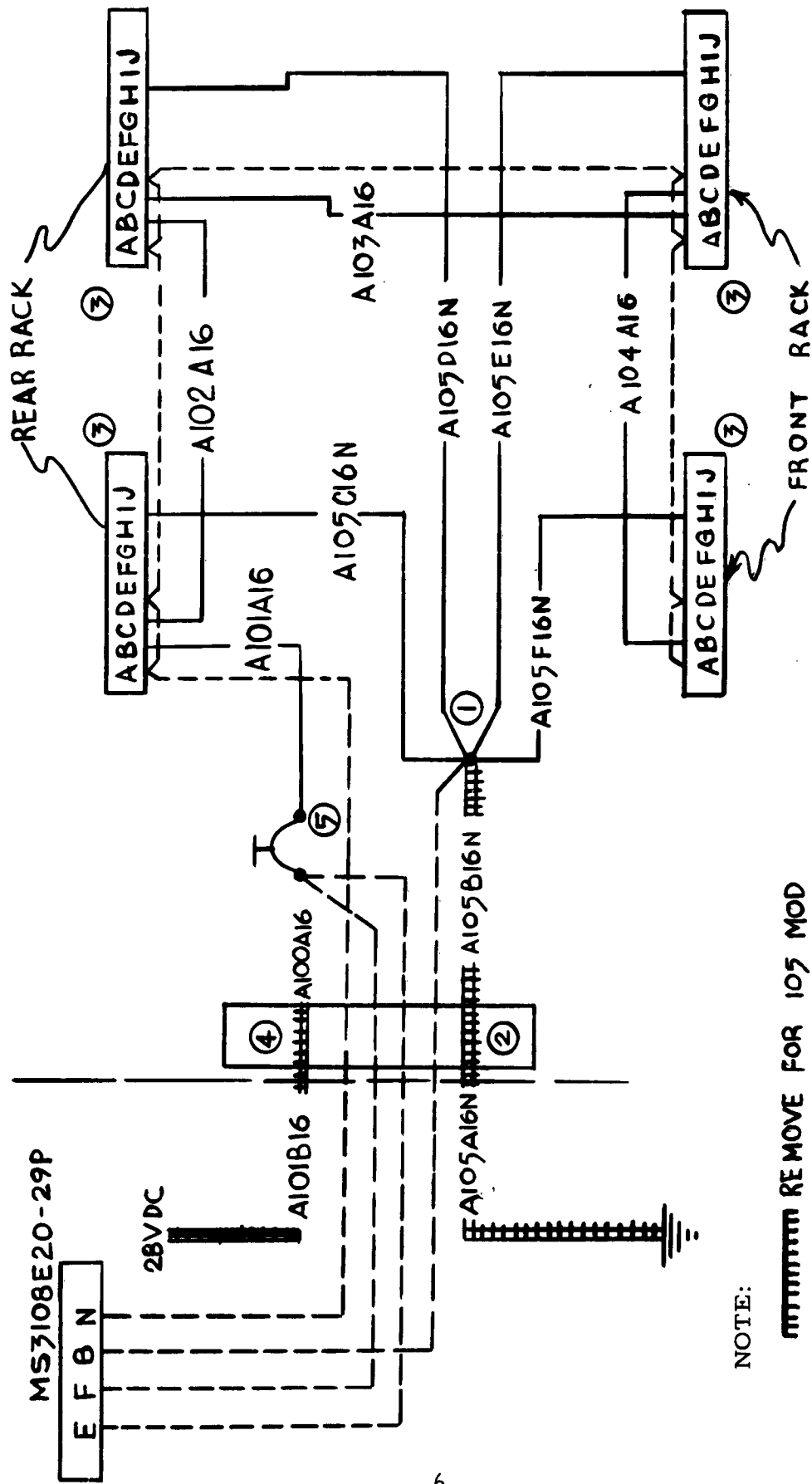
b. Modification Instructions:

- (1) Remove eight (8) each, bolt, part #AN5-23A, and discard.
- (2) Install eight (8) each, brace-sway, bomb container, part #59C9158, fastened by eight (8) each, bolt, stock #5306-680-6504, or equivalent. Shim each brace-sway with two (2) each washer, part #AN960516, SN5310-167-0820, or equivalent; to provide approximately 1/16 inch spacing between each brace-sway and the shell assembly (Annex 3, Photo 1).
- (3) Shim the remaining eight inch brace-sway as in step 2.
- (4) Remove one (1) each, bolt-sway brace, bomb container, part #59A91952, from the original eight (8) each, brace-sway, and install so that the sixteen (16) each, brace-sway have one bolt-sway brace in either the front or rear position provided all installations are identical. (Annex 3, Photo 2).

