6. To turn off set, move function switch to OFF.

NAVIGATION INDICATORS

Bearing-Distance-Heading Indicator (BDHI)

An ID-663B/U BDHI (figure 1-34) is installed on the instrument panel. Power is supplied by the instrument a-c bus. The BDHI provides a compass card, No. 1 and No. 2 bearing pointers, and a range indicator. The No. 1 pointer displays UHF/ADF or LF/ADF relative bearing. The No. 2 pointer displays TACAN or VOR bearing, as selected through the VOR/TACAN switch. The range indicator displays slant range to surface-based TACAN beacons or line-of-sight distance to AN/ARN-52 equipped aircraft (set 63 channels apart) in the A/A mode. On aircraft having T.O. 1L-10A-542 incorporated, rear cockpit displays of compass heading, ADF, VOR, and TACAN bearings are indicated on a radio magnetic indicator, ID-250/ARN.

Note

Selection of UHF/ADF operation overrides LF/ADF (AN/ARN-83 radio compass) operation.

Course Indicator

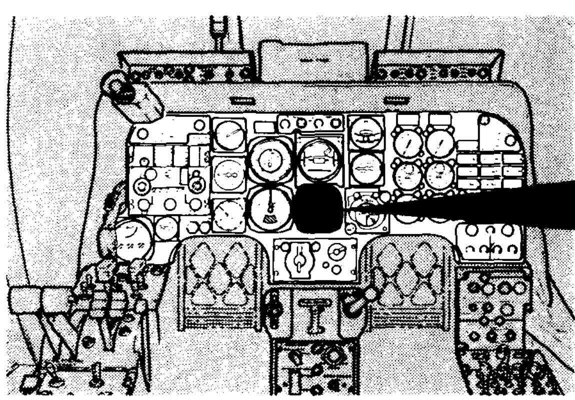
A course indicator, ID-387/ARN (figure 1-6) is installed on the instrument panel. When used to display VOR or TACAN information, aircraft heading and position are indicated relative to a selected course. The desired course is set in the course selector window with the course set knob. For additional information, refer to AFM 51-37.

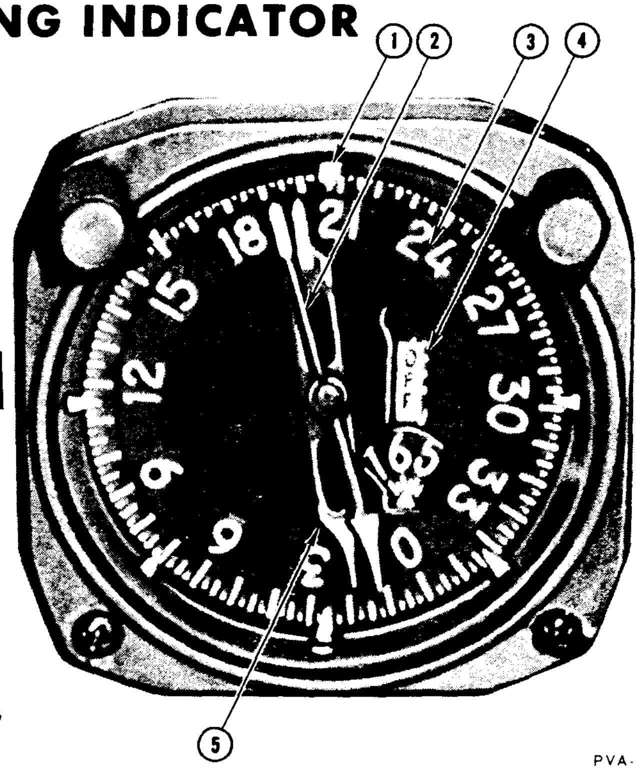
IDENTIFICATION SYSTEMS

IFF-SIF, AN/APX-64(V)

The IFF-SIF system provides radar positive identification and specialized displays in four basic modes as part of the FAA/DOD AIMS (MK XII) system.

BEARING-DISTANCE-HEADING INDICATOR





1. TOP (HEADING) INDEX.
2. No. 1 (ADF) POINTER.
3. ROTATING COMPASS CARD.
4. RANGE INDICATOR AND WARNING FLAG
5. No. 2 (VOR-TACAN) POINTER

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Figure 1-34

Power is supplied from the primary a-c bus. Operating modes and codes are as follows:

MODE	SIF CODES	PURPOSE
1	32	Military Rapcon
2	None	Military Identification
3/A	4096	FAA Identification
4		(Operationally classified)
C	None	Altitude Reporting

IFF-SIF Controls and Indicators

The IFF-SIF control panel (figure 1-35) is located on the right console.

Master Knob—The MASTER knob selects IFF mode of operation as follows:

EMER — Automatic emergency squawks, military and civilian 7700.

OFF — System secured.

STBY — Warm-up power only; no response to interrogation.

LOW — Transponder sensitivity is reduced.

NORM — Receiver sensitivity normal to interrogation with selected modes responding as interrogated.

