

AD-780 773

PROPOSED QF-4B SUPPLEMENT TO THE F-4B
NATOPS FLIGHT MANUAL (NAVAIR 01-245FDB-1)

William G. Seeman, Jr.

Naval Air Development Center
Warminster, Pennsylvania

31 December 1973

DISTRIBUTED BY:

NTIS

National Technical Information Service
U. S. DEPARTMENT OF COMMERCE
5285 Port Royal Road, Springfield Va. 22151

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER NADC-73219-30	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER AD 780 773
4. TITLE (and Subtitle) PROPOSED QF-4B SUPPLEMENT TO THE F-4B NATOPS FLIGHT MANUAL (NAVAIR 01-245FDB-1)		5. TYPE OF REPORT & PERIOD COVERED Phase Report
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) William G. Seeman, Jr.		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS NAVAL AIR DEVELOPMENT CENTER Warminster, PA. 18974		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS AIRTASK A535-5351-001D 4W47X1000
11. CONTROLLING OFFICE NAME AND ADDRESS Naval Air Systems Command Department of the Navy Washington, D. C. 20361		12. REPORT DATE 31 December 1973
		13. NUMBER OF PAGES 124
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		15. SECURITY CLASS. (of this report) UNCLASSIFIED
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; distribution unlimited.		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) QF-4B Drone target aircraft Remotely piloted vehicles Aerial targets Reproduced by NATIONAL TECHNICAL INFORMATION SERVICE U. S. Department of Commerce Springfield VA 22151		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This report presents a general description of, and operating procedures for, the QF-4B target aircraft. It is intended to supplement the existing F-4B NATOPS Flight Manual. Consequently, the report is written with the presumption that the reader is familiar with the F-4B NATOPS Flight Manual.		

DD FORM 1473
1 JAN 73EDITION OF 1 NOV 68 IS OBSOLETE
S/N 0102-014-6601

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

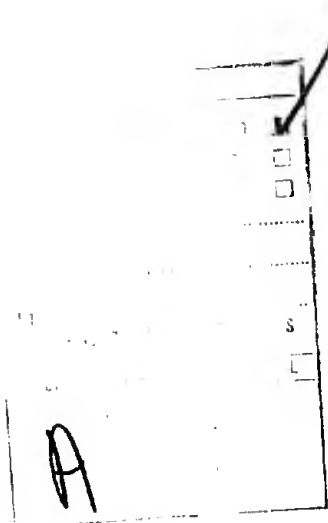
NADC-73219-30

NOTICES

REPORT NUMBERING SYSTEM - The numbering of technical project reports issued by the Naval Air Development Center is arranged for specific identification purposes. Each number consists of the Center acronym, the calendar year in which the number was assigned, the sequence number of the report within the specific calendar year, and the official 2-digit correspondence code of the Command Office or the Functional Department responsible for the report. For example: Report No. NADC-73015-40 indicates the fifteenth Center report for the year 1973, and prepared by the Crew Systems Department. The numerical codes are as follows:

CODE	OFFICE OR DEPARTMENT
00	Commander, Naval Air Development Center
01	Technical Director, Naval Air Development Center
02	Program and Fiscal Management Department
03	Anti-Submarine Warfare Program Office
04	Remote Sensors Program Office
05	Ship and Air Systems Integration Program Office
10	Naval Air Facility, Warminster
20	Aero Electronic Technology Department
30	Air Vehicle Technology Department
40	Crew Systems Department
50	Systems Analysis and Engineering Department
81	Administration and Technical Services Department
85	Computer Services Department

PRODUCT ENDORSEMENT The discussion or instructions concerning commercial products herein do not constitute an endorsement by the Government nor do they convey or imply the license or right to use such products.



APPROVED BY:

H. A. Langer

DATE: 31 Dec 1973

SUMMARY

Under the authority of AIRTASK A5355351/001D/4W47X1000 the NAVAIRDEVCON (Naval Air Development Center) is developing a kit to convert a standard F-4B Fighter aircraft into a QF-4B target aircraft. This kit provides for removal and modification of some F-4B equipment and installation of additional equipment required to operate the aircraft as a target. This report has been prepared to provide system descriptions and operating procedures necessary to operate the target aircraft, both in manned and unmanned flight. It is proposed that this information be published as a supplement to the existing F-4B NATOPS Flight Manual. Hence, this report has been written in the same format as the F-4B NATOPS. Also, since it is intended as a supplement, it is written with the assumption that the reader is familiar with the F-4B NATOPS Flight Manual.

TABLE OF CONTENTS

<u>Section</u>		<u>Page</u>
I	Aircraft	1-1
II	Indoctrination	2-1
III	Normal Procedures.	3-1
IV	Flight Procedures.	4-1
V	Emergency Procedures	5-1
VI	All-Weather Operation.	6-1
VII	Communications Procedures.	7-1
VIII	Weapons Systems.	8-1
IX	Flight Crew Coordination	9-1
X	NATOPS Evaluation.	10-1
XI	Performance Data	11-1
 <u>Appendix</u>		
A	Foldout Illustrations.	A-1

FOREWORD

SCOPE

This proposed NATOPS supplement has been prepared to provide QF-4B aircrews and remote operators with system descriptions and operating procedures for the QF-4B target aircraft. This publication has been prepared with the assumption that QF-4B aircrews are fully qualified in the F-4B aircraft and familiar with the F-4B NATOPS Flight Manual.

Section I, Part 1, of this publication is a brief description of the QF-4B and a summary of the differences between the F-4B and QF-4B. Section I, Part 2 contains descriptions and operating procedures for those systems which provide the remote control capability in the QF-4B target aircraft. System descriptions, operating procedures and operating limitations, except those relating to weapons systems, contained in the F-4B NATOPS Flight Manual are applicable to the QF-4B and are not repeated in this publication.

WARNINGS, CAUTIONS, AND NOTES

The following definitions apply to WARNINGS, CAUTIONS, and NOTES found throughout the manual.

WARNING

Operating procedures, practices, conditions, etc, which may result in injury or death, if not carefully observed or followed.

CAUTION

Operating procedures, practices, conditions, etc, which, if not strictly observed, may damage equipment.

NOTE

An operating procedure, condition, etc, which is essential to emphasize.

WORDING

The concept of word usage and intended meaning which has been adhered to in preparing this manual is as follows:

"Shall" has been used only when application of a procedure is mandatory.

NADC-73219-30

"Should" has been used only when application of a procedure is recommended.

"May" and "need not" have been used only when application of a procedure is optional.

"Will" has been used only to indicate futurity, never to indicate any degree of requirement for application of a procedure.

GLOSSARY

AC	Alternating Current
A/CS	Automatic Flight Control System
APCS	Approach Power Compensator System
ARI	Aileron Rudder Interconnect
C-1	Primary Control Aircraft
C-2	Secondary Control Aircraft
C/C	Control Circuits
COMRCVR	Command Receiver
CC	Direct Current
DT	Direct Throttle
F-1	Fox 1, Remote Takeoff and Landing Operator
FEI	Firing Error Indicator
FSK	Frequency Shift Keyed
G	Vertical Acceleration
IRIG	Inter-Range Instrumentation Group
LDG, 1dg	Landing Gear
MDM	Miss Distance Measuring
NOLO	No Live Operator, Unmanned Flight
OOSC	Out-of-Sight Controller
PC	Power Control (hydraulic system)
RAPC	Remote Approach Power Compensator
SPC	Static Pressure Compensation
TAS	True Airspeed

GLOSSARY (Continued)

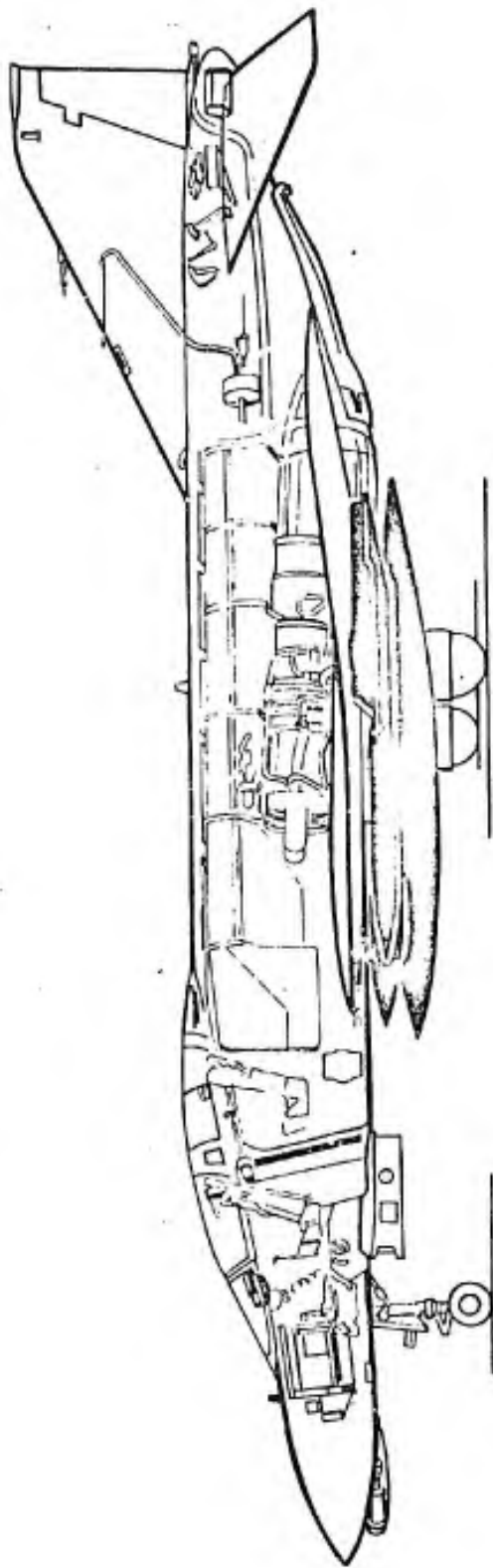
TOA	Takeoff Angle
TM	Telemetry
XMTR	Transmitter

SECTION I AIRCRAFT

Table of Contents

	Page
Part 1 - General Description	1-5
Aircraft	1-5
Cockpits	1-5
Station Loading	1-6
Part 2 - Remote Systems	1-7
Air Data Computer	1-7
Arresting Hook System	1-8
Auto Brakes	1-9
Automatic Flight Control System	1-12
Auto Throttle System	1-18
Command Receiving Systems	1-23
Control Circuits	1-27
Drone Control Configuration	1-30
Drag Chute System	1-33
Dual Controls Configuration	1-33
Electrical Power Supply System	1-35
Engines	1-38
Failsafe System	1-38
Firing Error Indicator System	1-42
Flaps	1-44
Flight Controls	1-46
Fuel System	1-47
Hydraulic Power Supply System	1-51
Landing Gear System	1-52
Lighting Equipment	1-54
Miss-Distance Measuring System	1-56
Radar Beacon System	1-56
Speed Brakes	1-57
Telemetry System	1-59
Part 3 - Servicing	1-61
Part 4 - Operating Limitations	1-61
Aircraft	1-61
External Stores	1-61

NADC-73219-30



QF-4B Target Aircraft

Part 1 - GENERAL DESCRIPTION**AIRCRAFT****DESCRIPTION**

The QF-4B target aircraft is a supersonic, twin engine, jet propelled aircraft capable of pilotless, remote controlled flight. It may also be flown in the conventional manner with a crew of two. For manned flight, the aircraft may be controlled through the standard systems or may be controlled through the drone systems by means of an on-board command system which simulates the radio command link. The external configuration of the QF-4B is essentially the same as the F-4B. The only external change is the addition of antennae for command receivers, beacons, FEI pods and telemetry.

COCKPITS**DESCRIPTION**

While significant changes have been made in the cockpits, neither the arrangement of essential flight instruments nor the two man crew capability of the F-4B has been altered. The bulk of the modification has been accomplished by exchanging weapons systems controls for drone systems controls. The Drone Switch and Light Panel, the Primary Control Panel and the Emergency Control Panel are installed in the top center of the pilot's instrument panel in place of the gunsight and radar scope. On the lower left of the instrument panel, the Secondary Control Panel and the Spare Switch Panel have replaced the Bomb Control Panel, Missile Control Panel and Missile Status Panel. Additional control panels have been installed on the left and right consoles. Details of the forward cockpit arrangement may be seen in figure A-1. Similar exchanges of equipment have been made in the rear cockpit with the result that a complete set of drone controls is available to the second crewman. In addition, all circuit breakers for the drone system are in the aft cockpit on the Target Power Control Panel. Details of the aft cockpit arrangement may be seen in figure A-2.

DUAL CONTROL CAPABILITY

There are no mechanical controls for flying the aircraft from the aft cockpit. However, there is a complete set of drone controls in the aft cockpit. When flying the aircraft with the drone systems engaged, the pilot may pass control to the aft cockpit by activating a switch on the Drone Switch and Light Panel. This allows the second crewman to fly the aircraft by means of the electrical control circuits. When flying the aircraft through the control circuits, the crewman in the aft seat has the same control capabilities as the pilot. However, the pilot in the forward cockpit retains the arming, engagement and control transfer functions.

Major Differences

There are three major differences in the basic controls which affect piloted flight without the drone systems engaged. The control stick grip has been replaced by a grip which has two four-way switches and a push-button switch on the top. With the drone systems disengaged the left four-way switch controls aircraft trim in the normal manner and the other two switches are inoperative. With the drone systems engaged all three switches are used to simulate commands. The normal flaps control switch has been replaced and a REMOTE position has been added. The REMOTE position is above the UP position and is used when controlling the flaps through the drone systems. If the flaps switch is placed in the REMOTE position, the flaps will automatically retract when the airspeed reaches between 230 and 244 knots. They will not come down until the switch is placed in the $\frac{1}{2}$ or DOWN position. The speed brake control switch has been replaced with a four-way switch of the type found on the stick grip. Moving the switch fore and aft controls the speed brakes in the normal manner with the drone systems disengaged. With the drone systems engaged this switch is used to simulate commands and disengage control circuits.

On aircraft which had been modified to include the AN/ALE-29 Chaff Dispenser Set, the integrated control panel in the aft cockpit has been removed. On these aircraft a switch has been added to control operation of the chaff dispenser doors. This switch is labeled ALE-29 DOORS OPEN or CLOSED and is located on a panel which has been installed in place of the integrated control panel. This switch shall be in the CLOSED position for flight.

STATION LOADING

External Stores Capabilities

For target operations the only external stores utilized will be the centerline tank on station 5 and/or FEI pods on stations 1 and 9. The structural provisions and wiring for all external store stations have been retained. However, in some cases, the basic aircraft wiring has been utilizing for drone systems. Thus, if external stores other than the centerline tank or FEI pods are to be carried, maintenance personnel must verify the compatibility of the stores with the drone wiring. The FEI pods are mounted on booms which are attached to standard pylons at stations 1 and 9. Each pod/boom combination weighs 162 pounds and shifts the C.G. by +0.06 percent.

External Stores Jettison

Since the weapons systems controls were removed during the conversion of the aircraft to a QF-4B, all of the external stores jettison methods available in the F-4B are not available in the QF-4B. Two methods of external stores jettison have been retained. These are the emergency

release system and the external tank jettison system. The emergency release system operates in the normal manner and will jettison the centerline tank and any other store which has been armed with the appropriate cartridge prior to flight. The external tank jettison system can be used to jettison external wing tanks in the normal manner.

Part 2 - REMOTE SYSTEMS

AIR DATA COMPUTER

DESCRIPTION

The air data computer has been modified to provide for remote operation in the QF-4B. The modification configures the air data computer for NOLO operation by shorting the input power fuses when the NOLO plugs are installed. The modification also enables the remote operator to reset the static pressure compensator by remote command and to monitor airspeed, altitude and Mach number via the telemetry system.

Static Pressure Compensator Indicator Light

In the event of a malfunction of the static pressure compensator the STATIC CORR OFF warning light in the cockpit is illuminated. The signal which is used to illuminate the light also triggers a telemetry signal to the remote operator. Upon receipt of a STATIC CORR OFF signal, the static pressure compensator may be reset remotely by momentarily keying a PARKING BRAKE ON command. If the compensator cannot be reset, as evidenced by a recurring STATIC CORR OFF signal, all airspeed and altitude data will be in error. However, no system dependent upon static pressure will become inoperative. In this case, refer to the Airspeed and Altimeter Position Error Correction charts in section XI of the F-4B NATOPS manual.

ADC Preflight Check

The static pressure compensator must be reset before each flight by momentarily placing the spring loaded CADC switch to RESET after starting the engines. This must be accomplished prior to inserting the NOLO plugs. The altimeter readings before and after reset must not vary over ± 40 feet.

NORMAL OPERATION

Piloted Flight

For piloted flight the ADC is operated in the manner outlined in the F-4B NATOPS manual.

NOLO Flight

Normal operation of the static pressure compensator shall be initiated prior to inserting the NOLO plugs. This is accomplished by placing the CADC switch in the RESET CORR position after the engines are started. After the NOLO plugs are installed the static pressure compensator may be reset remotely by momentarily keying a PARKING BRAKE ON command.

Emergency Operations

There are no emergency operations pertaining to the air data computer system.

Limitations

Altimeter transients should not exceed plus or minus 40 feet when the compensator is reset on the preflight check.

ARRESTING HOOK SYSTEM

DESCRIPTION

A remote actuation capability has been added to the existing arresting hook system. A "U"-shaped clamp fitting is attached to the existing hook control handle. From the handle, a cable is fed thru the handle clamp, to a tube fitted along the inboard edge of the right console in the cockpit, and fastened to an electromechanical rotary actuator.

After receiving an electrical command signal the motor rotates 90 degrees in approximately 2.5 seconds. The cable attached to the actuator pulley translates linearly and pulls the handle to its DOWN position, releasing the hook. The motor is then electrically reversed and rotates back, forming a slack in the cable. To raise the hook, an operator must manually push the handle up, whereby the slack is taken up. This also places the arresting hook handle in position for the next cycle. If an operator is in the aircraft and desires to lower the hook manually, he merely lowers the control handle in the conventional fashion.

HOOK ARM SWITCH

The hook arm switch is a two-position toggle switch located on the Drone Switch and Light Panel. Placing the switch in the ARMED position provides a ground return for the system control and power relays allowing the system to be activated.

HOOK Switch

The hook switch is a momentary switch on the Secondary Control Panel. Momentarily depressing this switch energizes a 4-second time delay relay

which locks in and provides a 4-second electrical signal to the actuator. After 4 seconds the actuator will release and reset itself.

NORMAL OPERATION

Piloted Operation

With control circuits engaged the hook can be lowered by depressing the hook switch any time the hook arm switch is in the ARMED position. The hook must always be raised manually by placing the handle in the UP position. However, it cannot be raised during a 5-second period immediately after depressing the hook switch. The hook may be lowered at any time by placing the handle in the down position.

NOLO Operation

The hook arm switch shall be placed in the ARMED position after control circuits are engaged and prior to installing the NOLO plugs. Then, the hook may be lowered at any time by momentarily keying a HOOK command. Once the hook has been lowered, it cannot be raised remotely. The hook must be raised by manually placing the hook handle in the UP position.

Emergency Operation

There are no provisions for emergency operation of the arresting hook.

Limitations

There are no practical arresting hook limitations for field arrestment.

AUTO BRAKES

DESCRIPTION

A remotely controlled auto brakes system is provided for stopping the aircraft during an aborted launch or during a recovery if the aircraft has missed the arresting cable. The auto brake system utilizes utility hydraulic system pressure which is routed through a brake pressure reducing valve into a brake control valve and then to the brakes via a shuttle valve. The brake control valve is opened and supplies constant brake pressure when a PARKING BRAKE command is executed. When a BRAKES ON command is executed an electrical pulse cycles the brake control valve resulting in a pulsating pressure being applied to the brakes. This combination of reduced pressure and pulsating application assures braking action without wheel skidding. The addition of the auto brakes system has not altered the manual operation of the brakes. Manual brake pressure may also be applied in conjunction with auto brakes operation. Manual brake pressure will be applied when the pulser is off and, if it is greater than the pressure out of the pressure reducing valve, manual pressure will be applied when the pulser is on. The auto brakes system also provides for an automatic application

of the brakes when the landing gear is commanded up in order to stop wheel rotation prior to the gear entering the wheel well.

Differential Brakes

The auto brake system is utilized to provide a remote differential braking capability. Differential braking is obtained by applying pulsating pressure to one wheel and releasing pressure on the opposite wheel.

AUTO BRAKES ARM Switch

The auto brakes arm switch is a two-position toggle switch located on the Drone Switch and Light Panel. Placing this switch in the ARMED position with control circuits engaged allows the system to be activated.

DIFFERENTIAL BRAKE STEERING ARM Switch

The differential brake steering arm switch is a two-position toggle switch located on the Drone Switch and Light Panel. Placing this switch in the Armed position, with control circuits engaged allows operation of the differential brake system provided the auto brakes arm switch is in the ARMED position.