(5) Wire the B-37K1 rack in accordance with the following wiring diagram. Locally manufactured cable, indicated by dashed lines on the diagram should be 43 inches long with approximately 22 inches external to the rack. (Annex 3, Photo 3) Internal wires may be cut shorter as required. If wires A101B16, A105A16N, A100A16, A105B16N, and the associated terminal block are installed in the rack they should be removed. (See note in Diagram, Page 6)

8. DEFICIENCIES

During this development program no modification deficiencies were noted. Pilots who flew F-100 sorties during William Tell 1962 reported that no unusual flight characteristics were encountered. The indicated airspeed varied from 160 to 450 knots.



DISTRIBUTION LIST

HQ USAF		AFSC	1
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MMDL	2	TACSO-A	1
		ASZFA	2
PACAF			
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		4510 CCr Tng Wg	5
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MCFLC	2	4520 CCr Tng Wg	
		DO	2
APGC		DM	2
TACLO-P	1	TFW-TTS	1
PGWM	1		
		5AF	2
ESD			
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WRNQS	2	LAR	2
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MOAMA		SEG	2
MONHSB	2	DORQ-T	10
MONA	2		
OOAMA			
OOYI	2		
SMAMA			
SMNB	2		

ANNEX 1

Loading, Downloading and Checkout Procedures

for

B-37K1 Bomb Rack and Mark 6 Mod 6 Parachute Flares

T.O. 1F-105D-CL-6-1

B-37K1 and Mark 6 Mod 6 Flare

REFERENCE MATERIAL: T.O. 1F-105D-2-11
T.O. 11B29-3-17-11
T.O. 11A10-1-1

A. POWER REQUIREMENTS:

1. 28 V.D.C. external power source, and 115 V.A.C. 400 cycle.

CAUTION - Aircraft battery switch must be off at all times when external dc power is connected. Before connecting dc power, all circuit breakers shall be disengaged, switches turned off and battery disconnected. Do not connect or disconnect servicing receptacle while external power is turned on.

B. AEROSPACE GROUND EQUIPMENT REQUIRED:

1. MJ-1 Lift Truck, PN 56J23136, boom assembly, lug beam assembly.
2. Table Rollers (4 each).
3. Pylon Cradle Assembly, PN 57W890480-3.
4. Torque Wrench, FSN 5120-221-7945, 5120-221-7944, 5120-221-7943.
5. Spanner, PN 57W890718-1.
6. Safety Locks.
7. Pylon Test Equipment:
 - a. Name: Tester Assembly Pylon-Cartridge Circuitry, PN 57W890639-1. (Republic)

Use and Application: Make pylon and ejector rack circuitry check.

b. Name: Cartridge Activated Device (CAD) Test Meter
(McLean) Model 88.

Use and Application: Check continuity of cartridges or
cartridge firing circuits.

8. MD-3 Ground Servicing Unit to provide external dc power.
9. Bomb Stand, PN 56D23736.
10. Maintenance Ladder.
11. Break Bar (3/4 inch Hinge Handle and Pipe).
12. AN/PSM 6 Multimeter.
13. Cannon Plug Pliers.

C. AIRCRAFT PREPARATION:

1. Check AFTO Form 781 for aircraft status.
2. POSITION aircraft in an area that meets all safety and security requirements.
3. GROUND aircraft properly with two wires from aircraft.
4. All internal power switches "OFF".
5. Disconnect gun firing lead.
6. Disconnect external power source.
7. Disconnect and extend aircraft battery.
8. FIRE FIGHTING equipment available.
9. Pylon installed as follows: (Insure center line installed).
 - a. Remove covers from receptacle in wings.

- b. Inspect pylon for serviceability; safety keys attached.
- c. Back off pylon sway pins.
- d. Using MJ-1 and suitable platform, raise pylon to within four inches of wing.
- e. Engage wing-to-eylon electrical plug to wing electrical receptacle and safety wire.

NOTE: Pads may be adjusted as necessary to obtain alignment of guns and forward and aft stabilizing pins.