Mode Select Switches—The mode select switches are used to select IFF mode response to interrogation. Mode select switch operation is as follows:

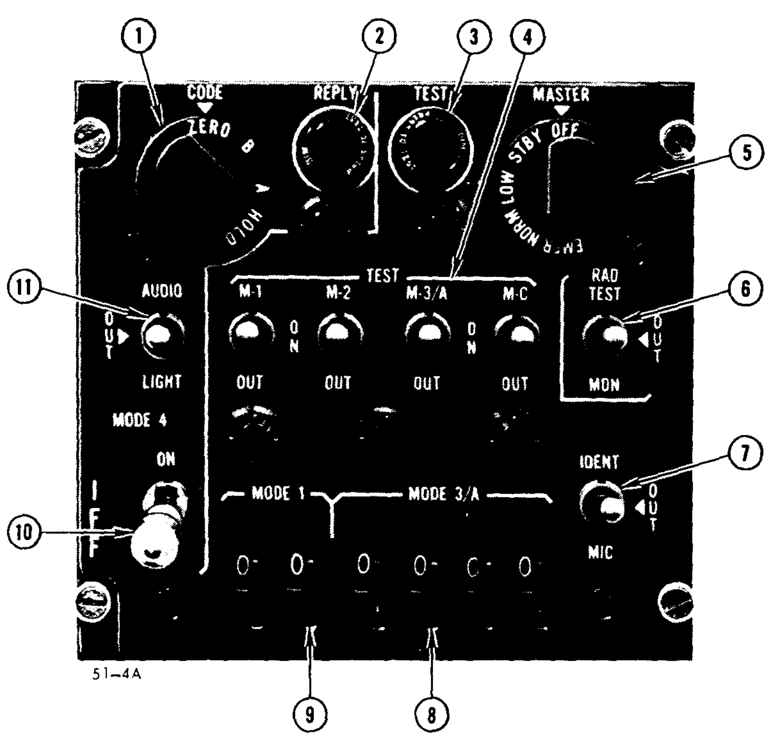
OUT — Mode does not respond to interrogation.

ON — Mode responds to interrogation with MASTER knob at LOW or NORM.

TEST — Inoperative.

Identification Switch—Holding the switch momentarily in IDENT provides a 30-second identification

IFF—SIF CONTROLS



1. MODE 4 CODE KNOB
2. MODE 4 REPLY LIGHT
3. TEST LIGHT
4. MODE SELECT SWITCHES
5. IFF MASTER KNOB
6. RAD/TEST MON SWITCH
7. IDENT SWITCH
8. MODE 3/A SIF CODE DIALS
9. MODE 1 SIF CODE DIALS
10. MODE 4 SELECT SWITCH
11. MODE 4 AUDIO/LIGHT SWITCH

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Figure 1-35

response, after which normal transponder operation resumes.

SIF Code Dials—SIF codes for IFF MODE 1 and MODE 3/A are selected by use of vernier-type, direct-reading dials on the IFF control panel.

Emergency IFF Switch—The observer's EMERG IFF switch (figure 1-8), guarded in NORMAL position, may be raised to ON to select emergency response to interrogation as required.

IFF Antenna Select Switch (Aircraft Having T.O. 1L-10A-629 Incorporated)—An IFF ANT SEL switch is located on the pilot's right console (figure 1-7) adjacent to the AM SEL switch. This switch is used to select upper or lower IFF antenna as desired.

IFF-SIF Operation

To operate the AN/APX-64(V) system at present capability, proceed as follows:

1. MASTER knob—STBY.
2. MODE 4 AUDIO/LIGHT switch—OUT.
3. M-1 switch—ON.
4. M-2 switch—AS REQUIRED.
5. M-3/A switch—ON.
6. M-C switch—OUT.
7. RAD TEST switch—OUT.
8. MODE 4 switch—OUT.
9. MODE 1 code—AS REQUIRED.
10. MODE 3/A code—AS REQUIRED.
11. IDENT switch—OUT.
12. MASTER switch—AS DIRECTED BEFORE TAKE-OFF.
13. For emergency, pull MASTER knob up and rotate to EMER.
14. To turn off IFF-SIF, rotate MASTER knob to OFF.

AIMS SYSTEM (AIRCRAFT HAVING T.O. 1L-10A-629 INCORPORATED)

Altimeter-Encoder, AAU-21/A

The AAU-21/A altimeter-encoder combines a conventional pneumatic altimeter and an altitude reporting encoder in one self-contained unit (figure 1-6). Altitude readout is displayed by a counter-drum-pointer system. The counters display by direct digital output 10,000 and 1,000 feet increments while the drum displays 100 feet increments. Direct digital readout can be made from minus 1,000 to 38,000 feet. The single pointer repeats the indications of the 100-foot drum and provides a quick indication of the rate of altitude changes. The digital readout is referenced to 29.92 inches Hg and is not affected by changes of barometric setting. The encoder provides coded altitude information in 100-foot increments for automatic transmission when the transponder is interrogated on Mode C and the mode select switch (figure 1-35) M-C is in the ON position. A code "OFF" flag will appear in the upper left portion of the instrument face if power to the encoder is lost. The code "OFF" flag only monitors the encoder function of the altimeter. It does not indicate transponder condition. Altitude reporting may be inoperative without the code "OFF" flag showing if the transponder fails or controls are improperly set. If the code "OFF" flag appears, check that a-c power is available and circuit breakers are in. If the flag is still visible, contact a ground radar to determine altitude reporting operation and proceed accordingly. In the event of encoder failure, the instrument continues to function as a normal barometric altimeter. The altimeter is set by turning the barometric setting knob on the lower left, front side of the case until the proper setting is visible in the Kollsman dial on the lower right side of the instrument display (range 28.1 to 31.0 inches Hg). The instrument also contains an internal vibrator which operates whenever d-c power is on. The vibrator provides for smooth display changes by minimizing mechanical friction effect. If the vibrator fails, the instrument will continue to function pneumatically, but a less smooth movement of the instrument display will be evident. The 100-foot pointer may stick when passing the 12-o'clock position. This effect can be lessened by tapping the instrument case.