BRAKES Switch

The brakes switch is a three-position toggle switch, spring loaded to the neutral position, located on the Secondary Control Panel. Momentarily moving the switch to the ON position energizes the pulser which cycles the brake control valve. Momentarily placing the switch in the OFF position removes power from the pulser and the brake control valve, releasing brake pressure.

PARKING BRAKE Switch

The parking brake switch is a momentary push button switch located on the Secondary Control Panel. Momentarily depressing this switch energizes the brake control valve which is held open supplying constant pressure to the brakes.

DIFFERENTIAL BRAKE/DIRECT RUDDER Switches

Differential brakes are operated in conjunction with direct rudder. There are two switches which may be used to command differential brakes/rudder. The left "trim" switch on the pilot's control stick grip may be moved right or left to RIGHT RUDDER/BRAKE and LEFT RUDDER/BRAKE command. The rudder switch on the Primary Control Panel may be used for this purpose. The latter is a three-position toggle switch spring loaded to neutral.

AUTO BRAKES Light

The AUTO BRAKES light is located on the Drone Switch and Light Panel. The light is illuminated whenever the brake control valve is energized. Thus, the light will flash in response to a BRAKES ON command and will be steady when PARKING BRAKE is commanded.

Brake Pressure Gauge

The brake pressure gauge is located on the left utility panel. This gauge registers the pressure at the output of the brake control valve. By monitoring the brake pressure, it is possible to determine if the AUTO BRAKES system is operating correctly. The gauge should read a constant 1000 psi. following a PARKING BRAKE command and a fluctuating pressure in response to a BRAKES ON command.

NORMAL OPERATION

Piloted Flight

For piloted flight the manual brake system may be used in the normal manner or the AUTO BRAKES system may be utilized. Control circuits must be engaged and the auto brakes arm switch in the ARMED position. PARKING BRAKE may be used to hold the aircraft in a stationary position with both engines operating up to 85 percent rpm. At higher power settings the brakes shall be released or manual override used to provide additional brake pressure. For landings the BRAKES ON command may be used to stop the aircraft in conjunction with the drag chute when the airspeed is 100 knots or less. The BRAKES ON command may also be used to stop the aircraft during an aborted takeoff if the airspeed is 100 knots or less. It should be remembered that the AUTO BRAKES system was not designed as the primary means of stopping the aircraft. Consequently, maximum braking is not available under all conditions. During simulated NOLO takeoffs the brakes off switch shall be depressed when the engines reach 85 percent rpm as thrust is increased to start the takeoff roll. When the landing gear is commanded up the brake pressure gauge should read 1000 psi until the flaps are up. When the flaps are up the pressure should drop to zero. The brakes off switch will release both modulated and steady (parking) brake pressure.

Differential braking may be used for steering during takeoff or landing by placing the differential brake steering arm switch in the ARMED position in conjunction with the auto brakes arm switch. During take off with brakes off a RIGHT/LEFT RUDDER command will result in pulsed brake pressure to be applied to one wheel. During landing with brakes on a RIGHT/LEFT RUDDER command will result in pulsating pressure being removed on one wheel and retained on the other wheel. When the RUDDER command is released pressure will be reapplied to both wheels.

NOLO Flight

The auto brakes arm switch and differential brake steering arm switch shall be placed in the ARMED position and the parking brake switch depressed after control circuits are engaged and prior to inserting the NOLO plugs. When checking systems at high power prior to takeoff manual override must be used to provide additional braking. When increasing thrust to start the takeoff roll the BRAKE OFF command shall be keyed when the engines reach 85 percent rpm. Upon landing, the drag chute and arresting hook shall be used as the primary means of stopping the aircraft. In the event that the arresting hook does not catch the wire BRAKES ON shall be keyed. The aircraft may be steered during takeoff and landing by use of RIGHT/LEFT RUDDER commands.

EMERGENCY OPERATION

For piloted flight the emergency air brakes are available as in the basic F-4B. There are no provisions for emergency operation of the AUTO BRAKES system for NOLO operation.

LIMITATIONS

The PARKING BRAKE command will not hold the aircraft stationary at power settings in excess of 85 percent rpm.

A BRAKES ON command shall not be executed at speeds in excess of 100 knots.

AUTOMATIC FLIGHT CONTROL SYSTEM

DESCRIPTION

The automatic flight control system is utilized to control pitch and roll attitude in response to remote commands as well as stabilizing the aircraft about all three axes, pitch, roll and yaw. All QF-4B aircraft are equipped with an automatic flight control system which has been modified in accordance with AFC 203. This modification provides for individual engagement of pitch, roll and yaw stability augmentation and removes the MACH HOLD feature. For drone operations the MACH HOLD feature has been restored. While it is possible to select stab aug singly or in combinations of axes, all three axes must be engaged in order for the AFCS to be fully effective. As in the basic aircraft pitch stab aug must be engaged in order to engage the AFCS mode. In the QF-4B, the AFCS mode must be engaged in order to engage the control circuits which provide for remote control of the aircraft. If roll stab aug is not engaged remote control of the roll axis is impossible even with control circuits engaged. In remotely controlled flight the AFCS maintains the aircraft at a fixed attitude, Mach number or altitude. By inserting command signals into the

AFCS it is possible to change the aircraft attitude in much the same manner as a pilot does in the control stick steering mode or engage and disengage the Mach hold and altitude hold functions. For remote operation, limitations have been added to prevent the aircraft from exceeding plus or minus 45 degrees in pitch and roll attitude.

REMOTE AFCS OPERATION

The AFCS is essential to the remote operation of the aircraft and must be engaged in order to engage control circuits. Once control circuits are engaged the aircraft attitude is controlled by inserting electrical signals into the AFCS. These signals may be generated by radio commands or switch closures in the cockpit.

Pitch Control

Climb or dive inputs are inserted in the AFCS similar to the signals generated by the pilot when controlling the aircraft during control stick steering. This is done by simulating the output of the stick force transducer. This creates an error signal in the AFCS amplifier which drives the stabilator in the proper direction to change the pitch attitude and eliminate the error. When the command is released the AFCS stabilizes the aircraft about the resultant pitch attitude. The preset voltage generated by a CLIMB or DIVE command goes through a gain programming TAS potentiometer in the Air Data Computer so that the pitch attitude is changed at a rate which results in a constant vertical acceleration throughout the flight envelope. Limit switches prevent the pitch attitude from exceeding plus or minus 45 degrees.

Pitch Center

Pitch Center utilizes a phase-sensitive circuit to determine if the aircraft is nose up or nose down relative to the pitch center attitude of 2 degrees. This phase-sensitive circuit sets the circuit logic to provide a climb or dive signal as required to drive the aircraft toward pitch center. A PITCH CENTER command, then, generates a climb or dive signal which drives the aircraft toward a 2-degree pitch attitude. When the attitude reaches 2 ± 1 degrees, the signal drops out, locking the aircraft on pitch center.

Takeoff Angle (TOA)

The takeoff angle is obtained in a manner similar to that used for pitch center except a bias voltage is inserted in the circuit to effectively change the null to a 12-degree pitch-up attitude. When the command is executed while groundborne prior to the takeoff run, the aircraft cannot respond. In this case the stabilator will deflect to a full leading edge down position. As the aircraft accelerates and starts to rotate, the stabilator will reposition as required to maintain the 12-degree pitch attitude.

Altitude Hold

Altitude hold as provided in the basic aircraft is used without change except to interlock it with other pitch commands. A CLIMB or DIVE command of greater than 0.5 second duration disengages altitude hold in the same manner as pressure on the stick in the basic aircraft. Likewise PITCH CENTER and MACH HOLD disengage altitude hold.

Mach Hold

Mach hold as provided prior to AFC 203 is installed in the aircraft. However, it is only operable with control circuits engaged. As with altitude hold, a CLIMB or DIVE command of 0.5 second duration or a PITCH CENTER command will disengage Mach hold. An ALTITUDE HOLD or THRUST INC/DEC command also disengages Mach hold.

Roll-Control

Roll-heading control inputs are similar to those used by the pilot when controlling the aircraft during control stick steering operation. A signal is introduced directly into the roll servo-amplifiers while simulating operation of the stick force transducer. This causes the ailerons to deflect and bank the aircraft in the desired direction. At the same time, the roll and course synchronizers are energized. Upon cessation of the signal, the roll synchronizer is stopped and the roll servo command input signal is removed. However, since a roll rate signal is used to drive the roll synchronizer in addition to a roll attitude input, the synchronizer will lead the aircraft attitude and the bank angle will increase after the command has stopped. A 45-degree switch on the roll synchronizer is used to limit the bank angle to 45 degrees. The roll servo command signal has two values; one when flaps are down and one when flaps are up. Each of these signal values results in a fixed aileron deflection. Thus, roll rate in response to a turn command varies with airspeed.

Turn Center

A phase sensitive circuit is used to determine the direction of bank. A TURN CENTER command results in a turn signal of the proper polarity to roll the aircraft towards wings level. A +5 degree switch on the roll synchronizer is used to drop out the turn signal as the wings near level. Then, the normal automatic roll level circuit takes over to lock the aircraft on heading and level the wings.

Roll Trim

A remote roll trim capability has been added. This system utilizes a feedback signal from the roll servo to determine an out-of-trim condition. Upon receiving a roll trim command this signal is used to drive the roll

trim motor in the proper direction to null the feedback signal from the servo. The trim motor is driven only for the duration of the roll trim command.

Heading Hold

The heading hold mode is identical to that in the basic aircraft and is engaged when the AFCS is engaged except when groundborne or with flaps one-half down. The heading hold feature has been disabled under these conditions to preclude heading errors causing the aircraft to bank during takeoff.

CLIMB/DIVE/TURN Switch

The climb/dive/turn switch is a five-position switch, spring loaded to center, located on the top right of the stick grip. Moving the switch forward to the DIVE position generates a signal to drive the aircraft in a nose-down direction. Moving the switch aft to the CLIMB position creates a signal to drive the aircraft in a nose-up direction. Moving the switch right to the RIGHT TURN position results in a signal to the roll servo amplifier which drives the right aileron and spoiler up and the left aileron down, rolling the aircraft to the right. Moving the switch to the left to the LEFT TURN position results in a signal to the roll servo amplifier which results in a left bank. This switch is inoperative with control circuits disengaged.

TRIM/DIRECT RUDDER Switch

The trim/direct rudder switch is a five-position switch, spring loaded to center, located on the top left of the stick grip. With control circuits disengaged this switch performs the normal trim function. With control circuits engaged this switch controls rudder deflection as discussed in the section on flight controls (Pg 2-7).

ROLL TRIM Switch

The roll trim switch is a momentary pushbutton switch located on the Primary Control Panel. Depressing this switch activates the automatic roll trim system. This system will drive the trim motor in a direction to reduce the roll servo feedback signal to zero as long as the switch is depressed.

TURN CENTER Switch

The turn center switch is a momentary pushbutton switch located on the top of the stick grip between the trim and the climb/dive switch. Momentarily depressing this switch will lock in a signal to the roll servo amplifier to deflect the ailerons and roll the aircraft towards wings level. This switch is inoperative with control circuits disengaged.

PITCH CENTER Switch

The pitch center switch is a momentary push button switch located on the Primary Control Panel. Momentarily depressing this switch locks in a signal to drive the aircraft attitude to 2 degrees. This switch is inoperative with control circuits disengaged.

TOA Switch

The TOA switch is a momentary pushbutton switch located on the Primary Control Panel. Momentarily depressing this switch locks in the TOA signal to drive aircraft to 12 degrees nose up. This switch is inoperative with control circuits disengaged.

ALTITUDE RETAIN Switch

The altitude retain switch is a momentary pushbutton switch located on the Primary Control Panel. Momentarily depressing this switch will lock in the altitude retain relay. The closure of this relay essentially duplicates the results of placing the ALT HOLD switch on the AFCS Control Panel in the ENGAGE position. When ALTITUDE RETAIN is locked in, MACH HOLD will drop out if it has been engaged. This switch is inoperative with control circuits disengaged.

MACH HOLD Switch

The Mach hold switch is a momentary pushbutton switch located on the Primary Control Panel. Momentarily depressing this switch energizes the Mach hold relay and drops out the altitude retain relay, if engaged. The closure of the Mach hold relay essentially duplicates the results of placing the Mach hold switch in the ENGAGE position on aircraft prior to AFC 203. This switch is inoperative with control circuits disengaged.

ALT HOLD Light

The ALT HOLD light is located on the drone Switch and Light Panel. This light is illuminated when altitude retain has been commanded with control circuits engaged.

MACH/PITCH Light

The MACH/PITCH light is located on the Drone Switch and Light Panel. This light is illuminated when Mach hold has been commanded.

NORMAL OPERATION

Piloted Operation

AFCS operation is unchanged with control circuits disengaged. All three stab aug switches shall be in the ENGAGE position prior to placing

the AFCS switch in the ENGAGE position for operations with control circuits engaged. The AFCS switch must be in the engage position in order to engage control circuits. Once control circuits are engaged the aircraft attitude is controlled by activating the command switches. The altitude retain mode can be disengaged by keying CLIMB, DIVE, PITCH CENTER, TOA for 0.5 seconds or MACH HOLD. MACH HOLD may be disengaged by keying CLIMB, DIVE, PITCH CENTER, or TOA for 0.5 seconds or ALTITUDE HOLD. The pitch altitude will change for the duration of a climb or dive command with an absolute limit of ± 45 degrees. Turn commands result in a fixed aileron deflection. Thus, the roll rate in response to a turn command will vary with airspeed. In order to provide adequate response at low speed, the aileron deflection is increased when the flaps are not up.

NOTE

In piloted flight, the pilot can change the aircraft altitude by manually displacing the control stick. However, the AFCS will continually attempt to return the aircraft to the altitude being maintained prior to displacement of the stick.

NOLO Operation

All three stab aug switches shall be engaged prior to placing the AFCS switch in the ENGAGE position. When the AFCS is engaged control circuits shall be engaged. After the NOLO plugs are installed the AFCS cannot be disengaged until the plugs are removed. TOA shall be commanded prior to brake release for the takeoff roll to verify a full leading edge down stabilator deflection. Attitude control is then maintained as in piloted flight except that commands are received via the radio link rather than switch closures in the cockpit.

AFCS Operation with Static Correction Off

Provisions are incorporated for remote reset of the static pressure compensator. In the event that the static pressure compensator fails, the autopilot will operate satisfactorily; however, the Mach and altitude hold modes may be affected. If the Mach or altitude modes are affected, the reference altitude or Mach number changes when the static pressure compensator fails.

Pitch Oscillations (Altitude Hold Mode)

When using the altitude hold mode, the aircraft may experience pitch oscillations in the transonic regions and below due to fluctuations in the ADC airspeed system. The nature of these oscillations varies from stick pumping to divergent oscillations. It is recommended that, if pitch oscillations occur, altitude hold be disengaged by keying PITCH CENTER. Then

maintain altitude as desired using CLIMB/DIVE commands. For piloted flight, standard corrective procedures may be applied and altitude hold reengaged. For NOLO flight, altitude retain operation between Mach 0.9 and 1.1 is not recommended. In any event, divergent pitch oscillations shall not be allowed to develop. If any divergent pitch activity is noted, corrective action shall be taken immediately.

Pitch Oscillations (Mach Hold)

When using AFCS with Mach hold engaged a divergent oscillation may result if thrust is added. If oscillations develop, thrust should be held constant and PITCH CENTER commanded to disengage MACH HOLD. Generally thrust should not be varied with Mach hold engaged.

NOTE

When using the AUTO THROTTLE system, THRUST INC/DEC commands will disengage MACH HOLD.

EMERGENCY OPERATION

In the event of a PC-1 failure, provisions are incorporated to automatically switch PC-2 pressure to the PC-1 side of the stabilator actuator in order to provide continued operation of the AFCS during NOLO flight. There are no provisions for emergency operation of the AFCS.

LIMITATIONS

Pitch and roll attitude cannot be commanded beyond plus or minus 45 degrees. If a load factor of +4G or -1G is sensed by the G-limit accelerometer the aircraft will automatically turn center and pitch center.

AUTO THROTTLE SYSTEM

DESCRIPTION

The auto throttle system utilizes the approach power compensator system (APCS) to provide for remote control of throttle position. The auto throttle system has three modes of operation: the remote approach power compensator (RAPC) mode for landing; RAPC mode for cruise; and the direct throttle (DT) mode. Flap position will govern the dual RAPC modes; flaps up will result in cruise mode and flaps down will result in the landing mode. Engine power settings from idle to maximum afterburner may be commanded in the DT mode. The basic APCS has been modified so that the cruise mode is available in addition to the landing mode with control circuits disengaged. Manual throttle operation is available with the system turned off, and an emergency override feature allows the pilot to manually position the throttle anytime the system is engaged by applying

a force of 20 to 40 pounds per throttle. The system may be disengaged by disengaging control circuits or by moving the APCS switch to OFF. With control circuits disengaged the basic APC system may be disengaged by moving the speed brake switch to IN or by moving the APCS switch to STBY or OFF.

Direct Throttle

The direct throttle mode is the engage mode of the auto throttle system. With the APCS switch in STBY a signal from the feedback transmitter on the power control lever is fed to the remote throttle coupler to allow the system to synchronize with the manually determined throttle position. When the system is armed, the output of the throttle coupler is inserted in the electronic control amplifier to balance the signal to the feedback transmitter to maintain the throttle position. A THRUST INCREASE or DECREASE command unbalances the circuit and the output of the electronic amplifier drives the torque boosters on the engines in the proper direction. Electrical limit switches on the power control levers prevent the thrust from being commanded beyond military power unless a BURNER ON command is executed. The BURNER ON command inserts a thrust increase signal into the electronic control amplifier until first stage afterburner operation is achieved. Then a thrust increase signal will drive the throttle as in the non-afterburning region. In the afterburning region the thrust decrease signal will operate as in the non-afterburning region until first stage afterburner position is reached. There, an electrical limit switch prevents a thrust decrease signal from further retarding the throttle. To reduce thrust out of the afterburning region a BURNER OFF command must be given. This allows a thrust decrease signal to pass until military thrust is achieved. Then the thrust decrease command is allowed to pass again. There is also an electrical limit switch which prevents a thrust decrease signal to pass to the electronic control amplifier when the power control level is at an idle position.

RAPC

The RAPC mode functions in exactly the same manner as the approach power compensator system in the basic F-4B. Its operation, however, has been expanded to include an 8.5 unit angle-of-attack reference for flaps up flight. A RAPC command locks in the RAPC relay. This removes the throttle coupler input from the electronic control amplifier and allows the output of the throttle computer to pass to the electronic control amplifier. A flaps up relay provides for switching the angle-of-attack reference from 19.2 to 8.5 units when the flaps are up. RAPC may be commanded at any time. If the engines are in afterburner, the RAPC command will result in a BURNER OFF signal which will decrease thrust below the MIL limit. Then, thrust is limited to 99 percent as in basic APCS operation. An airborne switch removes power from the RAPC relay upon landing, and the system reverts to direct throttle operation.

THROTTLE COMPUTER

The throttle computer has been modified to include an 8.5 unit angle-of-attack reference in addition to the 19.2 unit reference. It has also been modified to improve throttle response when operating in the cruise mode (8.5 units). The reference angle of attack and gain change is automatically programmed via the flaps-up relay. When the flaps are up the computer computes the throttle position required to maintain 8.5 units angle of attack.

THROTTLE ARM Switch

The throttle arm switch is a two-position toggle switch located on the Drone Switch and Light Panel. Placing this switch in the ARMED position activates the system when control circuits are engaged and the APCS switch is not in the OFF position. This switch is inoperative with control circuits disengaged.

APCS POWER SWITCH

The APCS power switch is a three-position toggle switch with positions of OFF, STBY and ENGAGE. In OFF, all power to the system is removed and the throttles must be manually positioned and auto throttle cannot be engaged. In STBY, power is supplied to the throttle computer and the throttle coupler so that the system may synchronize with the prevailing flight condition. However, the control amplifier is not active and the throttles must be positioned manually. The STBY position is utilized for auto throttle operation. With c/c engaged, placing the APCS switch in STBY and the throttle arming switch in ARMED engages the system. The system engages in a direct throttle mode and a command must be given to change the throttle position. If the APCS power switch is in the ENGAGE position when the throttle arm switch is placed in ARM, the holding coil will drop out and the APCS power control switch will move to STBY. The Auto Throttle system may be disengaged by placing the throttle arm switch in SAFE or by depressing one of the control circuits disengage switches.

THRUST INC/DEC Switch

The thrust inc/dec switch is a five-position switch, spring loaded to center, mounted in place of the speed-brake switch on the inboard throttle handle. Moving the switch up to the INC position causes the throttles to advance. Moving the switch down to the DEC position causes the throttles to retard. Moving the switch to either position causes RAPC or Mach hold to drop out, if engaged. The switch is effective for positioning the throttle between idle and MIL thrust and between minimum and maximum afterburner. It does not move the throttles between MIL and minimum afterburner. The INC and DEC positions are inoperative with c/c disengaged.