- f. Raise pylon, fully insuring that:
 - (1) Ejector gun mates with holes in wing.
 - (2) Stabilizing pins are inserted into corresponding sockets to wing.
- g. Install cap on ejector gun; torque to 190 to 200 foot pounds and safety wire.
- h. Reinstall cover over cap.
- i. Tighten front eccentric first, using a torque of 2 to 10 foot pounds to seat aft stabilizing pins, and insert screws in outboard pylon and clevis bolts in inboard pylons in nearest aligned screw hole.
- j. Repeat step i at aft eccentric.
- k. Replace cover on forward eccentric.
- l. Remove MJ-1.

10. Operational Checkout Pylon Jettison Circuit:

- a. Seat circuit breakers as follows:
 - (1) On primary circuit breaker panel, engage two pylon jettison wing circuit breakers.

(2) In access opening FF68, engage two pylon jettison wing circuit breakers.

- b. Install tester in each pylon jettison-gun-breach cavity.

NOTE: Insure safety switch is installed.

WARNING: Check that cartridges are removed from centerline pylon breach.

- c. Turn on external dc power.

d. On right auxiliary instrument panel, depress and hold INBOARD-PYLON-JETTISON switch.

RESULT: Tester light in each INBOARD-PYLON GUN breach should come on.

e. With switch still depressed, actuate SAFETY switch in each INBOARD PYLON to "SAFE" position.

RESULT: Each INBOARD PYLON tester light should come ON.

- f. Release INBOARD-PYLON-JETTISON switch.

RESULT: Each INBOARD PYLON tester light should go OUT.

g. On the right auxiliary instrument panel, depress and hold OUTBOARD-PYLON-JETTISON switch.

RESULT: Each OUTBOARD PYLON tester light should come ON.

h. With switch hold depressed, actuate "SAFETY" switch in each OUTBOARD PYLON to "SAFE" position.

RESULT: Each OUTBOARD PYLON tester light should go OUT.

- i. Actuate SAFETY switch to "ON".

RESULT: Each OUTBOARD PYLON tester light should come ON.

j. Release the OUTBOARD FYLON JETTISON switch.

RESULT: Each OUTBOARD FYLON test light should go OUT.

k. On the left auxiliary instrument panel, depress and hold the EXTERNAL STORE JETTISON switch.

RESULT: Each INBOARD and OUTBOARD pylon tester light should come ON.

l. Release the EXTERNAL STORE JETTISON switch.

RESULT: Each INBOARD and OUTBOARD pylon tester light should go OUT.

D. B-37K1 INSTALLATION PROCEDURES:

1. Disconnect ejector rack electrical disconnect from pylon connector and stow.

2. Open rack hooks and back off sway braces.

3. Raise B-37K1 container until lugs trip rack hooks to latched position.

4. Check bottoming of pins.

5. Shake B-37K1 container vigorously to insure positive locking.

6. Install ground safety locks.

7. Connect B-37K1 connector to pylon connector and safety wire.

8. Lower Forward and Aft sway braces to contact B-37K1. Torque both sway braces to 90 to 110 inch pounds.

E. B-37K1 CHECKOUT AND PRELOAD PROCEDURES:

CAUTION: Insure that cartridges are not installed in pylons.

1. Checkout bomb release circuit.

- a. Connect source of 28 V. D.C. to aircraft.

NOTE: Do not turn dc power on until specifically directed.

- b. Engage the following circuit breakers:

(1) On the armament c/b panel: (a) gun list control
(b) bomb rocket control (c) stores release and bomb arming.

(2) On the left hand primary circuit breaker panel:
(a) the two pylon jettison circuit breakers.

- c. Armament ground firing safety switch OUT.

- d. Index master armament switch to "WEAPONS".

- e. Engage the desired station selector switch.

NOTE: The transfer circuits will not operate, this has to be accomplished by using station selector switches. To release pairs, release one from each opposite wing station.

- f. Weapons selector switch to external stores.

g. Rockets, missiles and auxiliary stores switch to drop pod stores or tank.

- h. Index bomb mode selector switch to manual.

- i. Index bomb arming to tail or nose and tail.

- j. Turn on dc power.

- k. Check B-37K1 release system as follows:

(1) Index the pylon sequence selector switch to sequence single or pairs if opposite wing stations are to be used together.

(2) Depress and release the bomb rocket (Freeze) switch four consecutive times.

(3) RESULTS: One rocket should release each time the bomb rocket switch is depressed.

(4) Check that all eight arming solenoids are energized.

2. Perform safety voltage check.

- a. Insure cartridges are not installed in pylons.
- b. Insure aircraft is properly grounded.
- c. Insure switches are setup for operational check.
- d. Check that battery is connected.
- e. Apply 115 vac and 28 vdc to aircraft.

f. Using I-SM-6 Multimeter on 0.5 scale, and with a 500-ohm resistor attached, check for voltage at firing pins of all pylon cavities. There should NOT be a deflection of the needle.