Mode 4

Mode 4 is a military secure mode. It will operate only when the cryptographic transponder-computer (KIT-1A/TSEC) is installed. Controls and indicators for this mode are located on the left side and top of the AN/APX-64(V) control unit (figure 1-35) outlined by a white line. Mode 4 interrogation is received by a cryptographic transponder-computer which encodes and triggers a proper identification response signal. The IFF MASTER knob (figure 1-35) controls the transponder in all modes. When the MODE 4 select switch is selected ON, Mode 4 will operate normally in either NORM or EMER position of the IFF MASTER knob and at a reduced receiver sensitivity in LOW. Mode 4 is inoperative in either STBY or OFF position of the IFF MASTER knob. To operate Mode 4, the MODE 4 select switch must be in the ON position, selected codes must be inserted into the system, and CODE A or B selected on the Mode 4 CODE knob. Should Mode 4 fail to reply to a valid interrogation, the IFF caution light will illuminate.

The amber IFF caution light is located on the take-off checklist panel (figure 1-9). It illuminates to alert the pilot that the AN/APX-64(V) has failed to reply to a valid Mode 4 interrogation provided that the aircraft power is on and the IFF MASTER knob is not OFF. The IFF caution light circuitry monitors for: (1) Mode 4 codes zeroized, (2) transponder failure to reply to proper interrogation, and (3) automatic self-test function of the computer revealing a computer malfunction. Should the IFF caution light illuminate, check IFF MASTER knob NORM, MODE 4 select switch ON, and Mode 4 CODE knob in proper A or B code position for current time period. If the light remains on, avoid operation in a known Mode 4 interrogating environment or if already in one, take appropriate corrective or emergency action as operationally directed for this condition (inoperative Mode 4). The MODE 4 select switch is provided for control of Mode 4 operation. It is labeled ON and OUT. It is a positive action, lift-lock switch which must be pulled out to be placed OFF.

The MODE 4 AUDIO/LIGHT switch is a three-position toggle switch with LIGHT, OUT (center), and AUDIO positions. When the switch is placed in the LIGHT position, only the reply light of Mode 4 is enabled. The AUDIO position enables both the reply light and an aural indication. With the switch in AUDIO, an aural signal indicates that Mode 4 interrogations are being received and illumination of the reply light indicates that replies are transmitted. This switch must be in either AUDIO or LIGHT position when operating Mode 4. In the OUT position, both the light and audio indications are inoperative.

A green Mode 4 REPLY light is provided to indicate that Mode 4 replies are being transmitted when the MODE 4 AUDIO/LIGHT select switch is in either the LIGHT or AUDIO position. The REPLY light will not illuminate when pressed to test unless the MODE 4 AUDIO/LIGHT switch is in either the LIGHT or AUDIO position.

The Mode 4 CODE knob is a four-position (HOLD, A, B, and ZERO) rotary knob. A and B codes are preset daily as operationally directed by the single insertion of a code changer key. A is the present code and B is the next succeeding code, thereby enabling the set to properly reply to any valid Mode 4 interrogation during a given time period. The ZERO position zeroizes the code setting. Both codes are normally zeroized when the IFF MASTER knob is turned to OFF after the aircraft has landed. If a second flight is anticipated during the installed code time periods, the code setting may be retained by selecting the HOLD position of the knob. The HOLD position is spring-loaded to return to the A position. To hold codes, the knob must be held momentarily (2 to 3 seconds) to the HOLD position before power is removed from the transponder. Allow transponder power to remain on for at least 15 seconds after the knob is released, and then turn off as desired. The code setting is now mechanically latched and will be retained when aircraft power is turned off. To hold the code setting, the aircraft weight must be on the landing gear. The HOLD function will remain in effect until the aircraft weight is off the landing gear. If power is removed from the transponder less than 15 seconds after selecting HOLD, either by turning the transponder off or by turning off aircraft electrical power, the code setting will zeroize when transponder power is lost. Both A and B codes may be zeroized any time the aircraft has electrical power on and the IFF MASTER knob is in any position except OFF by placing the Mode 4 CODE knob to the ZERO position. The Mode 4 CODE knob must be pulled out before it can be turned to the ZERO position. Any time (in flight or on the ground) the IFF MASTER knob is placed in the OFF position, the A and B codes are zeroized unless the HOLD function has been properly actuated. Use code A or code B as operationally directed.

Transponder Test Set

When the transponder test set (TS-1843) is installed and operated in the self-test mode by placing one of the mode select switches (figure 1-35) in the TEST position, the test set generates interrogation pulse pairs for the desired mode. These interrogations are applied to the transponder to check for proper receiver frequency, sensitivity, and decoding. The test set analyzes the resulting replies for bracket spacing, frequency, power, and antenna circuitry and provides a go/no-go indication to the operator. The TEST light (figure 1-35) illuminates for a go condition. If the TEST light does not illuminate, the selected mode is in a no-go condition. The self-test modes will operate only if the IFF MASTER knob is set to the NORM position. With the RAD TEST/MON switch (figure 1-35) in MON position, the transponder test set indicates transponder performance by illuminating the TEST light when interrogation replies are made. RAD TEST position is used for ground test operation and requires additional equipment. The AN/APX-64(V) will operate normally without the test set installed but the operator is deprived of all test capabilities.