BURNER ON/OFF Switch

The burner on/off switch is a three-position toggle switch, spring loaded to center, located on the Primary Control Panel. Momentarily placing the switch in the ON position will cause thrust to increase until the minimum afterburner setting is reached. Momentarily placing the switch in the ON position will cause thrust to increase until the minimum afterburner setting is reached. Momentarily placing the switch in the OFF position results in the thrust being decreased to MIL thrust. If operating in the afterburner, the BURNER ON signal has no effect. If BURNER ON is keyed and then prior to reaching MIL thrust BURNER OFF is keyed, the throttles will stop in the position they were in at the time the OFF signal was keyed. The BURNER ON/OFF switch is inoperative with c/c disengaged.

RAPC Switch

The RAPC switch is a momentary pushbutton switch located on the inboard throttle handle. Momentarily depressing the switch, when airborne, removes the direct throttle input to the electronic control amplifier. At the same time the path from the throttle control computer to the electronic control amplifier is closed. The computer then computes the throttle position to maintain the desired angle of attack (19.2 units flaps down or 8.5 units flaps up). A RAPC signal will disengage Mach hold. This switch is inoperative with control circuits disengaged.

RAPC Light

The RAPC light on the Drone Switch and Light Panel illuminates when RAPC is engaged.

REMOTE THROTTLE PLATE

To provide the pilot positive indication of military and minimum afterburner throttle positions, mechanical stops are installed on the throttle quadrant. To move the throttles between the two regions the handle must be displaced laterally. For AUTO THROTTLE operation, the minimum afterburner stop is removed as is the plate between the throttle handles, and the idle stop springs. A remote throttle plate is then installed which has a fold-down idle stop which physically prevents the throttles from being inadvertently retarded below idle cutoff. The remote throttle plate also contains provisions for NOLO plates. The NOLO plates hold the throttles in the outboard position to bypass the MIL stops.

NOTE

When the remote throttle plate is installed, hold down and lock the idle stop as soon as both engines are in the operating range to prevent inadvertent engine shutdown.

NORMAL OPERATION

Piloted Operation

It is possible to engage the approach power compensator system anytime the aircraft is in flight. This operation is the same as in the basic aircraft with the exception that with flaps up the throttle computer computes the throttle position to maintain 8.5 units angle of attack instead of 19.2 units. With control circuits engaged the APCS power switch shall be placed in the STBY position prior to placing the throttle arm switch in the ARMED position. The auto throttle system engages in the direct throttle mode. THRUST INC/DEC and BURNER ON/OFF commands may then be used to control thrust from idle to maximum afterburner. RAPC may be used to position the throttles for an efficient cruise setting with flaps up or to maintain the proper throttle position during landing approaches with flaps down. In the RAPC mode the throttles are positioned between 73 to 99 percent. RAPC may be commanded at any time. If commanded when operating in the afterburning region the thrust will immediately be reduced to below MIL thrust then maintained between 73 and 99 percent. When transitioning between afterburning and non-afterburning region, the throttles must be manually moved around the mechanical stops.

NOLO Operation

The NOLO plate shall be installed, the mechanical minimum afterburner stop removed, the APCS switch in STBY and the throttle arm switch in the ARMED position prior to inserting the NOLO plugs. In addition the engine select switch shall be in BOTH and the temperature select switch in NORM. Takeoff should be made by commanding BURNER ON and holding THRUST INC to obtain maximum thrust. This will verify afterburner operation and provide shortest takeoff roll with maximum runway available for stopping in the event of an aborted takeoff. RAPC should be used in conjunction with altitude retain to obtain most efficient loiter conditions.

WARNING

Do not use RAPC in conjunction with altitude retain during Single engine operation or at altitudes in excess of 32,000 feet. The RAPC mode of operation is limited to 99 percent rpm. At some gross weight conditions this is not sufficient to maintain constant altitude flight and stall may result.

CAUTION

When commanding BURNER ON or BURNER OFF without the minimum afterburner stop removed the throttles must be manually moved around the stop to prevent the throttles from driving against the mechanical stops.

NOTE

With control circuits engaged APCS cannot be engaged except through the AUTO THROTTLE system.

EMERGENCY OPERATION

There are no provisions for emergency operation of the Auto Throttle system.

NOTE

The pilot can manually override the throttles by exerting 20 to 40 pounds force per throttle. In this case the throttles must be held in the desired position.

When manually retarding the throttles with the Auto Throttle system engaged, the throttles can be pulled against the APCS minimum-speed stop. The throttles cannot be retarded below this point unless the force against the minimum speed stop is relieved and the Auto Throttle system is disengaged.

LIMITATIONS

The RAPC mode is limited to operation within the 73 to 99 percent throttle range.

COMMAND RECEIVING SYSTEM

DESCRIPTION

The command receiving system consists of two AN/DRW-29 command control receivers, a dual receiver transfer relay box, a multiplexer, two AT-335/ARW antenna and associated control panels. The command receiving system receives, interprets and relays commands through the signal distribution system to operate the various drone systems.

AN/DRW-29 Command Receivers

The AN/DRW-29 command control receivers are capable of receiving a frequency modulated signal in the frequency range of 406 to 550 megahertz. The received signal may be frequency-modulated by as many as six separate fixed-frequency audio signals, simultaneously. The radio receiver detects these audio-frequency modulations of the received signal, separates the individual audio frequencies (if more than one is present), and provides outputs in the form of relay closures to indicate the presence of any combination (up to six at any one time) of 20 preselected audio frequencies.

The output relay closures are used to control functions external to the radio receiver. The received rf signal is converted to an if frequency, amplified and demodulated. The demodulated signal is then applied through a set of contacts of the carrier relay to all 20 audio decoders. Each decoder is tuned to a specific audio frequency in the range from 7.5 to 73.95 kHz, and each will energize its corresponding relay when its specific audio frequency is present in the audio signal. The second output from the if amplifier is used by the carrier detector circuit to produce a dc output voltage, the magnitude of which is proportional to received signal strength. When the received rf signal at the input of the radio receiver is 10 microvolts or more, the carrier detector circuit energizes the carrier relay, which passes the audio signal to the audio decoders. If the rf signal level drops below 5 microvolts, the carrier relay is deenergized, the audio output circuit is opened, and all decoder input circuits grounded. The carrier relay also provides externally connected single-pole double-throw switching through another set of contacts. Two command control receivers are installed in the target drone; however, only one receiver is in command of the drone at any one time. Either receiver is capable of operation independently of the other. The dual receiver transfer relay box places the standby receiver in operation on failure of the operating receiver.

Dual Receiver Transfer Relay Box

The dual receiver transfer box is a primary interlock component for the target drone command control system. The unit contains five relays that function to transfer control from one command control receiver to the other in the event that either receiving system fails. If both systems fail, a signal is supplied to initiate the carrier failure sequence (fail safe system) in the target drone control system. Power for the carrier relays in the command control receivers is routed through the dual receiver transfer relay box.

Multiplexer

The multiplexer functions to convert the 20-channel output of the receivers into 54 command control channels to which the functions are assigned as shown in table 2-1. The 54 command control channels are generated from the basic 20 channels provided by the receivers by using channels 2 through 20, omitting 12, keyed singly to provide 18 command channels; then using channel 1 keyed simultaneously with each of the other channels to provide 19 additional command control channels; and then using channel 12 keyed simultaneously with each of the other channels from 3 through 20 to provide 17 further command control channels to make a total of 54.

AT-335/ARW Antenna

Two AT-335/ARW quarter wave, streamlined, antennas are installed forward of the cockpit, one on top of the fuselage and one on the bottom.

TABLE 2-1. COMMAND CONTROL FUNCTIONS

Channel	Function	Local Control
2	Brakes Off	Secondary Control Switches
3	Brakes On	Secondary Control Switches
4	Mach Hold	Primary Control Panel
5	Landing Gear Up	Primary Control Panel
6	Landing Gear Down	Primary Control Panel
7	Climb	Stick Grip
8	Dive	Stick Grip
9	Left Turn	Stick Grip
10	Right Turn	Stick Grip
11	Turn Center	Stick Grip
13	Altitude Retain	Primary Control Panel
14	Thrust Increase	Throttle Handle
15	Thrust Decrease	Throttle Handle
16	Right Rudder and Nose wheel	Primary Control Panel
17	Left Rudder and Nose wheel	Primary Control Panel
18	Takeoff Angle	Primary Control Panel
19	Engine Shut DN LT	Secondary Control Panel
20	Engine Shut DN RT	Secondary Control Panel
1 and 2	Spare	Primary Control Panel
1 and 3	Wing Fuel Jettison	Emergency Command Panel
1 and 4	PAPC	Primary Control Switches
1 and 5	Cameras On	Secondary Control Panel
1 and 6	Spare	Emergency Command Panel
1 and 7	Chute Jettison	Secondary Control Panel
1 and 8	Wing Flaps Down	Primary Control Panel
1 and 9	Wing Flaps Up	Primary Control Panel
1 and 10	Chute Deploy	Secondary Control Panel
1 and 11	Parking Brake	Secondary Control Panel
1 and 12	Carrier Recovery	Emergency Command Panel
1 and 13	Speed Brakes Down	Primary Control Panel
1 and 14	Speed Brake Up	Primary Control Panel
1 and 15	Pitch Center	Primary Control Panel
1 and 16	Roll Trim	Primary Control Panel
1 and 17	Arresting Hook Down	Secondary Control Panel
1 and 18	Abort	Spare Control Panel
1 and 19	Spare	Spare Control Panel
1 and 20	Half Flaps	Primary Control Panel
12 and 3	Low Altitude Control On	Stick Grip
12 and 4	Burner Off	Primary Control Panel
12 and 5	Burner On	Primary Control Panel
12 and 6	Telemetry Calibrate	Secondary Control Panel
12 and 7	External Stores Jettison	Emergency Command Panel
12 and 8	Spare	Secondary Control Panel
12 and 9	Spare	Secondary Control Panel
12 and 19	Smoke On	Secondary Control Panel

TABLE 2-1. COMMAND CONTROL FUNCTIONS (cont.)

Channel	Function	Local Control
12 and 11	Smoke Off	Secondary Control Panel
12 and 13	No. 1 Receiver	Secondary Control Panel
12 and 14	No. 2 Receiver	Secondary Control Panel
12 and 15	Spare C	Secondary Control Panel
12 and 16	Spare D	Secondary Control Panel
12 and 17	Spare E	Spare Control Panel
12 and 18	Spare F	Spare Control Panel
12 and 19	Spare G	Spare Control Panel
12 and 20	Spare H	Spare Control Panel

Either of the AN/DRW-29 command control receivers may be connected to either of the two antennas; however, receiver No. 1 is normally connected to the top antenna and receiver No. 2 to the bottom antenna.

COMMAND RECEIVER Switch

The command receiver switch is a two-position toggle switch located on the Drone Control Panel on the right-hand console. Placing the switch in the ON position applies power to the AN/DRW-29 command receivers provided the drone master switch is ON.

Receiver Switch

The receiver switch is a three-position toggle switch, spring loaded to center, located on the secondary control panel. Momentarily placing the switch in the No. 1 or No. 2 position energizes the relays in the dual receiver transfer relay box to connect the receiver selected to the multiplexer.

No. 1 and No. 2 Receiver Lights

The No. 1 and No. 2 receiver lights are located on the Drone Control Panel adjacent to the command receiver switch. The No. 1 or No. 2 receiver light is illuminated when the corresponding command receiver is active.

Carrier Light

With the drone master switch ON the carrier light will be illuminated whenever the command receiver switch is ON and the received signal strength is sufficient to energize the carrier relay.

NORMAL OPERATION

Piloted Operation

The command receivers may be activated anytime the C/C master switch is ON by placing the command receiver switch in the ON position. The first carrier receiver relay to energize will complete a path for energizing its respective carrier relay in the dual receiver transfer relay box. The other receiver will then be placed in standby operation. Either receiver may then be selected by placing the receiver switch in the No. 1 or No. 2 position as desired. In the event of a receiver failure the receiver transfer relay box will automatically switch to the operable receiver.

NOLO Operation

After completing basic aircraft checks and with the C/C master switch ON, the command receiver switch shall be placed in the ON position. With the transmitting station operating both No. 1 and No. 2 receivers shall be selected and checked for operation prior to inserting the NOLO plug. Receiver selection may be accomplished remotely by keying NO. 1 RECEIVER or NO. 2 RECEIVER commands. In the event of a receiver failure the receiver transfer relay box will automatically switch to the operable receiver.

EMERGENCY OPERATION

There are no provisions for emergency operation of the command receivers.

LIMITATIONS

The AN/DRW-29 command receivers have a line-of-sight range of approximately 180 miles.

CONTROL CIRCUITS

DESCRIPTION

The control circuits utilize 28 volt dc electrical power from the aircraft electrical system to energize the drone system components and to provide excitation voltage to the relay logic which controls command input signals. Until the control circuits are engaged the aircraft is operated in the same manner as a basic F-4B aircraft. Upon engagement of the control circuits the stick force sensor is removed from the AFCS loop and the aircraft attitude must be controlled through the AFCS using commands. At the same time, standby power is applied to the remaining drone systems allowing them to be controlled by commands when the appropriate arming switch has been placed in the ARMED position. The AFCS must be engaged prior to engaging control circuits.

C/C MASTER Switch

The C/C master switch is a two-position toggle switch located on the Drone Switch and Light Panel. Placing the switch in the ON position allows power from the right 28-volt dc bus to energize the C/C Power Control relays. Normally open contacts on these relays are wired in series to the ground return to the C/C MASTER light. Thus, all relays must operate to illuminate the light which is located on the Drone Switch and Light Panel. Two additional contacts on the C/C master essential control relay also close when the C/C master switch is ON. Closure of these contacts allows the right and left 28V dc buses to energize the right and left W power buses which provide stand-by power to the drone systems.

C/C ARM SWITCH

The C/C arm switch is a two-position toggle switch, spring loaded to OFF, located on the Drone Switch and Light Panel. Momentarily placing the switch in the ARM position energizes the C/C arm relay, provided the AFCS is engaged. This relay locks in and allows power to pass to the C/C engage switch. When the C/C arm relay is energized a normally open set of contacts close to provide a ground return to the C/C ARM light which is located on the Drone Switch and Light Panel. This light is illuminated until C/C is engaged.

C/C ENGAGE SWITCH

The C/C engage switch is the NOSEWHEEL STEERING/HEADING HOLD CUTOFF switch on the stick grip. When the C/C arm relay is energized the nose-wheel steering power is removed from the switch and 28 v dc from the control circuits is applied. Momentarily depressing the switch, with C/C armed, energizes and locks in the C/C engage relay. When this relay is energized 28 v dc power from the aircraft energizes the right and left Y power buses. This is the power to energize all control relays in the drone systems. When C/C is engaged the C/C ARM light is out and the C/C ENGAGE light on the Drone Switch and Light Panel is illuminated.

C/C DISENGAGE Switches

There are three C/C disengage switches on the QF-4B. They are the trigger switch on the stick grip, the AFCS emergency disengage switch on the stick and the speed brakes switch on the throttle handle. Momentarily moving the speed brakes switch to IN or OUT or depressing either of the other two switches energizes the autopilot disengage relay. This in turn removes power from the AFCS engaged relay. When the AFCS engaged relay is de-energized power is removed from the C/C arm and C/C engage relays. When the C/C engage relay drops out dc power is removed from the Y power buses. Thus, the aircraft reverts to basic operation in the STAB AUG mode.

C/C TEST Switch

The C/C test switch is a solenoid switch located on the Command Master Panel. Placing this switch in the TEST position allows Control Circuits to be engaged without AFCS engaged. A groundborne interlock is contained in the circuit to limit operation of this switch to groundborne operation. When this switch is utilized in C/C engagement all remote functions are operable except those associated with the AFCS.

STAB NULL Light

The STAB NULL light is located on the Drone Switch and Light Panel. This light is illuminated when the stabilator is in the proper position for groundborne engagement of the AFCS.

C/C MASTER Light

The C/C MASTER light is located on the Drone Switch and Light Panel and is illuminated when the C/C master switch is ON. Failure of the light to illuminate when the switch is ON is an indication of a failure of one of the relays which tie the aircraft buses to the drone buses or a failure in the aircraft electrical system.

C/C ARM Light

The C/C ARM light is located on the Drone Switch and Light Panel. The light will illuminate when the C/C arm switch is momentarily placed in the ON position with the C/C master ON. The light will be extinguished when C/C is engaged or the C/C master is placed in the OFF position.

C/C ENGAGE Light

The C/C ENGAGE light is located on the Drone Switch and Light Panel and is illuminated when C/C is engaged.

NORMAL OPERATION

Piloted Operation

The control circuits may be engaged anytime the AFCS is engaged. The system is engaged by placing the C/C master switch ON, momentarily placing the C/C arm switch in the ARM position and then momentarily depressing the C/C engage switch. A failure in the aircraft electrical system will cause the C/C master off relay to be energized. When this relay is energized the power path to the relays connecting the aircraft buses to the drone buses is opened and control circuits disengage. The control circuits disengagement also causes the AFCS to disengage. In the event of a malfunction

in the drone systems, control circuits may be disengaged by depressing the AFCS emergency disengage switch, depressing the trigger switch, moving the speed brakes switch to IN or OUT or placing the C/C master switch to OFF.

NOLO Operation

Control circuits shall be engaged, after the basic aircraft checks have been completed and AFCS engaged, by placing the C/C master switch in the ON position, momentarily placing the C/C arm switch in the ARM position and then momentarily depressing the C/C engage switch. Once the NOLO plugs are installed control circuits can be disengaged only by removing the NOLO plugs and keying a disengage switch or placing the generator control switches in the OFF position. With the NOLO plugs installed an electrical failure will not result in control circuits disengagement.

EMERGENCY OPERATION

There are no provisions for emergency operation of the control circuits.

LIMITATIONS

The AFCS must be engaged to engage control circuits.

DRONE CONTROL CONFIGURATION

DESCRIPTION

The QF-4B target drone is configured to be a DF-4B drone control aircraft by the installation of a chase electronics rack and two C-902/ARW-55 transmitter control boxes. The chase electronics rack replaces the drone electronics rack in the nose compartment and the transmitter control boxes replace dummy control boxes in pilot's cockpit. The drone control system consists of two AN/ARW-55 transmitting sets, two KY-5/ARW audio coders and the associated electronics required to connect the QF-4B command panels to the transmitting sets. Each transmitting set is independent and capable of transmitting all commands required to operate a QF-4B target drone. The QF-4B command panels are utilized to key commands in the same manner as the onboard pilot keys commands to operate the QF-4B with control circuits engaged.

COMMAND MASTER PANEL

The command master panel is the "dog bone" located at the base of the pilot's instrument panel. This panel contains the switches which control power to the command system, provide for transmitter selection and mode of carrier operation. Indicator lights are also provided to indicate carrier status and transmitter selection.

COMMAND MASTER Switch

The command master switch controls power to the entire command system. Placing the switch in the ON position applies standby power to the command transmitters.

XMTR Switch

The XMTR switch provides for selection of the main or auxiliary transmitters. Placing the switch in the MAIN or AUX position places the corresponding transmitter and audio coder in the operate condition.

CARRIER Switch

The carrier switch controls the mode of operation of the transmitting sets. With the switch in the KEYED position a carrier is transmitted only during the time a command is being keyed. With the switch in the CONSTANT position a carrier signal is transmitted continuously.

XMTR Lights

Two XMTR indicator lights are located on the command master panel. These lights are labeled MAIN and AUX. The light which is illuminated indicates the transmitter which is in operation.

CARRIER Lights

Two carrier indicator lights are provided on the command master panel. The CARRIER OFF light is illuminated whenever the command master switch is ON and a carrier is not being transmitted by the command transmitting set. The CONSTANT CARRIER light is illuminated when the carrier switch is in the CONSTANT position and a carrier is being transmitted.

Sidetone Volume Control

The command system includes a sidetone oscillator which generates an audible tone to the pilot's headset when a command is keyed. The volume of this tone is controlled by the sidetone volume control.

AN/ARW-55 COMMAND TRANSMITTING SET

Two AN/ARW-55 command transmitting sets designated as MAIN XMTR and AUX XMTR are included in the drone control system. Each set consists of one AT-335/ARW antenna, one T-309/ARW-55 radio transmitter and one C-902/ARW-55 transmitter control. One antenna is mounted on the top of the aircraft and one on the bottom. The transmitter connected to the top antenna is designated the MAIN XMTR, and the transmitter connected to the bottom antenna is designated the AUX XMTR. The AN/ARW-55 transmitting set is capable of transmitting 20 separate audio notes referred to as channels. By using channels 2 through 11 and 13 through 20 separately

and in combination with (multiplexed) 1 and 12, 54 discrete functions may be commanded. The channel allocation for each function is as given in table 2-1 for the QF-4B command receiving system.