WARNING: If voltage is present, discontinue loading operation until malfunction is eliminated.

- g. Rotate pylon safety switch to "SAFE" position.

F. MARK 4 MOD 4 FLARE PREPARATION and LOADING PROCEDURES:

CAUTION: Discontinue loading.

NOTE: All maintenance items on the Mark 4 Mod 4 Flare are taken from the rear of the flare.

1. Position the mounting brackets at the 14.5 inch and 28.5 inch position for the rear (Annex 3, Photo 4) low flares and at the 5 inch and 17 inch position (Annex 3, Photo 5) for the front two flares.

2. Insert the screw in each of the carrying lug bands and tighten the nuts approximately three threads.

NOTE: The carrying lug bands are left loose so that minor adjustments can be made during loading.

3. Open bomb rack hooks and back off sway brace bolts.

4. Position flare to carrying hooks and cock the rack. Check the inspection hole and assure the rack is fully cocked and locked. Tighten the carrying lug band until the two ends of the bands contact each other.

5. Connect the arming tape to either of the two arming solenoids.

6. Screw the sway brace bolts down against the flare and tighten finger tight.

7. Shake the flare to make sure it is stable on the rack. Tighten sway brace lock nuts.

8. Fold the slack in the arming tape and tape to the flare. (Annex 3, Photo 6).

G. MARK 6 MOD 6 FLARE ARMING PROCEDURES:

1. Loosen the set screw in the front end of the flare, turn the dial to the desired setting and retighten the set screw to hold the pointer in place.

2. Remove the wing nut type screw and retain until the flare has been expended.

NOTE: The setting is the distance it takes the flare to function below the aircraft.

H. PYLON ARMING PROCEDURES:

1. Assure that stray voltage check has been accomplished in accordance with step E2.

2. Insure that pylon safety switch is in "SAFE" position.

3. Using Model 88 CAD tester, check continuity of cartridge prior to installation.

NOTE: The following check applies to any of the cartridges used in the ejector-rack and pylon-jettison guns and should be performed before installation.

WARNING: Do not use an ohm-meter to check cartridge continuity. The CAD test meter (Model 88) will be used. It develops a maximum current of approximately 0.15 milliamps which is minute compared to the minimum current required to ignite the cartridge.

(a) Position tester so that primer of cartridge is contacting lower probe of tester, and outer rim of cartridge is contacting upper probe.

RESULT: Test meter should register in the "GOOD" range.

4. Insert cartridge in liners and install in pylon jettison breach only.

5. Torque liners to 180 to 240 inch pounds and safety wire together.

6. Remove bomb rack safety lock and secure covers.

I. DOWN LOADING PROCEDURES:

1. Turn off all electrical power; disconnect battery.

2. Insure ground safety key is rotated to the safe position.

3. Install ground safety lock on bomb rack.

4. Insure that aircraft is grounded and switches are off or normal.

5. Remove ejector cartridges from pylon jettison gun.

6. Insert and tighten the wing nut type screw.
7. Loosen the set screw and return the pointer to the safe position and retighten set screw.
8. Loosen sway brace bolts.
9. Support the flare firmly in both hands and have someone trip the manual release.

CAUTION: Care must be taken not to pull the arming tape during down-loading.

10. Remove the flares from the area and properly stow in their containers.

ANNEX 2

COCKPIT SETTINGS AND PROCEDURES

COCKPIT SETTINGS AND PROCEDURES

1. Check that the following circuit breakers are in:
 - a. On the armament circuit breaker panel:
 - (1) Gun control
 - (2) Bomb rack control
 - (3) Stores release and bomb arming
 - b. On the left console circuit breaker panel:

The two pylon jettison circuit breakers
2. Place master armament switch to WEAPONS.
3. Engage desired station selector switch.
4. Place weapons selector switch to EXTERNAL BOMBS.
5. Place RKR, MSL & AUX STORES to DROP POD STORES OR TANKS.
6. Place bomb mode selector switch to MANUAL.
7. Place bomb arming switch to TAIL ONLY or NOSE AND TAIL.
8. Place pylon sequence selector switch to sequence SINGLE, or PAIRS if opposite wing stations are to be used simultaneously.
9. Depress and release bomb rocket (Freeze) switch.

ANNEX 3

MODIFICATION AND INSTALLATION PHOTOGRAPHS