Antenna Select Switch

The IFF ANT SEL switch is a three-position switch located on the pilot's right console. Switch positions are TOP, BOTH, and BOTTOM. When the switch is in BOTH, the system automatically alternates between the top and bottom antennas.

The system is locked to the appropriate antenna in either TOP or BOTTOM position. Normally the switch is used in the BOTH (center) position. If poor pattern reception is detected by a ground station, switching to either the TOP or BOTTOM position may eliminate the problem.

Operation of Transponder

1. IFF MASTER knob–STBY (warm-up for 2 minutes).
2. Mode select switches–ON (desired modes).
3. Mode SIF code dials–SET (as desired).
4. RAD TEST/MON switch–OUT or MON (as desired).
5. IFF MASTER knob–NORM (before take-off).
6. Mode select switches–If the test set is installed, hold desired switch to TEST until TEST light illuminates. If light does not come on, the selected mode is inoperative. (There is no test for Mode 4.)

To Operate Mode 4

(IFF MASTER control knob
LOW, NORM, or EMER)

1. MODE 4 select switch–ON.
2. MODE 4 AUDIO/LIGHT switch–AUDIO/As desired.
3. Mode 4 CODE knob–A or B (as required by time period).

RADAR BEACON, SST-181X

The radar beacon set is used to extend the tracking range of ground-based radar stations. The beacon transponder, when installed, is in the nose wheel well. Power is supplied by the secondary d-c bus. Beacon operating mode is preset on the ground prior to flight. The beacon automatically transponds to interrogations in the preset mode.

Radar Beacon Power Switch (Aircraft Having T.O. 1L-10A-632 Incorporated)

On aircraft having T.O. 1L-10A-632 incorporated, a two-position toggle switch (RDR BCN) is located on the pilot's right console (figure 1-7). The ON-OFF positions of the switch allow selective operation of the radar beacon system.

See 1S-44 Defensive Systems para added

ARMAMENT SYSTEMS

The aircraft is capable of carrying varied conventional munitions loads, including gun pods, general-purpose bombs, dispensers, rocket packages, and fire bombs. For detailed information on applicable munitions, delivery procedures, and planning data, refer to the Nonnuclear Munitions Delivery Procedures Manual (T.O. 1L-10A-34-1-1). For stores capability, refer to Section V.

Note

Only those stores listed in Section V are authorized to be carried.

GUNNERY EQUIPMENT

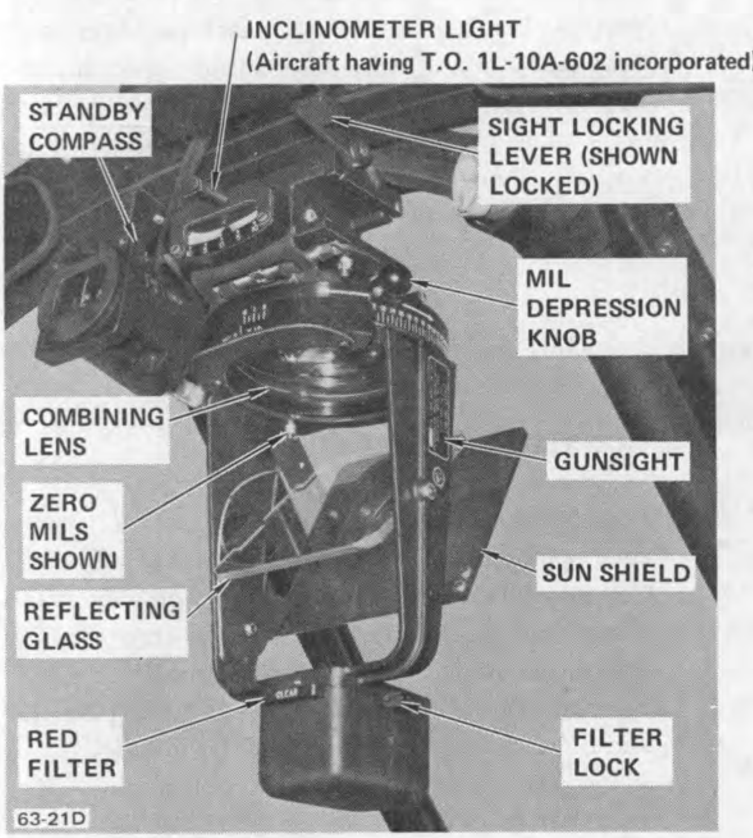
Four M60C (7.62mm) guns may be carried, two in each sponson. A total of 1000 rounds of ammunition may be carried in each sponson, providing 500 rounds per gun. Firing rate is approximately 550 rounds per minute per gun. The guns are electromechanically charged and cleared by the pilot. In addition, standard gun pods may be installed.

BOMBING AND ROCKET EQUIPMENT

A variety of nonnuclear munitions may be carried on five external store stations. Refer to Section V. Two pylons may be installed on each sponson and one pylon may be installed on the fuselage centerline. The centerline station will carry a single store weighing up to 1200 pounds for design "g" limits, and may be adapted for stores requiring 30-inch suspension spacing. The remaining stations are designed for 14-inch suspension spacing and will carry stores weighing up to 600 pounds for design "g" limits. The maximum underfuselage store loading for design "g" limits is 3600 pounds.