C-902/ARW-55 Transmitter Control

Two C-902/ARW-55 transmitter controls, one for each transmitter, are located on the pilot's left console. Each unit has a frequency selector and an XMTR POWER switch. Placing the XMTR POWER switch in the ON position allows power to be applied to the transmitting set when the command master switch is placed to the ON position. The setting of the frequency selector determines the transmission frequency of the set.

CONTROL PANELS

Remote commands are transmitted by operating the appropriate command function switches. These switches are located on control panels, the pilot's stick grip, the inboard throttle handle and the hand control in the aft cockpit. The QF-4B control panels and switches are utilized in the DF-4B and the switch operation is identical to QF-4B operation.

NORMAL OPERATION

Operation of the command transmitting system is initiated by setting the frequency selector to the assigned frequency and placing the XMTR power switch ON on both transmitter controls. Placing the command master switch ON applies standby power to the transmitting system. The desired transmitter may then be selected by placing the XMTR switch to MAIN or AUX as desired. Then the carrier switch shall be set to CONSTANT or KEYED as desired.

NOTE

If the command master switch has been ON for less than 35 seconds prior to selecting MAIN or AUX, the indicator light on the command master panel will not illuminate until 35 seconds "warm up" time has elapsed.

EMERGENCY OPERATION

There are no provisions for emergency operation of the command transmitting system.

DRAG CHUTE SYSTEM

DESCRIPTION

The QF-4B is equipped with a remotely operated drag chute for NOLO operations. The remote system is designed to operate only with the NOLO plug installed and weight on the landing gear. The drag chute control cable is routed over a set of pulleys mounted on a rotary actuator at station 573.6. A CHUTE DEPLOY command causes the actuator to rotate and effectively shorten the cable which simulates the action of the manual control handle. Once the command is keyed it is locked in but the signal will not pass to the actuator unless there is weight on the landing gear. A CHUTE JETTISON command unlocks the CHUTE DEPLOY command and drives the actuator to its original position releasing tension on the control cable allowing the chute to jettison if it has deployed. If the chute was not deployed the deployment command is simply removed and must be keyed again in order to deploy the chute. A THRUST INCREASE command will also cancel a chute deploy command or jettison a chute which has been deployed.

NORMAL OPERATION

Piloted Operation

For piloted flight the remote drag chute system is inoperative and the drag chute must be manually deployed in the normal manner.

NOLO Operation

The remote drag chute system is armed by the installation of the NOLO plugs. A CHUTE DEPLOY command will lock in anytime the NOLO plugs are installed; however, the chute will not deploy until there is weight on the landing gear. A CHUTE JETTISON or THRUST INCREASE command will drop out the deploy command and; if the chute is deployed, jettison the chute.

EMERGENCY OPERATION

There are no provisions for emergency operation of the drag chute.

LIMITATIONS

There are no limitations on operation of the remote drag chute system.

DUAL CONTROLS CONFIGURATION

There are no mechanical flight controls or throttle controls in the aft cockpit of the QF-4B aircraft. However, a complete set of command switches is provided so that the aircraft can be flown from the aft cockpit with control circuits engaged. All arming, engage and disengage functions

must be performed from the forward cockpit. In lieu of a mechanical control stick, a hand control has been installed in place of the antenna hand control. A throttle control panel has been provided for thrust control. A Primary Control Panel, Secondary Control Panel, Emergency Control Panel and Spare Switch Panel similar to the panels in the forward cockpit have been provided for control of the drone systems.

COCKPIT CONTROL SWITCH

The cockpit control switch is a two-position toggle switch located on the Drone Switch and Light Panel. Placing the switch in the AFT position deactivates the control switches in the forward cockpit and energizes those in the aft cockpit.

CONTROL STICK

The control stick is a hand stick mounted on the RIO instrument panel in place of the antenna hand control. Moving the stick fore and aft, right and left provides attitude control in exactly the same manner as moving the climb/dive/turn switch on the pilot's stick grip. The switch on the top center of the control stick is the turn center switch which duplicates the function of the turn center switch on the pilot's stick grip.

NORMAL OPERATION

The AFCS and control circuits must be engaged in the forward cockpit. Control may then be passed to the aft cockpit by placing the cockpit control switch in the aft position. The pilot shall also place the arming switches in the ARMED position as desired. Control can be returned to the forward cockpit by placing the cockpit control switch in the FORWARD position. The pilot must disengage the control circuits from the forward cockpit regardless of the position of the cockpit control switch.

NOLO Operation

NOLO Operation is unaffected by the dual control capability.

EMERGENCY OPERATION

Emergency disengagement of control circuits is accomplished from the forward cockpit only.

LIMITATIONS

There are no specific limitations related to the dual controls.

ELECTRICAL POWER SUPPLY SYSTEM

DESCRIPTION

The QF-4B electrical power supply system consists of the electrical power supply system of the F-4B plus two additional transformer-rectifiers and a target power control box. Protection against loss of essential circuits is provided in the form of two NOLO plugs which bypass normal circuit protection by placing jumpers across fuses or circuit breakers or applying voltage directly to a circuit without any protection.

A-C Electrical Power

All QF-4B aircraft are equipped with a split bus system. With control circuits disengaged the operation of this system is unchanged from the basic F-4B. With control circuits engaged the right and left generators energize the right and left non-essential transformer-rectifiers. If a generator fails during manned flight, the protection circuits are utilized to disengage C/C master power. At the same time, the bus tie closes and the remaining generator powers both buses and the system operates the same as a standard F-4B. In NOLO flight, a generator failure will also result in that generator being disconnected from the bus by the fault protection circuit. At the same time a lock-in voltage from the remaining generator control panel is applied to the generator control relay and line contactor for the remaining generator. This eliminates all circuit protection for the remaining generator. As in the basic F-4B the bus tie closes and attempts to power both ac buses from the one generator. When the bus tie closes, a lock-in voltage from the ac power control box is applied to prevent the bus tie from opening.

DC Electrical Power

The existing dc power supply system has been modified by the addition of two non-essential transformer rectifiers which supply power to the FEI and MDM systems. As with the basic system the non-essential transformer-rectifiers are connected in parallel through a 60-ampere bus tie current limiter. In the event of a generator failure in either manned or NOLO flight the non-essential transformer-rectifiers are deenergized.

NOLO Plugs

The NOLO plug receptacles are located on the number 1 circuit breaker panel and the target power control box in the aft cockpit. The NOLO plugs bypass normal circuit protection by placing jumpers across the circuit's fuse or circuit breaker or by applying voltage to a circuit without any protection. All essential circuit breakers are bypassed with the insertion of the two NOLO plugs except the generator circuits which are NOLO armed by the insertion of the NOLO plugs. In the event of a generator failure the NOLO relays will lock in the remaining generator and the bus tie.

NOLO ARM Light

The NOLO ARM light is located on the Drone Switch and Light Panel. It will be illuminated anytime either NOLO plug is installed.

WARNING

The NOLO ARM light shall never be on for piloted flight. The NOLO ARM light indicates a NOLO plug is installed thereby bypassing normal electrical circuit protection.

REMOTE ARM Light

The REMOTE ARM light is located on the Drone Switch and Light Panel. This light will be illuminated when control circuits are engaged, the flaps handle is in the REMOTE position, the flaps/speed brakes switch is in the ARMED position and both NOLO plugs are installed.

WARNING

The REMOTE ARM light shall never be illuminated for manned flight as it indicates that both NOLO plugs are installed.

NORMAL OPERATION

Piloted Operation

Operation of the electrical system is unchanged in piloted flight.

WARNING

NOLO plug(s) shall never be installed for piloted flight.

NOLO Operation

The electrical system is engaged in the normal manner. After control circuits are engaged and all ground checks completed the NOLO plugs shall be installed. Upon installation of either NOLO plug the NOLO ARM light shall illuminate. With both NOLO plugs installed, the flaps handle in the REMOTE position and the flaps speed brakes switch in the ARMED position, the REMOTE ARM light shall illuminate.

WARNING

Do not attempt NOLO flight if the REMOTE ARM light is not illuminated. Failure of the light to illuminate may indicate remote control of flaps and speed brakes or landing gear may not be possible, or control circuits may be lost if a generator fails.

EMERGENCY OPERATION

Piloted Operation

In the event of a generator failure, control circuits will automatically disengage through the action of the C/C master-off relay. The electrical system will revert to the basic aircraft configuration and standard emergency procedures shall be executed.

NOLO Operation

In the event of a generator failure, the failed generator will be disconnected from the system. The remaining generator and the bus tie will be locked in powering both ac buses from the single generator. Control circuits will remain engaged but the non-essential transformer-rectifiers will be disengaged resulting in loss of power to the FEI and MOM systems. The lock-in feature then prevents the second generator from disengaging from the buses.

NOTE

There is no provision for remote operation of the ram air turbine. In the event of a dual generator failure in NOLO flight the aircraft will be lost.

WARNING

Do not attempt to regain a lost generator with the NOLO plugs installed as the bus tie locks in anytime the aircraft is operating from only one generator.

LIMITATIONS

There are no specific limitations applicable to the electrical system.

ENGINES

DESCRIPTION

The standard General Electric J79-GE-8 engines are retained in the QF-4B with some modification. The AUTO THROTTLE system provides for remote control of the throttles. A remote engine shutdown capability is also incorporated to provide for emergency shutdown of an engine during NOLO flight. The existing system is modified so that a LEFT or RIGHT ENGINE SHUTDOWN command will apply power to the engine fuel shutoff valves and the throttle computer single engine operate relay; and will interrupt power to the left or right power control lever engage solenoids.

NORMAL OPERATION

Piloted Operation

The engine systems are operated in the normal manner for piloted flight. In addition, throttle control is available through the AUTO THROTTLE system.

NOLO Operation

The engines must be started and shutdown manually in the normal manner. Throttle control is accomplished through the AUTO THROTTLE system after the engines have been started.

EMERGENCY OPERATION

During NOLO flight the engines may be shut down in an emergency by a RIGHT or LEFT ENGINE SHUTDOWN command. These commands must be held for a minimum of 5 seconds to be effective.

LIMITATIONS

The limitations specified in the basic F-4B NATOPS manual apply to the QF-4B.

FAILSAFE SYSTEM

DESCRIPTION

The failsafe system automatically initiates a series of commands to maneuver the aircraft to a safe flight condition whenever a loss of radio command guidance carrier occurs. The target will execute one of three failsafe modes determined by the flight condition at the time of carrier loss. If the carrier is lost;

during takeoff with the airspeed less than 85 knots or during a landing with full flaps and the aircraft groundborne, the aircraft will execute an ABORT provided the NOLO plugs are installed;

during takeoff with the airspeed greater than 85 knots or during a landing prior to touchdown, the aircraft will execute a WAVEOFF;

subsequent to takeoff and prior to putting the flaps down for landing, the target will either orbit or fly a preset magnetic heading at a safe altitude.

Abort

With the airspeed less than 85 knots with 1/2 flaps or groundborne with full flaps, the failsafe abort mode will be activated following a 2-second carrier loss. When the abort mode is initiated the following commands are automatically locked-in:

BURNER OFF

THRUST DECREASE

BRAKES ON

HOOK DOWN

CHUTE DEPLOY

The same results may be obtained by an ABORT command. The failsafe abort mode and the ABORT command are operational only when the NOLO plugs are installed.

NORMAL

Phase 1

When carrier is lost for 7 seconds and the flaps are up, phase 1 failsafe is initiated. Phase 1 failsafe results in the following commands being automatically locked in:

BURNER ON (if airspeed is less than 240 KIAS)

BURNER OFF (if airspeed is greater than 240 KIAS)

THRUST INC

TOA (if altitude is less than 17,000 feet)

PITCH CENTER (if altitude is greater than 17,000 feet)

SPEED BRAKES IN

TURN CENTER

Phase 2

Phase 2 failsafe is initiated 7 seconds after phase 1 is initiated or 7 seconds after reaching 240 knots, whichever is greater. Phase 2 automatically locks-in the following commands:

RIGHT OR LEFT TURN (direction of turn is determined by position of Failsafe Turn Select Switch)

TURN CENTER (when at preset heading if Preset Heading mode has been selected)

RAPC (when altitude is above 17,000 feet)

ALTITUDE RETAIN (when altitude is between 17,000 and 32,000 feet and Mach number is less than 0.92)

NOTE

If phase 1 is initiated with airspeed less than 240 knots, BURNER ON will be commanded. When reaching 240 knots BURNER OFF is commanded and the 7-second, phase 2 time delay initiated.

Waveoff

The waveoff mode is effective when flaps are at the half position and airspeed is greater than 85 knots or when flaps are full down and the aircraft airborne. The action of waveoff failsafe is identical to the normal failsafe except the initial time delay is 2 seconds rather than 7 seconds.

ORBITING/PRESET HEADING Switch

The orbiting/preset heading switch is a three-position toggle switch located on the Drone Switch and Light Panel. Placing the switch in the ORBITING or PRESET HEADING position arms the failsafe system allowing power to pass to the failsafe logic circuitry when the loss of carrier relay is energized. Placing the switch in the ORBITING position will result in the aircraft turning in a constant 45-degree bank. Placing the switch in the PRESET HEADING position will result in the aircraft turning in a 45-degree bank until the preselected heading is reached. The aircraft will roll wings level and maintain level flight at the preselected magnetic heading. The center position is the SAFE position which prohibits power from being fed to the failsafe circuitry.

FAILSAFE TURN SELECT Switch

The failsafe turn select switch is a two-position toggle switch located on the command control junction box in the aft cockpit. The direction of turn to the preset heading or in the failsafe orbit is determined by the position of this switch.

CARRIER RECOVERY Switch

The carrier recovery switch is a guarded pushbutton switch located on the Emergency Control Panel. Momentarily depressing this switch energizes the carrier recovery relay. When the carrier recovery relay is energized power to the abort, waveoff, phase 1 carrier loss and phase 2 carrier loss relays is interrupted. This resets the failsafe system, provided carrier is regained or the orbit/preset heading switch is in SAFE.

FAIL SAFE Light

The failsafe light is on the Drone Switch and Light Panel. This light will be illuminated whenever the loss of carrier relay is energized and the orbiting/preset heading position is in either the ORBITING or PRESET HEADING position.

NORMAL OPERATION

Piloted Operation

With control circuits engaged the failsafe system is armed by moving the orbiting/preset heading switch out of the SAFE position. If the command receiver switch is OFF or if carrier is lost, failsafe action will be initiated. However, the abort mode is inoperative for piloted flight. If carrier is lost for 2 seconds during landing approach with flaps full down and RAPC engaged or during takeoff with half flaps and airspeed greater than 85 knots, the waveoff sequence will be initiated. Commands of TOA, BURNER ON, SPEED BRAKES IN and TURN CENTER will automatically be executed. At 240 knots the flaps and landing gear will be retracted by the action of the airspeed switch. At the same time BURNER OFF will be executed. Seven seconds after the initial set of commands phase 2 will commence. Depending on the position of the turn select switch, a right or left turn will be commanded (if the airspeed is less than 240 knots the sequence will be delayed until 7 seconds after 240 knots is reached). The aircraft will turn to the preselected heading or remain in a turn depending upon the position of the ORBITING/PRESET HEADING switch. When at 17,000 feet altitude ALTITUDE HOLD and RAPC will be commanded.

With flaps up, the normal failsafe mode is initiated 7 seconds after loss of carrier. In this case TOA is commanded if the aircraft altitude is less than 17,000 feet; at 17,000 feet or above PITCH CENTER is commanded. BURNER ON is commanded at airspeeds below 240 knots and BURNER OFF above 240 knots; SPEED BRAKES IN and TURN CENTER are automatically commanded at

this time. Seven seconds later phase 2 is initiated as in waveoff. During phase 2 RAPC and ALTITUDE HOLD are commanded when the aircraft is between 17,000 and 32,000 feet altitude. The failsafe logic remains locked in until carrier is regained and CARRIER RECOVERY is commanded. Once the initial time delay of 2 seconds for waveoff or 7 seconds for normal failsafe has been satisfied the sequence cannot be interrupted or reset by placing the ORBITING/PRESET HEADING switch to safe. CARRIER RECOVERY must be commanded or control circuits disengaged to reset the system.

NOLO Operations

With command receivers on and carrier established the orbiting/preset heading switch shall be set to ORBITING or PRESET HEADING as desired and the turn select switch set to RIGHT or LEFT as desired. Installation of the NOLO plugs arms the ABORT mode. ABORT may be commanded during takeoff with airspeed less than 85 knots or during landing roll with the throttles at the decrease limit. ABORT will automatically initiate under either of these conditions if carrier is lost for 2 seconds. The waveoff and failsafe modes function as in piloted flight. Failsafe remains locked in until carrier is regained and CARRIER RECOVERY is commanded.

EMERGENCY OPERATION

There are no provisions for emergency operation of the failsafe system.

LIMITATIONS

There are no specific limitations relating to the failsafe system.

NOTE

The ABORT mode is operable in NOLO flight only.

FIRING ERROR INDICATOR SYSTEM

DESCRIPTION

The QF-4B can carry J-ME 12700 Firing Error Indicator (FEI) pods on adapter booms attached to the pylons on stations 1 and 9. Each camera pod is composed of two 400-frame-per-second, 400-foot capacity, 16 millimeter camera mechanisms which are uniquely arranged and housed in a series of aluminum castings which act as the camera body and the aerodynamically configured pod. A 197-degree wide angle lens mounts to each of the camera mechanisms such that their optical centerlines are 180 degrees apart.

Command signals initiate the FEI system through the FEI Camera Control Box. A switch on the control box is positioned prior to flight for camera operation of 10, 20, or 40 seconds (40 seconds is maximum film capacity).

The same signal that initiates camera operation starts a coded timing system. As part of the FEI Camera Control Box there is a time base coder which intercepts time base signals available on the command control carrier and decodes them and sends impulses to the timing lights mounted in each camera mechanism. The time code signal which the FEI Camera Control Box receives must be a frequency shift keyed (PSK) signal of the Inter Range Instrumentation Group (IRIG) Code B format. These signals expose small marks along the edge of the film which vary in length depending upon the coded length of the impulse. Since the same code is simultaneously being placed on all four camera mechanisms it is possible to correlate the data on all films and other associated functions taking place on the range during the firing.

FEI Power Switch

The FEI power switch is a three-position toggle switch located on the Drone Control Panel on the right-hand console. The switch has positions of PWR ON, OFF and TEST. With the drone master switch ON placing the FEI power switch in the PWR ON position energizes the FEI power relay provided the flaps are up. With the power relay energized ac and dc power is routed to the FEI Control Box placing the system on standby. Placing the FEI power switch in the TEST position bypasses the flaps up interlock and energizes the FEI power relay regardless of flap position.

CAMERAS Switch

The cameras switch is a momentary push-button switch located on the Secondary Control Panel. Momentarily depressing this switch with control circuits engaged and FEI PWR ON activates the camera motor, the timer circuit and the time base coder. The duration of the resultant camera burst will be dependent upon the preset position of the timer.

NORMAL OPERATION

NOTE

The FEI system is a kit installation and not contained in all QF-4B aircraft. A dummy camera control box is normally installed in the aircraft. This dummy control box does not contain the circuitry required to operate the cameras. Thus, it is necessary to determine if an FEI kit, including the camera control box, has been installed.

Piloted Operation

The FEI system may be operated anytime control circuits are engaged. The FEI switch must be placed in the PWR ON or the TEST position. In the PWR ON position the cameras only operate when the flaps are up.

Momentarily depressing the cameras switch will activate the cameras. The cameras will automatically shut off in 10, 20, or 40 seconds depending upon the preset position of the timer switch.

NOLO Operation

The FEI switch shall be placed in the PWR ON position after control circuits are engaged and prior to inserting the NOLO plugs. CAMERAS may then be commanded anytime the flaps are up. A CAMERAS command will result in a camera burst of 10, 20 or 40 seconds depending upon the preset position of the timer switch.

EMERGENCY OPERATION

There are no provisions for emergency operation of the FEI system.

LIMITATIONS

The FEI system is limited to a maximum of 40 seconds of operation.

FLAPS

DESCRIPTION

A remote actuation capability has been added to the flaps system. The flaps may be remotely commanded to the UP, $\frac{1}{2}$ and DOWN positions. An airspeed switch provides for automatic retraction of the flaps when the airspeed reaches 240 knots and prevents extension at airspeeds above 240 knots. This switch operates regardless of the status of the control circuits. The manual operation of the flaps is unchanged from the basic F-4B.

WING FLAP Switch

A redesigned flap switch has been installed in place of the original flap switch. The redesigned switch has a REMOTE position above the normal UP position. When the switch is placed in the REMOTE position power is routed to the relay circuits which control the flaps in response to remote commands. Placing the switch in the UP, $\frac{1}{2}$, or DOWN position results in normal operation of the flaps.

FLAPS/SPEED BRAKES ARM Switch

The flaps/speed brakes arm switch is a two-position toggle switch located on the Drone Switch and Light Panel. Placing the switch in the ARM position energizes the flaps remote arm relay. With this relay energized, closed contacts provide a power path for FLAPS UP, $\frac{1}{2}$ FLAPS, and FLAPS DOWN commands.

FLAPS Switch

The flaps switch is a three-position toggle switch, spring loaded to the center or neutral position, located on the primary control panel. Momentarily placing this switch in the UP position retracts the flaps provided control circuits are engaged and the system is armed. Similarly, momentarily placing the switch in the DOWN position causes the flaps to extend to the full down position.

HALF FLAPS Switch

The half flaps switch is a momentary push-button switch located on the Primary Control Panel. Momentarily depressing this switch will cause the flaps to go to the $\frac{1}{2}$ position.

NORMAL OPERATION

Piloted Operation

The remote flaps system may be utilized anytime control circuits are engaged. The flaps/speedbrakes arm switch must be in the ARMED position and the flaps switch in the REMOTE position for remote commands to be effective. In addition, the airspeed switch restricts flap operation to airspeeds below 240 knots. If the flaps are not retracted prior to reaching 240 knots, the airspeed switch will automatically retract the flaps. Disengaging control circuits will deenergize the flaps remote arm relay and open all command power paths. However, the flaps will not reposition as a result of control circuits disengagement. Placing the flaps switch in the UP, $\frac{1}{2}$ or DOWN position will result in the flaps moving to the selected position regardless of the status of control circuits.

NOLO Operation

The flaps/speed brakes arming switch shall be placed in the ARMED position and the flaps switch placed in the REMOTE position prior to inserting the NOLO plugs. Flaps shall then be positioned by the use of FLAPS UP, HALF FLAPS or FLAPS DOWN commands as desired. The airspeed switch automatically retracts the flaps at 240 knots in the event they have not been commanded up prior to reaching that speed. The airspeed switch also prevents commanding HALF FLAPS or FLAPS DOWN at airspeeds above 240 knots. If flaps are retracted or prevented from extending by action of the airspeed switch, they must be commanded to the desired position when in the proper airspeed range as HALF FLAPS or FLAPS DOWN commands will not remain locked until the airspeed is less than 240 knots.

EMERGENCY OPERATION

Emergency operation of the flaps in piloted flight is the same as the basic F-4B. There is no provision for emergency operation of the flaps in NOLO flight.

LIMITATIONS

Limitations on flaps operation are unchanged from the F-4B.

FLIGHT CONTROLS

DESCRIPTION

The mechanical flight control system has not been modified. However, a capability to displace the rudder using electrical signals to the ARI amplifier and the rudder servo has been added.

Direct Rudder System

The direct rudder system is provided to assist in directional control during takeoff and landing. The system is engaged whenever control circuits are engaged, but a command is effective only if the flaps are not up or the aircraft is groundborne. A DIRECT RUDDER command results in a 15-degree displacement of the rudder. The rudder displaces while the command is being keyed and returns to neutral when the command is released. In addition, the heading hold mode at the AFCS is disengaged while the command is being keyed to enable skid turns to be accomplished with rudder commands.

RUDDER SWITCHES

There are two rudder switches which may be used to command rudder motion. The left "trim" switch on the pilot's control stick grip may be moved right or left for RIGHT RUDDER or LEFT RUDDER command. The rudder switch on the Primary Control Panel may also be used for rudder commands. It is a three-position toggle switch spring loaded to the center or neutral position. Moving the switch to the LT or RT position results in left or right rudder motion. When the switch is released the rudder returns to neutral. When the flaps are up and the aircraft is airborne, the rudder system is disabled and the rudder switches are inoperative.

NORMAL OPERATION

Piloted Operation

NOTE

With control circuits engaged the flight controls may be displaced manually but the AFCS will attempt to oppose these inputs.

The direct rudder system is engaged when control circuits are engaged. The rudder may then be displaced using RT/LT RUDDER commands provided the flaps are not up or the aircraft is groundborne.

NOLO Operation

Control of the rudder during NOLO operation is identical to operation during piloted flight except commands are received via the radio link.

EMERGENCY OPERATION

There are no provisions for emergency operation of the direct rudder system.

LIMITATIONS

The direct rudder system responds to commands only if the flaps are not up or the aircraft is groundborne. The maximum rudder deflection available with the direct rudder system is 15 degrees.

FUEL SYSTEM

DESCRIPTION

The existing fuel system has been modified to include an Auto Fuel Management system, a remote Fuel Dump System and a remote External Stores Jettison System. The Auto Fuel Management System provides for automatic switching to internal fuel transfer when the centerline tank is empty and for transfer from the centerline tank when groundborne during NOLO operations. The Fuel Dump system provides a capability to jettison fuel via remote command in NOLO flight. The External Stores Jettison System utilizes the external stores emergency release system to jettison the centerline tank in NOLO flight via a remote command.

Auto Fuel Management System

The QF-4B fuel transfer system is the same as the existing F-4B fuel transfer system except for provisions to automatically control transfer from the external centerline tank. The automatic control of transfer from the centerline tank includes the capability to pressurize and transfer fuel from the centerline tank while on the ground during NOLO operations. Provisions for automatic control of the external wing tanks are not included in the Auto Fuel Management System. Placing the existing external transfer switch to the CENTER position will allow the centerline tank fuel to transfer; energize the internal tank shutoff valves, thus stopping the internal wing fuel transfer; and apply 28 V ac to the centerline fuel flow transmitter. Upon completion of the external fuel transfer, the fuel flow transmitter switch is closed, illuminating the CTR EXT FUEL warning lamp. The lamp is monitored by a fuel transfer, 30-second time

delay, relay. After 30 seconds the fuel transfer relay closes. This allows the centerline tank shutoff valve to close, the internal wing tank fuel begins to transfer and the CTR EXT FUEL lamp goes out. The centerline tank shutoff valve then remains closed and the fuel transfer system will operate as in a standard aircraft.

Fuel Dump System

The existing fuel dump system is modified to obtain the remote fuel dump system. With a FUEL JETTISON command, 28V dc is removed from the closed side of the internal wing dump valve and 28V dc is applied to the open side of the valve to allow the fuel to be dumped. Also, 28V dc is applied to the internal wing fuel transfer relay coil to prevent the internal wing tank fuel from transferring. A FUEL JETTISON command is not effective unless the internal wing dump switch is in the NORMAL position, the NOLO plug is in, and the aircraft is airborne. The remote function will remain locked-in until the aircraft becomes airborne.

External Stores Jettison System

The basic F-4B was provided with four methods of jettisoning external stores; the emergency release system, the weapons release system, the missile release system and the external tank jettison system. Only two of these systems have been retained in the QF-4B. These are the emergency release system and the external tank jettison system. The emergency release system has been modified to provide for remote operation. This modification consists of the installation of a relay and the associated wiring required to tie it to the external stores emergency jettison switch. This added relay is energized when the external stores jettison command is keyed only if the NOLO plugs are installed. Power to this circuit is controlled by the centerline jettison circuit breaker through the existing circuit (landing gear handle up or airborne) which feeds the external stores emergency release button. With the relay energized, power is fed to the centerline rack cartridge and to both inboard and outboard wing cartridges if the following circuit breakers are in: CENTERLINE JETTISON (34-CB302), OUTBOARD JETTISON (44-CB301), OUTBOARD JETTISON (44-CB302), and MISSILE JETTISON (63-CB312).

NOTE

The MISSILE JETTISON (63-CB312) circuit breaker has been pulled and capped. This circuit breaker should not be rearmed unless stores are carried on the inboard pylons.

AUTO FUEL ARM Switch

The auto fuel arm switch is a two-position toggle switch located on the Drone Switch and Light Panel. Placing the switch in the ARMED position

initiates operation of the AUTO FUEL SYSTEM. The auto fuel arm switch is functional with or without control circuits engaged.

EXTERNAL TRANSFER Switch

The external transfer switch functions normally regardless of the position of the auto fuel arm switch. However, for the auto fuel management system to function, the external transfer switch must be in the CENTER position.

WING TRANSFER PRESSURE Switch

The wing transfer pressure switch functions normally regardless of the position of the auto fuel arm switch. For operation of the auto fuel management system the switch shall be in the NORMAL position. With the NOLO plugs installed the centerline tank is pressurized while groundborne with the wing transfer pressure switch in the NORMAL position. To simulate a NOLO condition during manned flight, the switch must be placed in the EMERG position when groundborne.

CENTERLINE EXTERNAL FUEL Light

The CTR EXT FUEL warning light on the master caution panel will illuminate in the normal manner when the external transfer switch is in the CTR position and fuel flow ceases. With the auto fuel arming switch in the ARMED position it will remain illuminated until the fuel transfer 30-second time delay is energized. When this relay is energized, power is removed from the external centerline tank select relay and the light goes out.

INTERNAL WING DUMP SWITCH

The location and function of the internal wing dump switch is unchanged from the F-4B. This switch must be in the NORMAL position for operation of the remote fuel dump system.

EXTERNAL TANK JETTISON SWITCH

The location and function of the external tank jettison switch is unchanged from the F-4B.

CAUTION

The external wing tanks can be jettisoned by the external wing tank jettison switch anytime power is on the airplane and the safety pins are removed. This circuit is not wired through the landing gear control handle.

EXTERNAL STORES EMERGENCY RELEASE BUTTON

The location and function of the external stores emergency release button is unchanged from the F-4B.

NORMAL OPERATION

Piloted Operation

During piloted flight, fuel management and fuel dump may be accomplished in the normal manner. In addition, the auto fuel management system may be utilized with or without control circuits engaged. With a centerline tank installed, the auto fuel management system is engaged by placing the auto fuel arm switch in the ARMED position and the external transfer in the CENTER position. As in the basic F-4B the centerline tank will not pressurize while on the ground unless the wing transfer pressure switch is placed in the EMERG position. With the auto fuel management system engaged the CTR EXT FUEL light will illuminate when the centerline tank is empty. It will remain illuminated and then go out as the wing fuel starts to transfer. The centerline tank may be jettisoned by pressing the EXT STORES EMERG REL button.

NOLO Operation

After inserting the NOLO plugs the auto fuel arm switch shall be placed in the ARMED position, the wing transfer switch in the NORMAL position, the internal wing dump switch in the NORMAL position and the external transfer switch in the CENTER position. When the NOLO plugs are inserted the centerline tank will pressurize and transfer while groundborne. When the centerline tank is empty centerline transfer will stop and wing transfer will automatically begin. The NOLO plugs also arm the fuel dump and external stores jettison systems. Wing fuel may be dumped by a FUEL JETTISON command and the centerline tank jettisoned by a STORES JETTISON command.

CAUTION

Fuel can be dumped while the target is groundborne if the internal dump switch is placed in the DUMP position when power is applied either externally or internally when the engines are running.

Safety pins must be removed and appropriate cartridges must be installed prior to flight or the external stores jettison system will not operate.

NOTE

The QF-4B was designed for operation with the external centerline tank only. Plumbing and structural provisions have been retained for the external wing tanks. No provisions have been made for remote control of external wing tank fuel transfer. In addition, circuitry for manual control of external wing tank fuel transfer may not be complete. If external wing tanks are required for piloted flight reference must be made to the appropriate maintenance manuals and the wiring modified as required.

EMERGENCY OPERATION

Emergency operation of the fuel system in piloted flight is as described in the basic F-4B NATOPS manual. There are no provisions for emergency operation in NOLO flight.

LIMITATIONS

The limitations are identical to the basic F-4B.

HYDRAULIC POWER SUPPLY SYSTEM

DESCRIPTION

The hydraulic power supply systems are retained in the QF-4B with one modification. This modification provides for automatically switching PC-2 pressure to the PC-1 side of the stabilator power control cylinder in the event of a failure of the PC-1 system during NOLO flight. With the NOLO plugs installed, the 1500 psi pressure switch which operates the CHECK HYD GAGES warning light is used to control two solenoid valves. These valves are in the PC-1 pressure and return lines at the stabilator power control cylinder. When PC-1 pressure drops to less than 1500 psi, the switch closes and power is applied to the two solenoid valves. These valves then operate switching PC-2 pressure to the PC-1 input to the stabilator power control cylinder and the PC-1 return from the power control cylinder to the PC-2 system return line.

NORMAL OPERATION

Piloted Operation

There is no change in operation of the hydraulic power supply systems in piloted flight.

NOLO Operation

The stabilator emergency hydraulic system is armed by the installation of the NOLO plugs. When the NOLO plugs are installed, PC-2 pressure will be

automatically routed to the PC-1 side of the stabilator power control cylinder when PC-1 pressure drops to less than 1500 psi.

EMERGENCY OPERATION

Piloted Operation

In the event of a hydraulic failure, control circuits shall be disengaged and standard emergency procedures followed.

NOLO Operation

Failure of the PC-1 system will result in automatic transfer of PC-2 pressure to the PC-1 side of the stabilator power control cylinder and allow continued flight. There are no provisions for emergency operation in the event that both PC-1 and PC-2 or the utility system fails. In that event the aircraft will be uncontrollable resulting in loss of the aircraft.

LIMITATIONS

No specific limitations pertain to the hydraulic system.

LANDING GEAR SYSTEM

DESCRIPTION

The landing gear system has been modified to provide for remote extension and retraction of the landing gear.

Landing Gear

The drone landing gear (LDG) system utilizes the existing LDG system by paralleling the remote function with the LDG handle control switch. The existing system is unchanged. For manned flight with C/C engaged, a test switch on the Drone Switch and Light Panel is provided to allow the gear to be commanded UP or DOWN. For NOLO flight the Remote LDG system is armed by the installation of the NOLO plugs. An airspeed switch provides for automatic retraction of the gear at 235 knots and prevents extension of the gear above 235 knots. This switch is effective only if the remote gear system is engaged.

Nosewheel Steering

When the C/C arm switch is in the armed position, the basic aircraft NOSEWHEEL ENGAGE button located on the pilot's stick grip automatically becomes the control circuits' engage button. Thus, with control circuits engaged, the nosewheel steering system is disabled. There is no provision for remote control of nosewheel steering.

Gear Test Switch

The gear test switch is a two-position toggle switch located on the Drone Switch and Light Panel. Placing this switch in the TEST POSITION arms the remote gear system for operation during piloted flight provided the gear handle is in the UP position and C/C is engaged.

CHK GEAR Light

The CHK GEAR Light is located on the Drone Switch and Light Panel. This light will flash whenever the gear test switch is in the TEST position and the landing gear is down.

GEAR Switch

The gear switch is a three-position toggle switch, spring loaded to center, located on the Primary Control Panel. Momentarily placing this switch in the UP position causes the landing gear to retract. Momentarily placing the switch in the down position lowers the landing gear, provided the airspeed is less than 235 knots.

LANDING GEAR POSITION INDICATORS

With the landing gear handle in the UP or DOWN position, the position indicators function normally. With C/C engaged and the gear test switch in the TEST position, GEAR UP and GEAR DOWN commands parallel the UP and DOWN switches on the landing gear handle. Thus, the position indicators response to UP and DOWN commands is the same as the response to up and down movement of the landing gear handle.

NORMAL OPERATION

Piloted Operation

The remote landing gear system may be used anytime control circuits are engaged. To operate the landing gear via the remote system, the Gear Test switch shall be placed in the TEST position and the landing gear handle placed in the UP position. The landing gear may then be raised or lowered using gear UP and DOWN commands.

The landing gear handle may be used to extend and retract the landing gear in the normal manner at any time.

With control circuits armed, the nosewheel steering button becomes the control circuits engage switch. Therefore, basic aircraft nosewheel steering is not available with control circuits engaged.

NOLO Operation

The landing gear handle shall be in the DOWN position for NOLO Operations. The remote landing gear system is armed by the installation of the NOLO plugs. The gear will automatically retract at 235 knots if they have not been commanded UP prior to reaching 235 knots. The 235 knot switch will also prevent a DOWN command from extending the gear above 235 knots.

EMERGENCY OPERATION

Piloted Operation

In piloted flight the landing gear may be extended using standard emergency procedures.

NOLO Operation

There are no provisions for emergency operation of the landing gear system in NOLO flight.

LIMITATIONS

The basic aircraft limitations apply to the landing gear system.

LIGHTING EQUIPMENT

DESCRIPTION

The external lighting system is modified to provide an indication to the chase aircraft pilot or Fox truck operator of an impending emergency due to a fire warning or engine overheat, low fuel, loss of generator or command carrier loss. The existing anti-collision beacon, tail light, right and left wing lights and top and bottom fuselage lights are utilized for this purpose. In all cases, except carrier loss, this system utilizes the existing signal fed to the pilots Right Vertical Warning Light Panel to energize an isolation relay which, in turn, places power on the appropriate relay. The carrier loss signal is derived from the carrier loss relay in the command receiving system. The emergency light system is operative in NOLO flight only.

NORMAL OPERATION

Piloted Operation

The normal pilot operation of the lighting system has been unchanged by this modification.

NOLO Operation

Prior to installing the NOLO plugs the external lights shall be set up as follows:

Tail Light Switch - BRIGHT
 Wing Light Switch - BRIGHT
 Steady-Flash Switch - FLASH
 Fuselage Lights Switch - BRIGHT

Installation of the NOLO plugs will arm the system and result in the following operation:

LIGHT LOCATION	FAILURE	LIGHT MODE
Top and bottom fuselage lights	Low fuel warning (1960 $\pm$ 200 lbs remain)	Flash
Left wing tip and join up light	Left fire warning or engine overheat	Steady
Right wing tip and join up light	Right fire warning or engine overheat	Steady
Anti-collision beacon (on fin leading edge)	Loss of generator	Flash
Tail Light	Loss of carrier	Flash

EMERGENCY OPERATION

There are no provisions for emergency operation of the lighting systems.

LIMITATIONS

There are no specific limitations relating to the lighting system.

NOTE

The external warning light system is operative in NOLO flight only.

MISS DISTANCE MEASURING SYSTEM

DESCRIPTION

Provisions are incorporated in the QF-4B for an AN/DRQ-4 Miss Distance Measuring (MDM) system. The AN/DRQ-4 receives a telemetry signal from an approaching missile, converts it to a lower frequency signal and transmits the lower frequency signal to a ground station. The frequency of the received and transmitted signal is shifted due to the doppler effect of the missile closure rate. This frequency shifted information is then used to calculate missile miss distance. The major components of the MDM system are a transmitting antenna, two receiving antennae, an AN/DRQ-4 transponder and an image rejection filter.

MDM Switch

The MDM switch is a two-position toggle switch located on the Target Power Control Box in the aft cockpit. With the switch in the ON position and the C/C Master ON, the MDM system is activated.

NORMAL OPERATION

Piloted Operation

The MDM system is activated by placing the MDM switch in the ON position with the C/C Master ON.

NOLO Operation

If the NOLO mission requires MDM operation, the MDM switch shall be placed in the ON position prior to inserting the NOLO plugs.

EMERGENCY OPERATION

In the event of a generator failure, the MDM system will become inoperative. There are no provisions for emergency operation of the MDM system.

LIMITATIONS

There are no specific limitations related to the MDM system.

RADAR BEACON SYSTEM

DESCRIPTION

Provisions are incorporated in the QF-4B for either an AN/DPN-77 (C Band) or AN/DPN-78 (X Band) radar beacon. The desired beacon is installed by the operating activity to enhance range and tracking

capabilities of the ground based tracking radar. The transponder receives coded C or X band (as applicable) interrogations from the interrogator radar. The transponder will reply to a proper interrogation at a different frequency in the same band. These return signals provide the interrogator radar with position data and identity of the aircraft.

BEACON POWER Switch

The beacon power switch is a two-position toggle switch located on the Drone Control Panel. Placing the switch in the ON position with the electrical system energized applies power to the transponder equipment.

NORMAL OPERATION

The operating activity shall install the desired beacon in the aircraft prior to flight. With the transponder installed and the aircraft electrical system energized, placing the beacon power switch in the ON position activates the beacon. For NOLO flight the beacon power switch shall be placed in the ON position prior to inserting the NOLO plugs.

EMERGENCY OPERATION

There are no provisions for emergency operation of the radar beacon system.

LIMITATIONS

There are no limitations pertaining to the radar beacon system.

SPEED BRAKES

DESCRIPTION

A remote actuation capability has been added to the speed brake system. The drone speed brake system for the QF-4B utilizes the existing speed brake system by paralleling the remote function with the speed brake control switch. The STOP or neutral position of the speed brake switch is utilized as the REMOTE position.