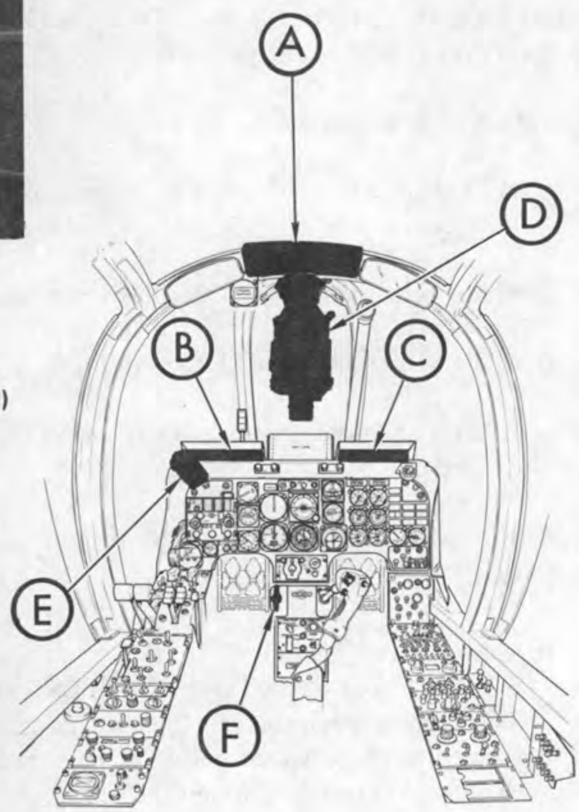
OPTICAL SIGHT AND ARMAMENT CONTROLS

(A) CAMERA, SMOKE AND GUNSIGHT CONTROL PANEL



(D) OPTICAL SIGHT

(E) STORES EMERGENCY RELEASE BUTTON

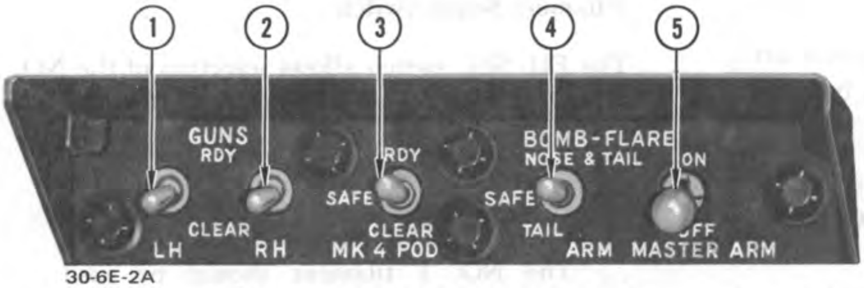


PILOT'S COCKPIT

(F) EMERGENCY STORES JETTISON HANDLE

VA-1-53E

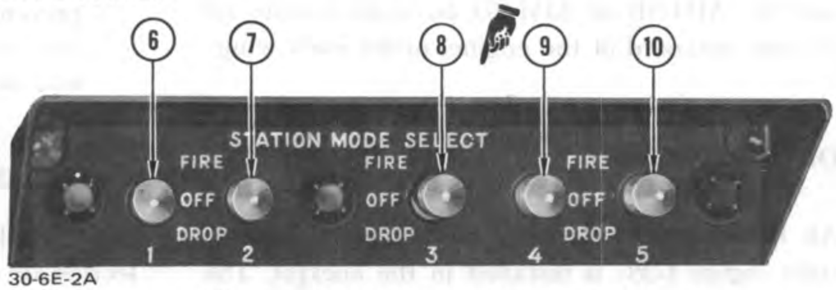
Figure 1-36 (Sheet 1 of 2)



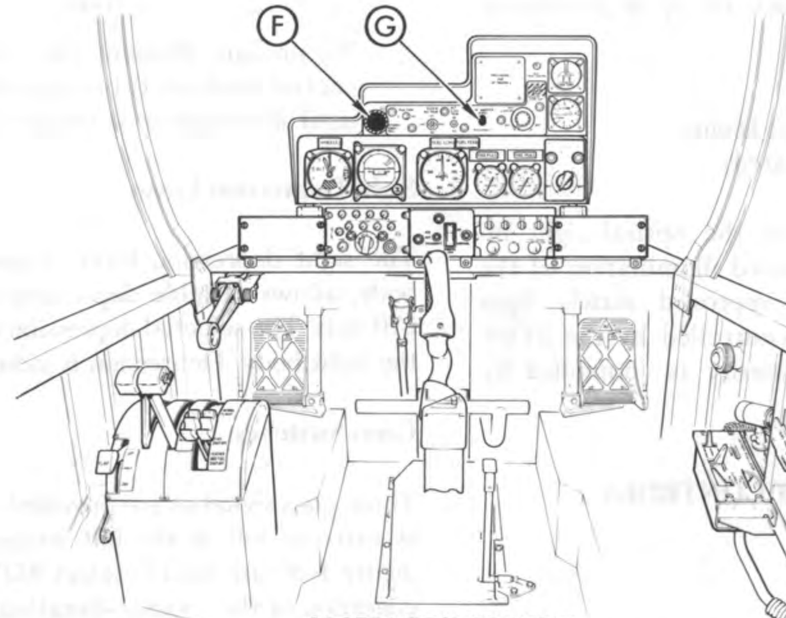
1. LEFT-HAND PAIR GUNS SWITCH
2. RIGHT-HAND PAIR GUNS SWITCH
3. MK 4 POD GUNS SWITCH
4. BOMB-FLARE ARM SWITCH
5. MASTER ARM SWITCH