SPEED BRAKES SWITCH (BASIC)

The speed brakes switch has been changed to a five-position switch which is spring loaded to the center or neutral position. Moving the switch to the OUT position (aft) applies voltage to the existing solenoid and causes the speed brakes to extend as in the basic aircraft. Momentarily moving the switch to the IN position (forward) energizes the retract solenoid and fully retracts the speed brakes. This signal is locked in to provide continuous pressure to the up side of the speed brakes actuator. Moving the switch to either position disengages APCS. If control circuits are engaged, moving the switch to either the IN or OUT position will disengage control circuits and APCS.

SPEED BRAKES SWITCH (Remote)

The speed brakes switch is a three-position toggle switch, spring loaded to center, located on the Primary Control Panel. With control circuits engaged momentarily placing the switch in the **OUT** position energizes and locks in the **OUT** relay, causing the speed brakes to fully extend. Momentarily moving the switch to the **IN** position results in full retraction of the speed brakes.

FLAPS/SPEED BRAKES ARMING SWITCH

The flaps/speed brakes arming switch is a two-position toggle switch located on the Drone Switch and Light Panel. Placing the switch in the **ARMED** position provides a ground return to the in and out relays allowing them to be energized by the speed brakes switch when control circuits are engaged.

NORMAL OPERATION

Piloted Operation

The speed brakes switch on the throttle handle may be used to extend or retract the speed brakes at any time. As in the basic aircraft moving the switch to the **IN** position will disengage **APCS**. With control circuits engaged moving this switch to the **IN** or **OUT** position will disengage control circuits. With control circuits engaged and the **ldg**, flaps, speed brakes arming switch in the **ARMED** position, the speed brakes may be positioned out or full in by activating the speed brakes switch on the Primary Control Panel.

NOLO Operation

With control circuits engaged and prior to inserting the **NOLO** plugs the flaps/speed brakes arming switch shall be placed in the **ARMED** position. With **C/C** engaged and the system armed, speed brakes may be positioned full in or out by **SPEED BRAKES IN** or **OUT** commands.

EMERGENCY OPERATION

Piloted Operation

Moving the speed brakes switch on the throttle handle to the **IN** or **OUT** position disengages control circuits and the system reverts to basic operation. Standard emergency procedures shall then be utilized.

NOLO Operation

There are no provisions for emergency operation of the speed brakes in **NOLO** flight.

LIMITATIONS

There are no specific limitations relating to the speed brakes system.

TELEMETRY SYSTEM**DESCRIPTION**

A telemetry system is incorporated to provide the remote operator with the real time data required to effectively fly the drone without visual contact. The telemetry system consists of an AN/AKT-21 telemetry transmitting set, an electronic commutator and various electronic signal conditioners and transducers. The AN/AKT-21 receives varying input signals from the monitored parameters, converts the signals to FM (frequency modulated) output signals, which are then amplified and transmitted to the receiving station. The output power of the AN/AKT-21 transmitting set is 25 watts which gives a line-of-sight range of 200 miles. The parameters which are telemetered are:

- Angle of Attack
- Vertical Acceleration
- Altitude
- Pitch Attitude
- Airspeed
- Mach Number
- Left Engine RPM
- Right Engine RPM
- Magnetic Heading
- Fuel Remaining
- Lost Carrier
- Hydraulic Failure
- Generator Loss
- Centerline External Fuel Empty
- Static Correction Off
- BLC Malfunction
- Low Fuel Warning

AN/AKT-21 Telemetry Transmitting Set

The AN/AKT-21 telemetry transmitting set is an integral system providing for the transmission of up to ten data channels over a single telemetry transmitter. The set, which is located in the nose compartment, contains the following major assemblies: ten subcarrier oscillators, one mixer amplifier, one transmitter, one RF power amplifier, one transducer power supply and one in-flight calibrator. The transmitting set receives input signals from the monitored parameters, converts them to frequency modulated signals which are then mixed, amplified and transmitted.

Electronic Commutator

The electronic commutator is used to expand the data handling capabilities of the AN/AKT-21 by time division multiplexing. The electronic commutator provides 28 additional data channels. The signal in each channel is sampled in regular sequence by the commutator. Thus, samples from a particular channel are intervalled in time between samples from all other channels. The output of the commutator modulates one channel of the AN/AKT-21, thus using that channel to provide the 28 additional channels.

TM PWR Switch

The TM PWR switch is a two-position toggle switch on the Drone Control Panel. Placing the switch in the ON position applies power to the AN/AKT-21 transmitting set.

TM CAL Switch

The TM CAL switch is a pushbutton switch located on the Drone Control Panel. Momentarily depressing this switch operates the in-flight calibrator. The calibrator switches the inputs of the subcarrier oscillators from their data inputs to a calibration bus. The calibrator applies a precision voltage to all of the subcarrier oscillators simultaneously. The TM CAL switch must be depressed four times to complete the calibration process. The first three times calibration voltages are applied. The fourth actuation of the switch returns the system to the data mode.

NORMAL OPERATION

Piloted Operation

Normal operation of the telemetry system is initiated by placing the TM PWR switch in the ON position after the aircraft is on internal power and the C/C Master switch is ON. The system may then be calibrated by depressing the TM CAL switch four times with approximately 3-second intervals between actuation. The TM PWR switch shall be placed OFF prior to securing the generators and/or engines.

NOLO Operation

After the aircraft is on internal power and the C/C Master switch is on, the TM PWR switch shall be placed ON. When the telemetry receiving station has acquired the signal, TM CAL should be depressed four times with a 3-second interval between each actuation of the switch. The system may also be calibrated remotely by use of the TM CAL command. After the aircraft has landed the TM PWR switch shall be placed OFF prior to securing engines and/or generators.

EMERGENCY OPERATION

There are no provisions for emergency operation of the telemetry system.

LIMITATIONS

The telemetry system has a line-of-sight range of 200 miles.

Part 3 - SERVICING

For information pertaining to servicing (i.e., authorized AGE, consumable materials, capacities, pressures and cockpit procedures) refer to NATOPS Servicing Checklist (NAVAIR 01-245 FDB-1C).

Part 4 - OPERATING LIMITATIONS

AIRCRAFT

GENERAL

All operating limitations specified in Section I, Part 4, of the F-4B NATOPS manual (NAVAIR 01-245FDB-1) apply to the QF-4B aircraft. Limitations during flight with control circuits engaged are contained in the discussion of the remote system operation in Section I, Part 2, of this publication.

CARRIER OPERATIONS

Catapult takeoff and carrier arrested landings are prohibited with control circuits engaged.

EXTERNAL STORES

GENERAL

The centerline fuel tank may be carried on and jettisoned from the QF-4B within the limits specified in Section I, Part 4, of the F-4B NATOPS flight manual (NAVAIR 01-245FDB-1). The FEI pods may be carried within the limits specified in the F-4B NATOPS manual for the basic aircraft with wing mounted stores. Jettisoning of the FEI pods is prohibited. Carriage and jettison of all other external stores specified in the F-4B NATOPS manual is permissible within the limits specified therein, provided that control and jettison capability is verified in accordance with the appropriate maintenance manuals.

S E C T I O N I I I N D O C T R I N A T I O N

Table of Contents	Page
Ground Training.	2-3
Flight Training Syllabus	2-4
Operating Criteria	2-6
Crewmember Flight Equipment.	2-8

GROUND TRAINING

MINIMUM GROUND TRAINING SYLLABUS

The overall ground training syllabus for each activity varies according to local conditions, field facilities, requirements from higher authority and the immediate Unit Commander's estimate of operational readiness. The minimum ground training syllabus for each phase is set forth below:

Pilot/RIO

All QF-4B pilots/RIO's shall complete all standard F-4B ground training except weapons systems training is not required.

Remote Operator

All remote operators (Fox, Chase Plane and Out of Sight Controllers) shall receive the following F-4B flight support lectures:

J79 engine

F-4B air induction system

Flight controls, flaps, BLC, and AFCS

Aircraft systems and emergency procedures

Aircraft operating limitations

Flight characteristics

Climb, loiter and cruise performance

Fuel management/mission planning

Single-engine performance

NATOPS Flight Manual (open and closed book)

Stressing normal and emergency procedures and aircraft/
engine limitations

Telemetry system

Pilot/RIO/Remote Operators

Upon completion of the F-4B ground training all operators shall receive the drone system lectures:

F-4B/QF-4B differences

Remote systems

Simulated NOLO procedures

NOLO procedures

QF-4B NATOPS Flight Manual examination
Stressing normal and emergency procedures and remote
systems limitations.

WAIVING OF MINIMUM GROUND TRAINING REQUIREMENTS

F/RF-4 qualified crewmembers and remote operators shall be instructed on the differences from model qualified, and comply with those items listed below, as directed by the unit commanding officer.

Where recent pilot experience in similar aircraft models warrant, Unit Commanding Officers may waive the minimum ground training requirements provided the pilot meets the following mandatory qualifications:

The minimum requirements set forth in the
F-4B NATOPS Manual (Section II).

Has satisfactorily completed the QF-4B NATOPS
Flight Manual examination.

Where recent remote operator experience warrants, Unit Commanding Officers may waive the minimum ground training requirements provided the remote operator meets the following mandatory qualifications:

Received the Remote Systems briefing.

Has satisfactorily completed the F-4B and QF-4B
NATOPS Flight Manual examinations.

FLIGHT TRAINING SYLLABUS

AIRCREW FLIGHT TRAINING SYLLABUS

Prior to commencing the flight training described herein, all crew members shall have completed the F-4B aircrew flight training and the familiarization and flight support lectures previously described for the QF-4B. A qualified instructor pilot should be assigned for the first familiarization flight and occupy the rear seat. The geographic location, local command requirements and other factors will influence the actual

flight training syllabus and the sequence in which it is completed. The specific phases of training are:

- Airborne control circuits engagement
- Auto Throttle operation
- Slow flight with control circuits engaged
- Acceleration run to Mach 2.0 with control circuits engaged
- Subsonic and supersonic maneuvering with control circuits engaged
- Operation of remote flaps, landing gear, rudder and auto brakes systems
- Takeoff and landing with control circuits engaged
- Failsafe system operation
- Auto Brakes operation

REMOTE OPERATOR FLIGHT TRAINING

Prior to flight training all remote operators shall have completed the ground training previously described.

Fox Operator

The specific phases of flight training for the Fox operator are:

- Preflight setup and check procedures
- Takeoff
- Lost carrier
- Lost communications
- Control transfer
- Failsafe
- Landing, arrested and non-arrested

Chase Operator

The specific phases of flight training for the Chase operator are:

- Join-up and climb out
- Control transfer
- Rendezvous and descent
- Approach
- Lost Carrier
- Lost Communications

Out-of-Sight Controller

The specific phases of flight training for the out-of-sight controller are:

- Control transfer
- Subsonic and supersonic maneuvering
- Auto Throttle
- Mach Hold
- Altitude Hold
- RAPC
- Acceleration run to Mach 2.0
- Failsafe
- Slow flight

OPERATING CRITERIA

CEILING/VISIBILITY REQUIREMENTS

All flights with control circuits engaged should be in Visual Flight Rules (VFR) conditions. With control circuits disengaged the requirements of the F-4B NATOPS Flight Manual apply.

MINIMUM FLIGHT QUALIFICATIONS

Minimum flight qualifications specified in the F-4B NATOPS Flight Manual are applicable to the QF-4B.

REQUIREMENTS FOR VARIOUS FLIGHT PHASES

Airborne Control Circuits Engagement

Pilot

Not less than 10 hours in F-4B as first pilot.

RIO

Satisfactory completion of ground training including satisfactory completion of QF-4B NATOPS Flight Manual examination.

Takeoff and Landing With Control Circuits Engaged

Pilot

Not less than 15 hours in F/QF-4B as first pilot with at least 3 hours with control circuits engaged including simulated approaches with control circuits engaged.

RIO

Have a minimum of 3 hours in model as crewmember.

Have completed at least one flight with control circuits engaged.

Remote Control by Out-of-Sight Controller or Chase Plane

Pilot

Not less than 15 hours in F/QF-4B as first pilot with at least 3 hours with control circuits engaged.

RIO

Have a minimum of 3 hours in model as crewmember.

Have completed at least one flight with control circuits engaged.

Takeoff and Landing with Remote Control by Fox Operator

Pilot

Not less than 15 hours in F/QF-4B as first pilot with at least 5 hours with control circuits engaged.

Have completed three takeoffs with control circuits engaged.

Have completed three full stop landings with control circuits engaged.

RIO

Have a minimum of 5 hours in F/QF-4B as crewmember.

Have completed at least one takeoff and landing with control circuits engaged.

NOLO Flights

Fox Operator

Have completed three takeoffs with safety pilot aboard.

Have completed three full-stop landings with safety pilot aboard including both arrested and non-arrested landings.

Chase Plane Operator and Out-of-Sight Controller

Have completed at least two flights with safety pilot aboard.

CREWMEMBER FLIGHT EQUIPMENT

Crewmember flight equipment specified in the F-4B NATOPS Flight Manual is applicable to the QF-4B.

SECTION III PROCEDURES

Table of Contents	Page
Part 1 - BRIEFING/DEBRIEFING	3-3
Briefing	3-3
Debriefing	3-3
Part 2 - MISSION PLANNING.	3-3
General.	3-3
Part 3 - PILOTED FLIGHT PROCEDURES	3-3
Preflight.	3-3
Takeoff.	3-6
Inflight	3-10
Landing.	3-10
Postflight	3-12
Night Flying	3-12
Part 4 - NOLO FLIGHT PROCEDURES.	3-12
Preflight.	3-12
Takeoff.	3-16
Takeoff Technique.	3-19
Climb.	3-20
Inflight	3-23
Landing.	3-23
Postflight	3-27

Part 1 - BRIEFING/DEBRIEFING

BRIEFING

GENERAL

A briefing card will be used in conducting the briefing. Every participant in the operation shall attend the briefing and record all flight numbers, call signs and all other data necessary to complete the mission. Each operating activity should establish briefing guides which are applicable to the local geography and range safety requirements. In general those items specified in Section III, Part 1, of the F-4B NATOPS Flight Manual should be covered.

DEBRIEFING

GENERAL

Postflight debriefing is an integral part of every flight. The operation conductor should review the entire flight from takeoff to landing including not only errors and poor techniques but also methods of correcting them. Also, the flight leader shall cover completely any deviations from standard procedures. All operation should be reviewed using telemetry and radar tracking information when available.

Part 2 - MISSION PLANNING

GENERAL

Refer to Section XI, Performance Data, of the F-4B NATOPS Flight Manual to determine fuel consumption, correct airspeed, power settings and optimum altitude for the intended mission.

Part 3 - PILOTED FLIGHT PROCEDURES

PREFLIGHT

GENERAL

The yellow sheet must be checked for flight status, configuration and servicing before manning the aircraft. At least the 10 previous B sections should be reviewed for discrepancies noted and corrective action taken. Weight and Balance clearance is the responsibility of the Maintenance Department.

AFT COCKPIT CHECK FOR SOLO FLIGHT

1. Complete standard F-4B aft cockpit check.

2. Target Power Control Box Circuit Breakers - IN
3. Failsafe Turn Select switch - RIGHT or LEFT as desired.
4. Check NOLO plugs - REMOVED

BEFORE ENTERING COCKPIT

1. Complete standard F-4B checks.

AFTER ENTERING COCKPIT

Pilot

Before electrical power

1. C/C Master - OFF
2. All arming switches
 - a. Fail Safe - SAFE
 - b. Autobrakes- SAFE
 - c. Hook - SAFE
 - d. Flaps/Speedbrakes - SAFE
 - e. Autothrottle - SAFE
 - f. Autofuel - SAFE
 - g. Differential Brake Steering - SAFE
 - h. Gear Test - SAFE
3. Cockpit Control Switch - FORWARD
4. T.M. PWR - OFF
5. FEI PWR - OFF
6. Beacon PWR - OFF
7. Command Receiver Switch - OFF
8. Complete standard F-4B cockpit checks

RIO

Before electrical power

1. Target Power Control Box circuit breakers - IN.
2. Failsafe Turn Select switch - As desired

3. Check NOLO plugs - REMOVED.
4. Complete standard F-4B cockpit check.

BEFORE STARTING ENGINES

Pilot/RIO

1. Follow standard F-4B procedures.

STARTING ENGINES

Pilot

1. Start engines in normal manner.
2. Position and Lock Idle Stop (if remote throttle plate installed).

RIO

1. Complete normal procedures.
2. Challenge pilot for idle stop down and locked.

BEFORE TAXIING

Pilot

1. Complete normal F-4B procedures.
2. C/C Master - ON.
3. Center stick using stick force transducer - STAB NULL light illuminates.
4. AFCS - ENGAGE.
5. C/C Arm switch - ARMED.
6. C/C Engage switch - DEPRESS.
7. Command RIGHT TURN and LEFT TURN and check aileron and spoiler movement.
8. Command CLIMB and DIVE and check stabilator movement.
9. Command TOA and check stabilator for full leading edge down.

10. Command PITCH CENTER.
11. Command RT RUDDER and check nosewheel and rudder motion.
12. Disengage C/C
13. Report ready to taxi.

RIO

1. Complete normal F-4B procedures.

TAXIING

Pilot/RIO

1. Complete normal F-4B procedures.

TAKEOFF

GENERAL

Takeoff may be accomplished with control circuits engaged or disengaged. With control circuits disengaged the normal F-4B procedures are applicable. This section provides procedures for takeoff with C/C engaged.

BEFORE TAKEOFF

Complete engine warmup in accordance with the F-4B NATOPS Flight Manual.

FLAP POSITIONS

Takeoff shall be made with half flaps.

Pilot

1. Complete normal F-4B takeoff checklist.
2. ADI OFF flag - OUT OF WINDOW.
3. Pitch, roll and yaw stab aug switches - ENGAGED.
4. C/C Master - ON.
5. TM Pwr Switch - As Desired.
6. Beacon Pwr Switch - As Desired.

7. Trim-set for takeoff
8. Center controls

NOTE

Move stick using stick force transducer and use STAB NULL light to place stick in proper position

9. AFCS Switch - ENGAGE
10. C/C Arm Switch - ARMED
11. C/C Engage Switch - DEPRESS
12. Orbiting/Preset Heading Switch - SAFE
13. Autobrakes Arm Switch - ARMED
14. Command - PARKING BRAKE
15. Hook Arm Switch - ARMED
16. Flaps/Speed Brakes Arm Switch - ARMED
17. Wing Flaps Switch - REMOTE
18. APCS Switch - STBY
19. Air Temp Switch - NORM
20. Engine Select Switch - BOTH
21. Autothrottle Arm Switch - ARMED
22. Wing Transfer Pressure Switch - NORMAL
23. External Transfer Switch - CENTER
24. Autofuel Arm Switch - SAFE

NOTE

The Autofuel System must be armed when airborne.

25. Differential Brake Steering Arm Switch - ARMED

26. Gear Test Switch - SAFE
27. Gear Test Light - OFF
28. Command - HALF FLAPS
29. Command - TOA
30. Compass Controller - SLAVE

RIO

1. Complete standard F-4B checks
2. Challenge Pilot after C/C engagement for:
 - a. Differential Brake Steering Arm Switch - ARMED
 - b. Gear Test Switch - SAFE
 - c. Gear Handle - DOWN
 - d. Wing Flaps Switch - REMOTE
 - e. Idle Stop - IN PLACE and LOCKED
 - f. Compass controller - SLAVE

TAKEOFF TECHNIQUE

Takeoff with control circuits engaged is similar to an afterburner takeoff in a standard F-4B. The runway centerline should be used as a directional guide. Steering can be accomplished using RL/LT RUDDER commands to obtain differential braking. Prior to commencing the takeoff roll command TOA and THRUST INC, the takeoff roll should be started by commanding BRAKES OFF when the engines are at 80 percent rpm and 450-470 degrees EGT. After takeoff roll has begun, THRUST INC is commanded to obtain MIL THRUST and EGT and RPM are checked. Then BURNER ON and THRUST INC are commanded to obtain MAX THRUST. If one afterburner fails to light, sufficient directional control is available with rudder/differential brake steering to continue takeoff with asymmetric power. As the airspeed increases the aircraft will smoothly rotate to 10-12 degrees pitch attitude and the AFCS will continually reposition the stabilator as required to maintain that attitude. Do not exceed 22 units angle of attack during the lift-off phase. If angle of attack is excessive, DIVE commands may be used to decrease angle of attack.

WARNING

Do not use CLIMB commands to obtain full aft stick prior to takeoff roll. CLIMB commands may result in high pitch attitude reference (up to 45 degrees is possible) with resultant over-rotation and stall.

AFTER TAKEOFF

When the aircraft is definitely airborne, perform the following:

Pilot

1. Ensure that aircraft is definitely airborne before retracting the landing gear.
2. Manually raise the landing gear.
3. Command FLAPS UP at 300 feet or 200 KCAS.

NOTE

If boarding steps have inadvertently been left extended, or if they extend in flight, do not exceed 400 KCAS and land as soon as practicable.

4. Selective Identification Feature - AS DESIRED
5. Autofuel Arm Switch - ARMED.

RIO

The RIO will challenge the pilot on the following:

1. Landing gear - UP
2. FLAPS - UP
3. Selective Identification Feature - AS DESIRED.
4. Lower Ejection Handle - AS DESIRED

TRANSITION TO CLIMB

Complete standard F-4B procedures

CLIMB

Complete standard F-4B procedures

INFLIGHT

Refer to Inflight Procedures, Section IV.

LANDING

DESCENT/INSTRUMENT PENETRATION

Standard F-4B procedures are applicable.

PATTERN ENTRY

Enter the traffic pattern at the altitude and airspeed prescribed by Local Course rules.

LANDING TECHNIQUE

Enter the pattern as Local Course rules dictate, utilizing THRUST INC/DEC and SPEED BRAKES IN/OUT commands as necessary to maintain pattern airspeed and altitude. At the brake reduce thrust and extend speed brakes (if required). As the airspeed decreases through 235 knots CAS command FLAPS DOWN and lower the landing gear. Continue to decelerate to, and maintain, 150 knots CAS. After the gear and flaps have been checked and reported, roll into the base leg and establish a mild rate of descent. Establish 19 units angle of attack and command RAPC. RAPC will attempt to maintain 19 units angle of attack and should position the throttles to maintain approximately 84 to 86 percent rpm when at 19 units. Attempt to land within the first 1,000 feet of runway whenever possible; however, do not chop power prior to crossing the end of the runway. The sudden loss of boundary layer control air causes the airplane to settle immediately. At touchdown command THRUST DEC to retard the throttles to idle and manually deploy the drag chute. The nose drops almost immediately due to the airplane center of gravity and stabilator location. As the nose drops the AFCS will increase the stabilator deflection and thus increase the drag. Utilize RT/LT RUDDER commands as required. BRAKES ON may be commanded when airspeed is less than 100 knots CAS. Differential Brake steering will automatically engage below 85 KCAS. At the end of the landing roll disengage C/C and utilize basic nosewheel steering to taxi off the runway.

LANDING

Pilot

1. Landing checklist - COMPLETE

- a. Wheels
- b. Flaps
- c. Hook
- d. Harness

2. UHF antenna - UPR
3. Lower ejection handle guard - AS DESIRED
4. Wheel lights - CHECK
5. Wheel brakes - CHECK
6. Brake Pressure gauge - CHECK
7. Upon touchdown - THRUST DEC to IDLE
8. Drag Chute - DEPLOY

RIO

1. Pilot's Checklist - MONITOR
2. Communication antenna - UPR
3. Equipment - STOW
4. Harness - LOCKED
5. Lower ejection handle guard - AS DESIRED
6. Landing checklist - COMPLETE
7. Report - READY FOR LANDING

DRAG CHUTE PROCEDURES

Standard Drag Chute procedures are applicable

LANDING ROLL

Landing roll characteristics are unchanged

CROSSWIND LANDING

Standard crosswind landing procedures are applicable

HEAVY GROSS WEIGHT

Standard heavy gross weight landing procedures are applicable.

POSTFLIGHT

POSTFLIGHT PROCEDURES

Standard F-4B postflight procedures are applicable.

POSTLANDING

Pilot

1. Place all arming switches to SAFE
2. T.M. power OFF
3. Disengage C/C
4. Complete F-4B postlanding checklist

RIO

1. Challenge pilot for landing gear handle in DOWN position test switch on SAFE, TM power OFF.
2. Complete F-4B postlanding checklist.

NIGHT FLYING

Standard F-4B night flying procedures are applicable to the QF-4B.

PART 4 NOLO FLIGHT PROCEDURES

PREFLIGHT

GENERAL

All pre-NOLO maintenance checks shall be completed in accordance with the appropriate maintenance manuals no more than 72 hours prior to a NOLO flight. Weight and balance clearance is the responsibility of the Maintenance Department. However, the FOX operator should review the Weight and Balance Handbook (AN-01-1B-40) prior to flight and compare the anticipated takeoff and landing data with the prescribed limits. The setup pilot shall complete the following preflight procedures:

AFT COCKPIT CHECK

1. Complete standard F-4B aft cockpit check for solo flight
2. Target Power Control Box Circuit Breakers - IN
3. Failsafe Turn Select Switch - AS DESIRED
4. Hand Control - Secured

BEFORE ENTERING COCKPIT

1. Complete standard F-4B exterior inspection
2. Normal opening canopy lever - AFT/OPEN
3. Landing gear handle - DOWN
4. Emergency canopy release handle - FORWARD and SHEAR WIRED
5. Center rear view mirror - CHECK
Ensure mirror clears the windshield bow when canopy is closed
6. Aft cockpit electrical test receptacle - ENSURE CAP TIGHTENED

NOTE

It is possible to trip both generators off the line if the electrical test receptacle 3P325 under the right canopy is loose. The generators cannot be restored until cap is tightened.

AFTER ENTERING COCKPIT

Before Electrical Power

1. Complete normal F-4B cockpit checks
2. C/C Master Switch - OFF
3. All Arming Switches - SAFE
4. Cockpit Control Switch - FWD
5. FEI Power - OFF
6. TM Pwr - OFF
7. BEACON PWR - OFF

8. COMRCVR Switch - OFF
9. Command Master Panel - All Switches OFF
10. Air Temp Switch - NORM
11. Engine Select Switch - BOTH

After Electrical Power

1. Complete standard F-4B checks

BEFORE STARTING ENGINES

1. Complete standard F-4B checks

STARTING ENGINES

1. Start engines in the normal manner
2. When throttles are in operating range lock NOLO plate idle stop in position.

BEFORE TAXIING

1. Complete standard F-4B checks
2. RT GEN OUT and LT GEN OUT lights - OFF
3. ADI OFF flag - OUT OF WINDOW
4. Pitch, roll and yaw stab aug switches - ENGAGED
5. C/C Master - ON
6. C/C Arm Switch - ARMED
7. TM Pwr Switch - ON
8. COMRCVR FWR switch - ON
9. Center controls

NOTE

Move stick using stick force transducer and use stab null light to place stick in proper position

10. AFCS switch - ENGAGE
11. C/C Engage Switch - DEPRESS
12. Autobrakes Arm Switch - ARMED
13. Command - PARKING BRAKE
14. Hook Arm Switch - ARMED
15. Flaps/Speed Brakes ARM Switch - ARMED
16. Wing Flaps Switch - REMOTE
17. APCS Switch - STBY
18. Air Temp Switch - NORM
19. Engine Select Switch - BOTH
20. Autothrottle Arm Switch - ARMED
21. Wing Transfer Pressure Switch - NORMAL
22. External Transfer Switch - CENTER
23. Differential Brake Steering Arm Switch - ARMED
24. Gear Test Switch - SAFE
25. Gear Test Light - OFF
26. Communications check - Establish communications with the Fox operator
27. Remote Control Ground Check

The Fox operator shall key each of the following functions in the sequence specified. The setup pilot shall acknowledge proper response to each command. In the event the aircraft does not respond to a command the setup pilot shall key that command locally. This will serve to isolate the command transmitting-receiving system from the aircraft systems.

CLIMB
DIVE
TOA
PITCH CENTER
ALTITUDE HOLD
MACH HOLD
PITCH CENTER

RIGHT TURN
LEFT TURN
BRAKES ON
BRAKES OFF
PARKING BRAKE
HALF FLAPS
FLAPS DOWN
RT RUDDER
LT RUDDER
FLAPS UP
HOOK DOWN
THRUST INC
THRUST DEC
SPEED BRAKES DOWN
SPEED BRAKES UP
TM CAL

28. Chase plane check

Each chase plane shall key the following commands and the setup pilot shall acknowledge proper response.

CLIMB
DIVE
RT TURN
LT TURN
THRUST INC
THRUST DEC

29. C/C Disengage switch - DEPRESS
30. All Arming Switches - SAFE
31. Hook handle - Place in UP position
32. Report ready to taxi

Taxiing

Pilot

1. Complete normal F-4B procedures

TAKEOFF

Before Takeoff

The control aircraft shall be airborne at least 15 minutes prior to the scheduled drone takeoff. Two control aircraft should be utilized, a

primary control aircraft (C-1) and a secondary control aircraft (C-2). The control aircraft shall orbit the field (see figure 3-1) while the safety pilot taxis the drone into position and completes the final setup procedures. The Fox operator (F-1) will be in position and maintenance will make final equipment removals at this time.

Flap Positions

All NOLO takeoff shall be made with half flaps

Pilot

1. Engines - RUN UP (one at a time)
 - a. Variable area inlet ramps - CHECK FULLY RETRACTED
 - b. Oil pressure - CHECK
2. Engine anti-ice - AS DESIRED
3. Pitot heat - ON
4. Compass - CHECK SYNC
5. Compass - SET LATITUDE, SET SYNC MODE
6. SIF - AS DESIRED
7. Takeoff Check list - COMPLETE WITH F-1
 - a. Controls checked

Check controls for freedom of movement, normal pressure drop and freedom of movement.

- b. Wings - LOCKED
Check wing pin unlock handle down and WING PIN UNLOCK lights out.
8. C/C Master - ON
9. C/C Arm Switch - ARMED
10. Beacon Pwr - ON
11. TM Pwr - ON
12. Stab Aug Switches - ENGAGE
13. Trim - Set for takeoff
14. AFCS Switch - ENGAGE

NOTE

Center controls prior to APCS engagement using stick face transducer and stab null light to place the control stick in the proper position.

15. C/C Engage Switch - ENGAGE
16. Orbiting/Preset Heading Switch - SAFE
17. Autobrakes Arm Switch - ARMED
18. Command - PARKING BRAKE
19. Autobrakes light - ILLUMINATED, steady
20. Hook Arm Switch - ARMED
21. Flaps/Speed Brake Switch - ARMED
22. Flaps handle - REMOTE
23. APCS Switch - STBY
24. Air Temp Switch - NORM
25. Engine Select Switch - BOTH
26. Autothrottle Arm Switch - ARMED
27. Wing Transfer Pressure Switch - NORMAL
28. External Transfer Switch - CENTER
29. Differential Brake Steering Arm Switch - ARMED
30. Gear Test Switch - SAFE
31. Cockpit Control Switch - FORWARD
32. NOLO Plate Idle Stop - IN POSITION
33. FEI Pwr Switch - ON
34. COMRCVR Switch - ON
35. Signal Fox to turn CARRIER ON
36. CARRIER ON Light - ILLUMINATED

37. NOLO Plugs - INSTALLED

NOTE

When the NOLO plugs are installed AFCS and C/C cannot be disengaged using the disengage switches. With NOLO plugs installed AFCS and C/C may be disengaged by placing both GEN SWITCHES OFF.

- 38. NOLO ARM Light - ILLUMINATED
- 39. REMOTE ARM Light - ILLUMINATED
- 40. ORBIT/PRESET Heading - Set as desired
- 41. Auto Fuel Arm Switch - ARMED
- 42. FAILSAFE light - OFF
- 43. Evacuate aircraft
- 44. Canopies - CLOSED

Fox Operator

- 1. Upon signal from setup pilot - CARRIER ON
- 2. When pilot evacuates the aircraft signal all personnel to clear the area.
- 3. Command - HALF FLAPS
- 4. Command - TOA
- 5. Call READY FOR TAKEOFF

TAKEOFF TECHNIQUE

The centerline of the runway should be used as a directional guide. Differential brake steering is engaged until the aircraft reaches 85 knots. At this speed the rudder is effective and differential brake steering is automatically disengaged. Takeoff is made with half flaps, MAX thrust and TOA commanded. The TOA command will result in full stabilator deflection and the takeoff will be similar to a piloted afterburner takeoff. As the aircraft accelerates to flying speed the aircraft will smoothly rotate to 10-12 degrees pitch attitude. It will continue to maintain this attitude when the aircraft becomes airborne. Flaps and gear should be commanded UP when the aircraft is definitely airborne and prior to reaching 250 knots.

An airspeed switch will provide automatic retraction of the flaps and landing gear prior to reaching 250 knots if the commands have not been executed. C-1 and C-2 should assume the positions shown in figure 3-1 when F-1 calls READY FOR TAKEOFF. C-2 shall fly a loose-wing position on C-1. During the takeoff run C-2 shall drop astern of C-1 being in position to assume control of the drone in the event C-1 "overruns" the drone during the pickup attempt.

Fox Operator

1. When C-1 and C-2 call READY FOR TAKEOFF - BURNER ON
2. At approximately 85 percent rpm - BRAKES OFF, THRUST INC
 - a. Command THRUST INC for 12 seconds to assure maximum thrust
 - b. Maintain directional control with RT/LT RUDDER commands
3. When the drone is definitely airborne key - GEAR UP
4. When the drone is 300 feet or 200 knots command - FLAPS UP
5. When the control aircraft is in position and calls CARRIER ON - CARRIER OFF.
6. Call - CARRIER OFF

Chase Pilot(s)

1. When F-1 calls READY FOR TAKEOFF position aircraft as shown in figure 3-1 and call - READY FOR TAKEOFF.
2. When in position and drone has flaps and gear up - CARRIER ON.
3. Call CARRIER ON
4. Command - BURNER OFF

CLIMB

The drone is in the control of C-1 or C-2 during the climb. After BURNER OFF is commanded the drone will continue to accelerate in MIL thrust to the climb Mach number. When at the climb Mach number CLIMB/DIVE commands should be used to obtain the drone pitch altitude required to maintain the Climb Mach number. Then MACH HOLD should be commanded. During climb the control aircraft should:

- a. Establish communication with the firing unit(s) and coordinate the remote control checks with all other stations

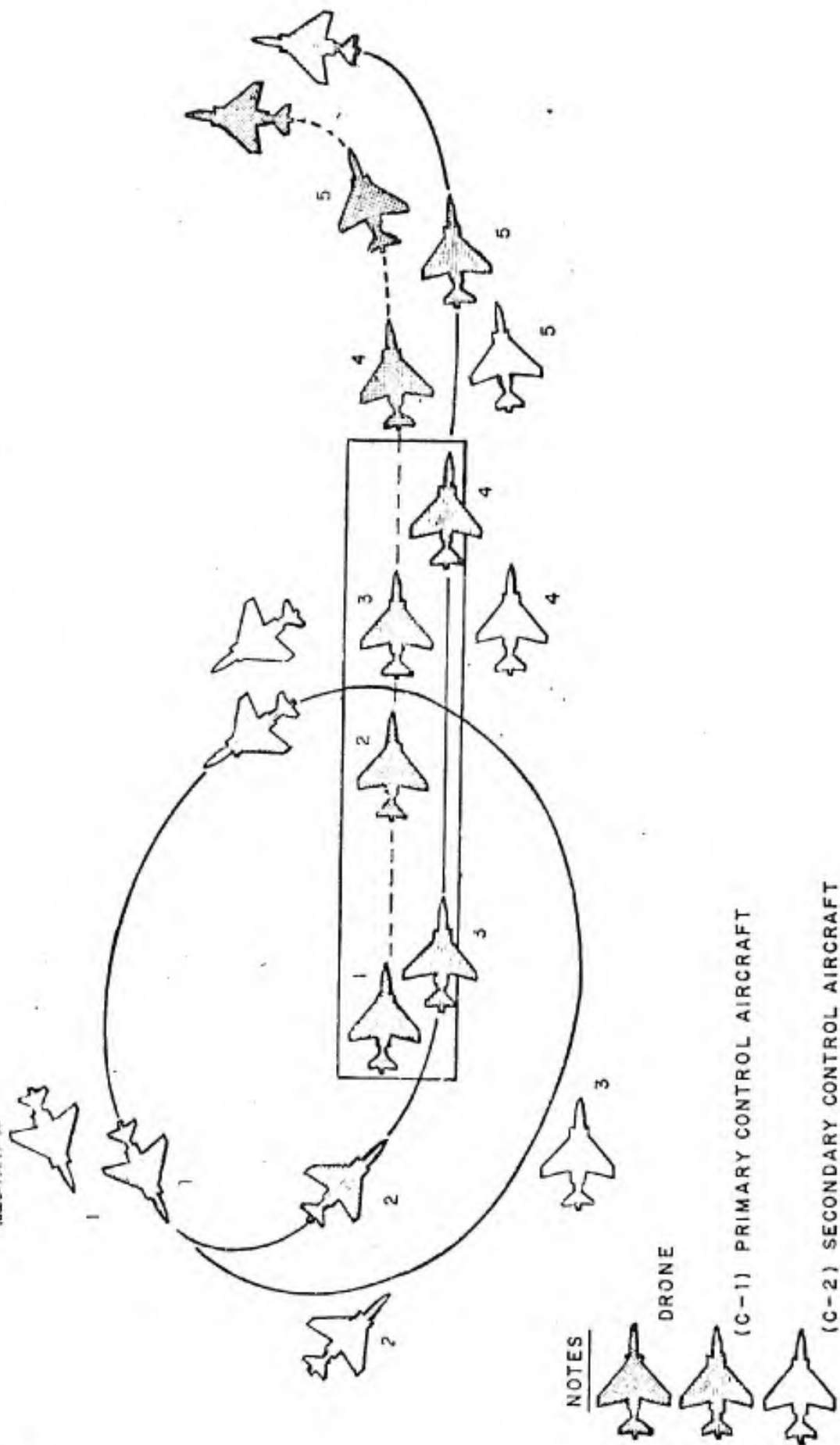


Figure 3-1. QP-48 Drone Takeoff Pattern

b. Inform the base and the firing unit(s) as to the number and type of control aircraft, estimated time of arrival on station, weather on station and any other pertinent information.

c. Act, in all respects, as flight leader having the authority to terminate the operation at his discretion. Determine the flying qualities of the drone in case of damage or system malfunction and make the decision whether to destroy the drone or attempt a recovery. The primary control aircraft shall ensure the compliance of range safety regulations by the entire control group. The secondary control aircraft shall stand by to assume the duties of primary control at any time.

INFLIGHT

Refer to Inflight Procedures, Section IV.

LANDING

DESCENT

Upon completion of the firing exercise the Out of Sight Controller (OOSC) passes control back to C-1 for descent and landing. Descent is made with the drone at IDLE thrust, speed brakes out and MACH HOLD engaged. MACH HOLD should be engaged at 250 kias.

PATTERN ENTRY

C-1 shall enter the pattern with the drone at the altitude and airspeed prescribed by local course rules. Whenever possible the pattern entry should be in accordance with figure 3-2.

LANDING TECHNIQUE

C-1 shall escort the drone in the pattern shown in figure 3-2. On the downwind leg decrease airspeed to 215 knots and command FLAPS DOWN, GEAR DOWN and HOOK DOWN. After the gear and flaps have been checked and reported, command RAPC. Roll into the base leg and establish a mild rate of descent. When on final, C-1 shall call ON FINAL. At this time F-1 shall turn carrier on and assume control of the drone. C-1 shall then turn carrier off and move out to starboard and assume a position to pick up the drone in case of a waveoff by F-1. Use of RAPC will result in the proper thrust setting to maintain 19 units angle of attack. CLIMB/DIVE commands are utilized to maintain the glide slope. F-1 should attempt to land the drone in front of the Fox truck (figure 3-2). F-1 should command full THRUST DEC at touchdown. This will cause loss of boundary control air and the aircraft will settle immediately. At touchdown deploy the drag chute. The nose drops almost immediately due to the airplane center-of-gravity and stabilator location. As the nose drops the AFCS will increase the stabilator deflection in an attempt to maintain the landing attitude. This increased stabilator

deflection will increase the drag and assist in slowing the aircraft. Directional control is maintained by RT RUDDER or LT RUDDER commands. Differential brakes will be automatically engaged as the speed and rudder effectiveness decreases. All NOLO landings should utilize the arresting gear. In the event the arresting hook is damaged or misses the wire AUTO BRAKES may be utilized to stop the aircraft.

NOTE

RAPC should be utilized to control thrust during the landing approach. If THRUST INC/DEC commands are utilized constant operator attention to throttle setting is required greatly increasing the workload and probability of mishap.

RAPC will automatically disengage upon touchdown. The throttle position will then remain fixed until THRUST DEC is commanded.