Ⓑ WEAPON CONTROL PANEL

6. STATION 1 MODE SELECT SWITCH
7. STATION 2 MODE SELECT SWITCH
8. STATION 3 MODE SELECT SWITCH
9. STATION 4 MODE SELECT SWITCH
10. STATION 5 MODE SELECT SWITCH



Ⓒ STATION MODE SELECT PANEL †



OBSERVER'S COCKPIT

* Ⓕ STORES EMERGENCY RELEASE BUTTON

* Ⓖ MASTER ARM SWITCH

* AIRCRAFT HAVING T.O. 1L-10A-510 INCORPORATED
† AIRCRAFT HAVING T.O. 1L-10A-579 INCORPORATED

VA-1-152A

Figure 1-36 (Sheet 2 of 2)

Note

The external store station pylons are bolted on, and may be removed, but cannot be dropped in flight.

MISSILE EQUIPMENT PROVISIONS

Attachment provisions for the LAU-7/A launchers and the AIM-9B or AIM-9D air-to-air missile are located outboard of the engine, under each wing.

OPTICAL SIGHT

An illuminated, reflecting, noncomputing optical sight (figure 1-36) is installed in the cockpit. The reticle image consists of a 2-mil pipper and quadrantial markings composed of divided 50- and 100-mil rings, with cardinal lines made up of alternating 10-mil marks and spaces.

Inclinometer Light (Aircraft Having T.O. 1L-10A-602 Incorporated)

A post light, mounted on the optical sight inclinometer, provides improved illumination of the mil settings index and improved reticle light intensity. Illumination is controlled by the STBY COMPASS switch and intensity is controlled by the INSTRUMENTS knob.

SIGHT AND ARMAMENT CONTROLS

Master Arm Switch

The ON position of the MASTER ARM switch (figure 1-36) applies power to the d-c armament bus when the landing gear handle is in the UP position. All armament selection, release, and firing power is provided through the master arm circuit. On aircraft having T.O. 1L-10A-510 incorporated, an ARM MASTER switch is provided in the observer's cockpit (figure 1-36) to control power to the pilot's MASTER ARM switch. The ground safety provisions to prevent the electrical armament firing or release, may be bypassed for ground checks and maintenance through an ARMT SAFETY DISABLE switch in the left main landing gear well.

Filament Select Switch

The FIL SEL switch allows selection of the NO. 1 or NO. 2 sight reticle illuminator filament.

Note

Check both NO. 1 and NO. 2 filaments. The NO. 1 filament should be used throughout the mission. This will prevent the NO. 2 filament from burning out and shorting the NO. 1 filament making the gunsight unusable.

Gunsight Dimming Switch Knob

Sight reticle brightness (BRT) control and OFF selection are available through the GUNSIGHT DIMMING switch knob.

Note

To prolong filament life, the brightness control knob shall be maintained at OFF until illumination is required.

Sight Depression Lever

The sight depression lever, mounted on the sight body, allows variable depression settings from 0 to 270 mils. The selected depression is read directly on the sight body. Depression is indicated in mils x 10.

Guns Switches

Three guns switches are provided. The two switches at extreme left of the left weapons control panel (figure 1-36) are used to select RDY (ready) or SAFE condition of the sponson-installed guns. These guns may be fired in selected pairs or simultaneously. The gun charging mechanism may be ground-checked through use of an auxiliary gun charger switch in each sponson. On aircraft having T.O. 1L-10A-510 incorporated, the ARM MASTER switch in the observer's cockpit must be in the NORM position for armament system operation. When the MK 4 gun pod is installed and the MASTER ARM switch is ON, the MK 4 POD switch is used to charge and select the RDY (ready) condition. The RDY position of the MK 4 POD switch charges the guns and arms the bomb button circuit for firing. The CLEAR position removes all ammunition from the gun cylinder.

Note

SUU-11 ( )/( ) Minigun pods are charged by moving the desired STATION MODE SELECT switches to FIRE, however they cannot be cleared from the cockpit.

Station Mode Select Switches

The STATION MODE SELECT switches (figure 1-36) are used to select installed external munitions for firing or release as required. The OFF position is used to disable the bomb release button circuits. On aircraft having T.O. 1L-10A-579 incorporated, the STATION MODE SELECT switches are lever-lok type requiring that the switch be lifted out of detent for DROP selection.

Bomb-Flare Arm Switch

The BOMB-FLARE ARM switch is used to arm mechanically or electrically fuzed bombs. Munitions may be armed for NOSE & TAIL or TAIL fuze detonation, as required.

Bomb Release Button

The bomb release button is located on the pilot's stick grip (figure 1-16). This button is used to drop any store selected through the DROP position of the STATION MODE SELECT switches, and to fire any externally carried, forward-firing munitions selected by the FIRE position.

Trigger

The trigger is located on the pilot's stick grip (figure 1-16). This switch is used to fire the sponson (internal) guns only.

Stores Emergency Release Button

The pilot's STORES EMER REL button (figure 1-36), when depressed, releases all external stores. On aircraft having T.O. 1L-10A-510 incorporated, a STORES EMER REL button is also provided in the observer's cockpit. Either of the buttons operates the stores emergency release system if the battery bus is operative and the aircraft is airborne. The emergency release system is independent of the MASTER ARM switch.

Stores Jettison Handle

The EMER ST JETT handle (figure 1-36) is located on the center pedestal. All stores *except* the centerline station store may be jettisoned manually by pulling this handle out approximately 3 inches.

Note

> If retention of the centerline-mounted external fuel tank is desired, the other underfuselage stores will be released by pulling the EMER ST JETT handle.

STRIKE CAMERA, KB-18A

Power and mounting provisions are installed for a KB-18A panoramic camera (figure 1-37) in the observer's cockpit. This 3-inch focal length camera carries 250 feet of 70mm film, providing approximately 300 exposures. Picture format covers 180 degrees along the line of flight on a 9.4- by 2.25-inch field. The camera is mounted in a cradle mechanism, which, when operated by the observer, automatically opens the camera doors and extends the camera.

CAMERA CONTROL UNIT

The camera control unit contains controls, electronic equipment, and protective devices for operation of the strike camera system. Two switches on the unit are used for preflight settings: a cycle rate selector switch and an exposure index selector switch. A third switch is provided for ground personnel to test operation of the camera.

Note

> The overrun select switch on the camera control unit is not operative.

STRIKE CAMERA CONTROLS AND INDICATORS

The strike camera, smoke generator, and gunsight controls (figure 1-38) are located on a panel above the optical sight.

Camera Extend—Power On Light

The green CAMERA EXTEND—POWER ON light (figure 1-38) illuminates when electrical power is available and the camera is lowered to the operating position. *The strike camera will not operate until fully extended.*

Camera Switch

With monitor d-c and No. 1 monitor a-c bus power available and the camera extended, moving the CAMERA switch to ON selects camera operation. The switch causes continuous operation until turned off.

KB-18A CAMERA

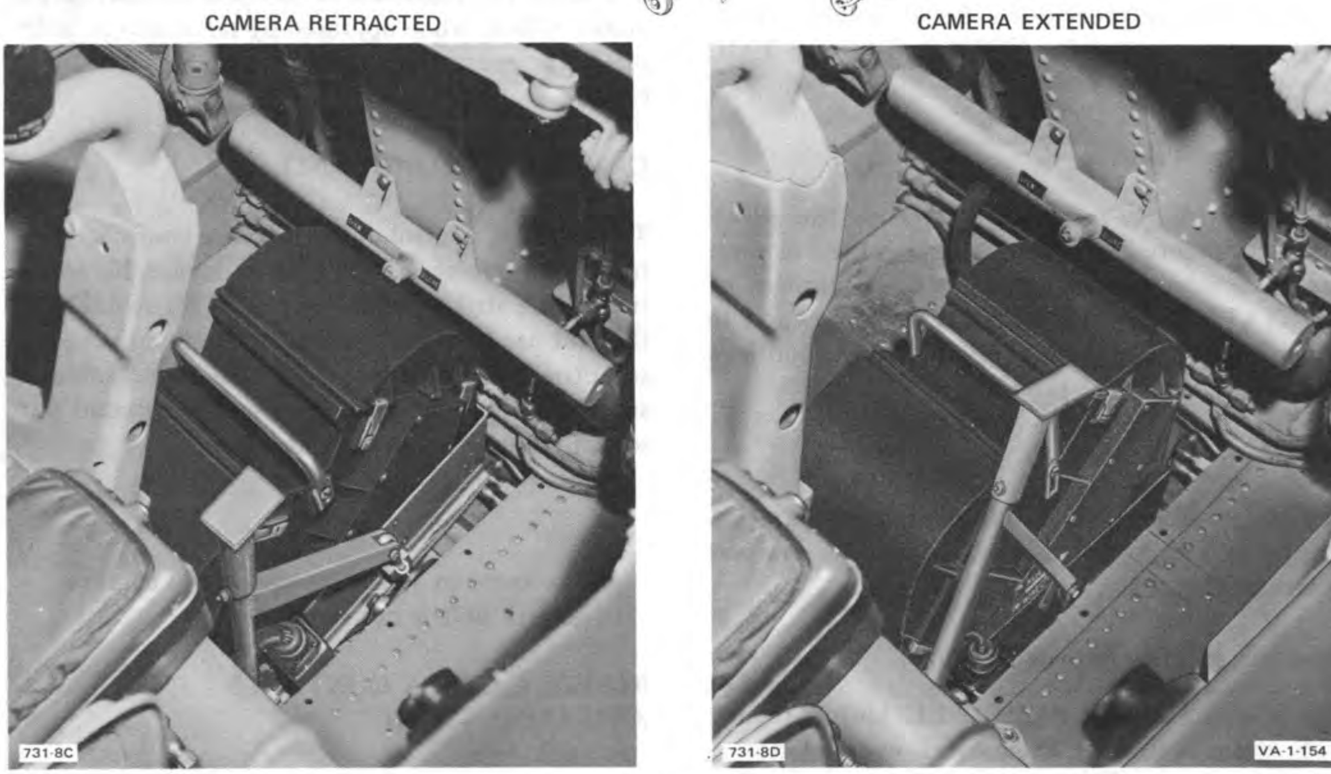


Figure 1-37

End-of-Film Light

The amber END OF FILM light (figure 1-38) illuminates on exhaustion of strike camera film.