LANDING

Chase Pilot

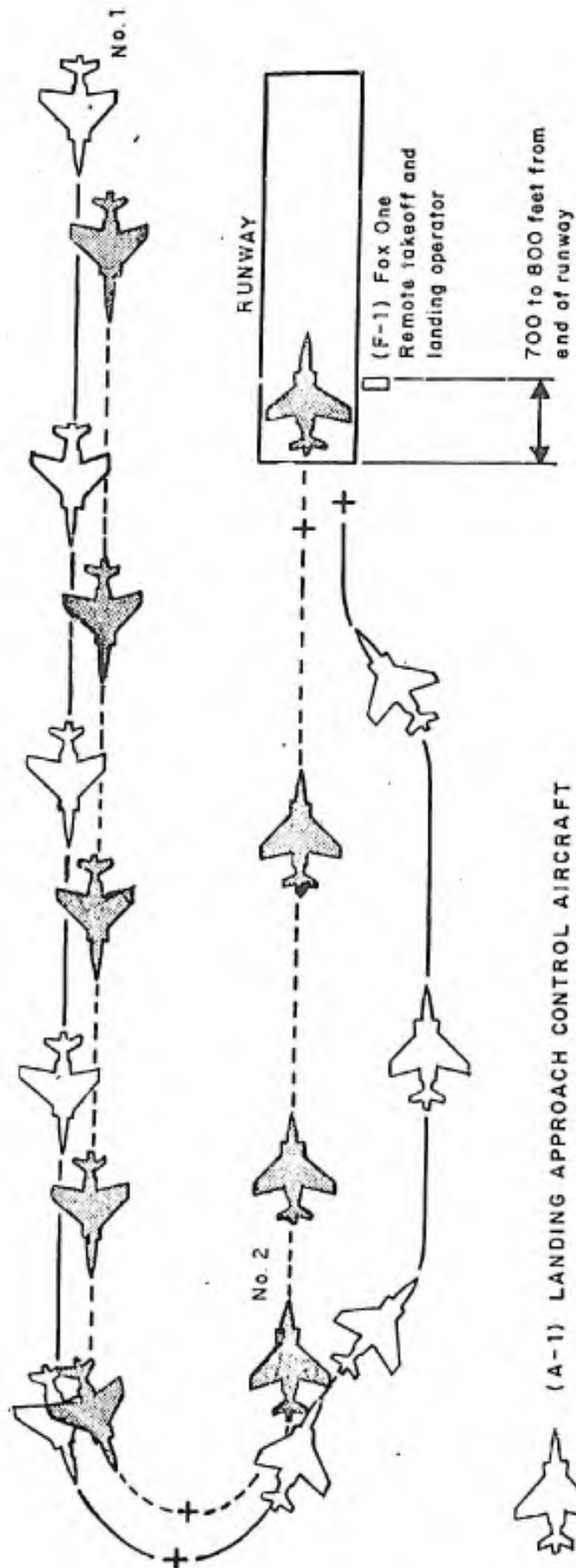
1. Landing check list - COMPLETE
 - a. Wheels
 - b. Flaps
 - c. Hook
2. When flaps down - RAPC
3. Call - ON FINAL
4. When F-1 calls CARRIER ON - CARRIER OFF

FOX OPERATOR

1. When C-1 calls ON FINAL - CARRIER ON
2. Call - CARRIER ON
3. At touchdown - THRUST DEC
4. Command - CHUTE

DRAG CHUTE PROCEDURES

The drag chute is normally deployed on all NOLO landings. All landings should be planned and flown as arrested landings. In case the arresting hook misses the wire the chute will assist in decelerating the



No. 1 -- 1,500 to 2,000 feet, altitude
 No. 2 -- 1,000 to 1,200 feet, altitude (2 to 3 miles) Range

Figure 3-2. QF-4B Drone Approach Pattern

aircraft to a speed where AUTOBRAKES may be safely used. In the event that a decision to waveoff is made after the chute is deployed the chute may be released by a CHUTE JETTISON or THRUST INC command. After the aircraft has come to a stop the chute may be released by the Fox operator or the safety pilot in accordance with local operating procedures.

LANDING ROL

The airplane is very clean on landing and even with fairly low residual thrust it wants to roll down the runway with little deceleration. Leave the flaps down to increase aerodynamic drag and to decrease residual thrust by utilizing BLC air. The AUTOBRAKES system is designed to stop the aircraft from speeds below 100 knots without skidding. The effectiveness of the system is such the aircraft can easily be stopped on the remaining runway if the arresting wire is missed.

CROSSWIND LANDING

The chase pilot should carefully compensate for crosswinds in the traffic pattern to guard against undershooting the final turn. On final approach, use the crab method to maintain course. The aircraft can be crabbed by using RT/LT RUDDER or RT/LT TURN commands. When using TURN commands TURN CENTER should be commanded when the aircraft is at the desired heading. This will reengage the heading hold system so that the desired crab angle will be maintained. Just prior to touchdown, RT/LT RUDDER should be commanded to align the aircraft with the runway heading. The Fox operator should be prepared for the aircraft to weather cock into the wind upon drag chute deployment. Weather cocking must be corrected by RT/LT RUDDER commands. Differential brake steering will automatically engage as the rudder becomes ineffective. When landing on a wet runway with a crosswind component in excess of 20 knots it may become necessary to jettison the drag chute after initial deceleration to maintain directional control.

POSTFLIGHT

POSTFLIGHT PROCEDURES

When the aircraft has been brought to a full stop, brakes applied and wheels chocked, the safety pilot should reenter the aircraft, place all arming switches in the SAFE position, remove the NOLO plugs and disengage C/C. The arresting gear may then be disengaged and the aircraft taxied off the runway. If necessary, the engines may be shut down prior to the safety pilot boarding the aircraft by means of LT/RT ENGINE SHUTDOWN commands.

POSTLANDING

Fox Operator

1. Command - PARKING BRAKE
2. Command - THRUST DEC (Insure thrust at IDLE)
3. Signal safety pilot to board aircraft

Safety Pilot

1. All arming switches - SAFE

NOTE

Commanded parking brake becomes inoperative when arming switches are in safe.

2. COMRCVR PWR switch - OFF
3. FEI pwr - OFF
4. BEACON PWR - OFF
5. TM PWR - OFF
6. NOLO plugs - REMOVE
7. C/C DISENGAGE
8. Signal crew to clear arresting hook
9. Hook - RAISE
10. Flaps - RETRACT
11. Stab Aug - OFF
12. Pitot heat - OFF
13. Temperature control knob - FULL HOT
Place temperature control knob to HOT to evaporate any water that may have collected in air conditioning system.
14. Defog/footheat handle - DEFOG
15. IDLE stop - FOLD BACK

NADC-73219-30

16. Throttles - OFF
17. Engine master switches - OFF
18. Generator control switches - OFF
19. All switches, levers and personal equipment - OFF or disconnected.

SECTION IV FLIGHT PROCEDURES

Table of Contents	Page
Piloted Flight	4-3
NOLO Flight.	4-5

PILOTED FLIGHT

C/C DISENGAGED

Flight characteristics and procedures are unchanged from the F-4B when C/C is disengaged.

C/C ENGAGED

With the C/C engaged the aircraft may be controlled through the various drone systems. Pitch and roll attitude must be controlled by CLIMB/DIVE and RT/LT TURN commands. The various other systems (flaps, throttles, fuel, etc) may be selectively armed and operated through the control circuits. Pitch and roll attitudes are limited to ± 45 degrees when C/C is engaged.

INFLIGHT C/C ENGAGEMENT

Pilot

1. C/C Master - ON
2. Cockpit control switch - FWD
3. All arming switches - SAFE
4. Command master panel switches - OFF
5. Air Temp switch - NORM
6. Engine select - BOTH
7. COMRCVR switch - OFF
8. Gyro - ADI OFF flag out of window
9. Compass controller - SLAVE and Latitude set
10. Stab Aug - All axes ENGAGE
11. Trim - SET for hands off level flight
12. AFCS - ENGAGE
13. Orbiting/Preset Heading Switch - SAFE
14. C/C Arm Switch - ARM
15. C/C Engage Switch - DEPRESS

Preceding page blank

16. Autobrakes Arm Switch - ARM
17. Autobrakes Light - OFF
18. Brake Pressure - Zero
19. Hook Arm Switch - ARMED
20. Flaps/Speed Brake Switch - ARMED
21. Flaps Handle - REMOTE
22. APCS Switch - STBY
23. Air Temp Switch - NORM
24. Engine Select Switch - BOTH
25. Autothrottle Arm Switch - ARMED
26. Wing Transfer Pressure Switch - NORMAL
27. External Transfer Switch - CENTER
28. Autofuel Arm Switch - ARMED
29. Differential Brake Steering Arm Switch - ARMED
30. Gear Test Switch - SAFE
31. CHK GEAR Light - OFF

RIO

1. Target power control panel - CIRCUIT BREAKERS IN
2. MDM Switch - OFF
3. Failsafe Turn Select Switch - LEFT/RIGHT as desired.

INFLIGHT REMOTE GEAR OPERATION

Since the remote landing gear system utilizes the UP position of the landing gear handle, takeoff and landing with the remote landing gear system engaged is not recommended. The system may be safely operated in flight. If in-flight operation of the remote landing gear system is desired the aircraft should be flown at 235 KIAS or less. With C/C engaged command HALF FLAPS or FLAPS DOWN, place the gear handle in the UP position and the gear test switch in the TEST position. The gear may then be lowered or raised by GEAR DOWN or GEAR UP commands.

NOLO FLIGHT

NOLO PROCEDURES

During climb out to the assigned operating area the chase pilot should verify that the drone operating characteristics are satisfactory for performing the planned mission and inform OOSC of the condition of the drone. When the drone is in the assigned area and OOSC has positive track he shall turn his carrier on and signal C-1 that carrier is on and OOSC has control. At that time C-1 shall turn his carrier off and proceed to his assigned station for the firing run. At the completion of the firing exercise OOSC shall maintain control of the drone until C-1 has been vectored into position and has the drone in sight. C-1 shall then inspect the drone for damage and make the decision to destroy or attempt to recover the drone. If the decision is made to recover the drone C-1 shall turn carrier on and assume control of the drone and start the descent. When C-1 has carrier on and the drone under control OOSC shall turn his carrier off.

SECTION V EMERGENCY PROCEDURES

Table of Contents	Page
General.	5-3
Communications	5-3
Electrical	5-4
Engine	5-4
Hydraulic.	5-4
Landing Emergencies.	5-4
Takeoff Emergencies.	5-5

GENERAL

In the event of an emergency during piloted flight, C/C shall be disengaged and emergency procedures applicable to the basic F-4B shall be followed. This section contains procedures to be followed to correct emergency conditions during NOLO operations.

COMMUNICATIONS

COMMUNICATIONS FAILURE PRIOR TO TAKEOFF

1. Delay takeoff until satisfactory communications are established between all units.

COMMUNICATIONS FAILURE DURING TAKEOFF

In the event of communications failure between F-1 and the control group (F-1 receives no response when passing control to the pickup aircraft after the landing gear and flaps are retracted), the following procedure is to be used:

1. F-1 command - LEFT TURN, TURN CENTER
2. C-1 upon observing the above signals shall turn carrier ON and command - RIGHT TURN, TURN CENTER
3. F-1 shall turn his carrier OFF.

COMMUNICATIONS FAILURE DURING FLIGHT

1. C-1 shall pass control to C-2 by use of hand signals in the same manner as "passing the lead" in formation flight.

COMMUNICATIONS FAILURE DURING LANDING APPROACH

If communications are not established or are lost during landing approach:

1. C-1 shall break SHARPLY to starboard
2. F-1 upon observing C-1 breaking starboard shall turn his carrier ON and command - TURN, TURN CENTER

NOTE

Direction of turn depends upon existing circumstances

3. F-1 shall continue the approach.

4. Upon observing TURN and TURN CENTER by F-1, C-1 shall turn his carrier OFF.

5. If C-1 does not observe TURN and TURN CENTER signals, he shall, immediately, take control of the drone and wave it off.

ELECTRICAL

GENERAL

In the event of a generator failure all essential electrical systems will be automatically tied to the remaining generator. C-1 shall then make the decision to continue the mission or initiate recovery depending upon existing circumstances. In either event the drone should be headed away from populated areas to the maximum extent possible since loss of the remaining generator will result in loss of control of the drone.

ENGINE

GENERAL

Single engine NOLO flight is not recommended. In the event of an in-flight engine failure the aircraft should be immediately directed to a safe area and crashed.

HYDRAULIC

GENERAL

In the event of a PC-1 or PC-2 failure continued flight is possible. In this case C-1 shall make the decision to continue the mission or initiate recovery based on existing conditions. If the utility system fails roll and yaw control as well as the capability to operate flaps and landing gear is lost. In this case guide the aircraft, if possible, to a safe crash area and destroy the drone.

LANDING EMERGENCIES

MISSED WIRE OR HOOK FAILURE

1. When aircraft has decelerated to 100 knots - BRAKES ON
2. Maintain directional control with RT/LT RUDDER commands

SINGLE ENGINE LANDING

A single-engine landing is not recommended.

NO FLAPS LANDING

A no-flaps landing is basically the same as a normal landing, except the pattern is expanded to avoid steep turns; the downwind, base leg and final approach speeds are increased 22 knots to provide adequate lateral control. RAPC cannot be used due to the flaps up reference angle of attack of 8.5 units. Use THRUST INC/DEC commands to control throttle position.

TAKEOFF EMERGENCIES

ABORTED TAKEOFF

Takeoff may be aborted at speeds under 85 knots by commanding abort. This command automatically executes the following commands:

BURNER OFF
THRUST DECREASE
BRAKES ON
HOOK DOWN
CHUTE DEPLOY

When the decision to abort is made with airspeed greater than 85 knots the above commands should be keyed manually.

NADC-73219-30

SECTION VI ALL-WEATHER OPERATION

Refer to basic F-4B NATOPS

NADC-73219-30

SECTION VII COMMUNICATIONS PROCEDURES

Refer to basic F-4B NATOPS

S E C T I O N V I I I W E A P O N S Y S T E M S

ELECTRONIC COUNTERMEASURES EQUIPMENT

DESCRIPTION

Aircraft which had been modified by AFC 333 or AFC 375 part II had been modified to include the AN/ALE-29A chaff dispenser set. This equipment has been removed from the QF-4B. The equipment removed includes the integrated control panel which controls the chaff dispenser doors. The integral control panel has been replaced by a panel which contains a switch to control operation of the doors.

ALE-29 DOOR SWITCH

The ALE-29 door switch is a two-position toggle switch located in the aft cockpit in the location formerly occupied by the integrated control panel. This switch controls operation of the ALE-29 doors.

NORMAL OPERATION

The ALE-29 door switch shall be in the CLOSED position for all flight operations.

EMERGENCY OPERATION

There are no special provisions for emergency operation of the chaff dispenser doors.

LIMITATIONS

There are no specific limitations related to this system.

NADC-73219-30

SECTION IX FLIGHT CREW COORDINATION

Refer to basic F-4B NATOPS

S E C T I O N X N A T O P S E V A L U A T I O N

Section X of the basic F-4B NATOPS manual is applicable to the QF-4B. The following pages contain a bank of questions relating to drone systems. The bank of questions is intended to assist the unit NATOPS Instructor/Evaluator in the preparation of ground examinations and to provide an abbreviated study guide. The questions from the bank may be combined with locally originated questions in the preparation of ground examinations.

QF-4B NATOPS QUESTION BANK

1. The steps for engaging control circuits are
 - a. _____
 - b. _____
 - c. _____
 - d. _____
 - e. _____
2. A Right Turn or Left Turn command results in a constant roll rate of 15 deg/sec. T/F. _____
3. SPC may be reset by a remote operator by _____.
4. RAPC automatically controls throttle setting to maintain _____ units angle of attack flaps down and _____ units flap up.
5. When the NOLO ARM light is illuminated it indicates _____.
6. The FLAPS switch has been modified by _____.
7. The steps for engaging the AUTOTHROTTLE system are:
 - a. _____
 - b. _____
 - c. _____
8. Abort failsafe is initiated after a _____ second carrier loss and results in the following automatic commands.
 - a. _____
 - b. _____
 - c. _____
 - d. _____
 - e. _____

9. The AUTO FUEL System may be used with or without control circuits engaged. T/F. _____
10. The speed brakes switch has been modified by _____.
11. The HOOK switch must be depressed for 4 seconds to fully extend the arresting hook. T/F. _____
12. During NOLO takeoff BRAKES OFF should be commanded when _____.
13. A HOOK UP command will raise the arresting hook. T/F. _____
14. A BRAKES ON command results in a steady pressure of 800 psi being applied to the brakes. T/F. _____
15. The maximum speed for AUTO BRAKES application is _____ knots.
16. To disengage ALTITUDE HOLD a CLIMB or DIVE command must be keyed for _____ seconds.
17. Control circuits may be disengaged by
 - a. _____
 - b. _____
 - c. _____
 - d. _____
18. A CLIMB or DIVE command results in a constant pitch rate of 3 degrees per second for the duration of the command. T/F. _____
19. All three axes of stab aug must be engaged to achieve proper operation of control circuits. T/F. _____
20. The maximum bank angle which may be commanded is _____ degrees.
21. With control circuits engaged heading hold is disengaged when
 - a. _____
 - b. _____
22. Pitch attitude cannot be commanded beyond $\pm$ _____ degrees.
23. RAPC and MACH HOLD can be used simultaneously. T/F. _____

24. To increase thrust from the nonafterburning to the afterburning region BURNER ON must be commanded. T/F. _____
25. During RAPC operation engine rpm is limited to _____ percent.
26. RAPC and MACH HOLD cannot be engaged simultaneously. T/F. _____
27. With the NOLO plate installed the _____ stop is removed.
28. RAPC should not be used in conjunction with ALTITUDE HOLD above _____ feet.
29. With NOLO plugs installed control circuits can be disengaged by _____ or _____.
30. Two conditions which must be met for a CHUTE DEPLOY command to be effective are:
 - a. _____
 - b. _____
31. The drag chute may be jettisoned remotely by:
 - a. _____
 - b. _____
32. The NOLO plugs are located
 - a. _____
 - b. _____
33. A generator failure will always result in disengagement of control circuits. T/F. _____
34. The REMOTE ARM light will illuminate when the following conditions are met:
 - a. _____
 - b. _____
 - c. _____
 - d. _____

35. A LEFT or RIGHT ENGINE SHUTDOWN command must be keyed for _____ seconds to be effective.
36. If one engine has been shut down by a remote command an interlock prevents shutdown of the second engine. T/F. _____
37. Waveoff fail-safe is initialed after a _____ second carrier loss provided
 - a. _____ and
 - b. _____ or
 - c. _____ and
 - d. _____
38. When waveoff is initiated the following commands are automatically locked in:
 - a. _____
 - b. _____
 - c. _____
 - d. _____
 - e. _____
39. The time delay between phase 1 and phase 2 failsafe is _____ seconds.
40. Phase 2 failsafe is not initiated unless airspeed is greater than _____ knots.
41. During phase 2 failsafe RAPC and ALTITUDE HOLD are engaged when altitude is between _____ and _____ feet.
42. The FEI system may be operated with camera bursts of _____, _____, or _____ seconds.
43. The maximum film capacity of the FEI system is _____ seconds.
44. To operate the FEI system the following steps must be completed
 - a. _____
 - b. _____
 - c. _____

45. To operate the flaps remotely the flaps handle must be in the _____ position.
46. The pilot may overrule the command system and position the flaps by placing the flaps handle in the desired position. T/F. _____
47. The flaps are automatically retracted when the airspeed reaches _____ knots.
48. The following steps are required to engage the direct rudder system:
 - a. _____
 - b. _____
 - c. _____
49. Nosewheel steering is automatically disengaged at _____ knots.
50. Heading hold is disabled with
 - a. _____or b. _____
51. The AUTO FUEL System expends fuel in the following sequence:
1 _____, 2 _____, 3 _____.
52. The AUTO FUEL System is engaged by completing the following:
 - a. _____
 - b. _____
 - c. _____
53. The CTR EXT FUEL warning light is illuminated for _____ seconds after centerline fuel is expended during auto fuel system operation.
54. Two of the original four methods of jettisoning external stores have been retained on the QF-4B. These are:
 - a. _____
 - b. _____
55. For remote FUEL JETTISON to operate the internal wing dump switch must be in the _____ position.

56. During NOLO operation PC-2 hydraulic pressure is automatically switched to the PC-1 side of the stabilator power control cylinder if PC-1 pressure drops to less than _____ psi.
57. For operation of the remote landing gear system during piloted flight the landing gear handle must be in the _____ position.
58. For NOLO operation of the landing gear system the landing gear handle should be in the _____ position.
59. With control circuits engaged the landing gear will automatically retract at _____ knots.
60. The gear test light will be illuminated when _____.
61. Direct rudder commands are inoperative when _____.
62. For proper operation of the emergency warning light system the light switches shall be set as follows:
- a. _____
 - b. _____
 - c. _____
 - d. _____
63. The speed brakes switch has been changed to a five-position switch spring loaded to neutral. T/F. _____

NADC-73219-30

SECTION XI PERFORMANCE DATA

Refer to basic F-4B NATOPS

A P P E N D I X A F O L D O U T I L L U S T R A T I O N S

Table of Contents	Page
Forward Cockpit	A-3
Aft Cockpit	A-5

FIGURE 4-1 FORWARD COCKPIT

A-3 (A-4 BLANK)

[illegible]

FIGURE A-2 AFT COCKPIT

111