Strike Camera Operation

Preflight Check

1. Cycle rate and exposure index—AS BRIEFED.
2. ~~Camera extend-retract operation—CHECK.~~ (O)

In-flight Operation

1. Camera—EXTEND (O).
2. CAMERA EXTEND—POWER ON light—ON (P).
3. CAMERA switch—ON (P).
4. CAMERA switch—OFF, as desired (P).
   On illumination of END OF FILM light, move CAMERA switch OFF.
5. Camera—RETRACT (O).

SMOKE GENERATOR SYSTEM

The smoke generator system consists of a 2.3-gallon oil tank, a pump and cockpit control switch, an oil shutoff valve, connecting tubing, and a generator nozzle. An oil-fed smoke generator nozzle is installed in the left engine exhaust to provide smoke for approximately 4 minutes. This system is designed to assist ground or airborne personnel in making visual contact with the aircraft as necessary. The smoke generator is serviced with MIL-F-12070 fog oil. Refer to AIRCRAFT SERVICING, in this section.

SMOKE GENERATOR SWITCH

The SMOKE GEN switch (figure 1-38) is installed on the camera, smoke, and gunsight control panel, above the optical sight. The switch has OFF and ON positions. To operate the system, the switch must be held in the ON position as desired. It is spring-loaded to the OFF position.

CARGO DELIVERY EQUIPMENT

CARGO COMPARTMENT

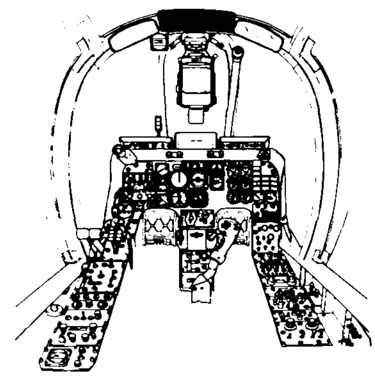
The cargo compartment, excluding the interior of the cargo door, with the observer's equipment package installed, measures 30 inches wide, 39 inches high, and 105 inches long, providing approximately 76 cubic feet of usable volume on 22 square feet of flooring.

Cargo Door

A manually operated cargo door is installed. The cargo door handle is mounted on the right side of the fuselage and is accessible from both inside and outside the aircraft. The door is unlocked by rotating the handle downward to the UNLOCK position. To lock the door closed, the handle is firmly rotated to the LOCK position (aligned with the fuselage).

SMOKE GENERATOR, CAMERA AND GUNSIGHT CONTROLS

CAMERA, SMOKE AND GUNSIGHT CONTROL PANEL 53-28A



VA-1-56B

Figure 1-38

CAUTION

To avoid possible structural damage, ensure the flaps are retracted before opening the cargo door. Also ensure the door is closed before operating flaps on ground.

Cargo Door Hold-open Rod

A telescoping hold-open rod is installed in the apex of the cargo door cone. This rod may be used to secure the door to receiving rings on the left boom (90 degrees open), or on the fuselage (180 degrees open). To lock the door in an open position, depress the release button adjacent to the stowed rod and pull the rod to the length desired. The rod and its door retainer lock into the ring, securing the door in position. To release the rod, depress the locking collar at the base of the retainer and push the rod fully into the stowage tube in the cargo bay door.

Cargo Conversion Package

The cargo compartment may be equipped for use as a general logistics carrier by installing a cargo barrier. See figure 1-39. To obtain full use of the cargo area, the observer's seat and control stick are removed. The cargo floor is capable of supporting 200 pounds per square foot. Cargo tie-down rings are placed 15 inches apart on both sides of the cargo compartment. The rings may be rotated into recesses in the side walls, eliminating interference during loading. Each ring will support a maximum restraining load of 500 pounds.

Cargo Bay Signal Package

The cargo bay signal package (figure 1-39) consists of an interphone cordset extension, a pilot's signal control panel mounted above the pilot's left console, and a paratroop signal panel mounted in the rear of the cargo compartment. The pilot's signal control panel consists of a JUMP SIGNAL switch and an ALARM switch. The paratroop signal panel consists of a READY light, a DROP/JUMP light, and a paratroop jump alarm which operate on 28-volt d-c electrical power.

Paratroop Jump Alarm—The paratroop jump alarm (figure 1-39) will sound when the pilot actuates the ALARM switch.

Alarm Switch—The guarded ALARM switch (figure 1-39) sounds the paratroop jump alarm in the cargo compartment by raising the guard and moving the switch from the OFF position to the ON position as desired.

Jump Signal Switch—The JUMP SIGNAL switch (figure 1-39) is a lock-type switch and must be pulled out prior to positioning. Moving the JUMP SIGNAL switch to the RDY position illuminates the READY light in the cargo compartment and positioning the switch to the DROP JUMP position illuminates the DROP/JUMP light and the READY light remains illuminated.

Ready Light—The amber READY light (figure 1-39) illuminates when the pilot positions the JUMP SIGNAL switch in the RDY position and remains illuminated when the DROP JUMP position is selected.

Drop/Jump Light—The green DROP/JUMP light (figure 1-39) illuminates when the pilot moves the JUMP SIGNAL switch to the DROP JUMP position.

Interphone Cordset Extension—The 168-inch interphone cordset extension (figure 1-39) is connected to the observer's interphone connector to establish voice communications between the crewman and pilot through the intercommunications set, AN/AIC-18. When not used, the cordset extension is stored in the equipment stowage bag.

OXYGEN SYSTEM

A diluter-demand regulated high-pressure gaseous oxygen system is installed. The oxygen regulators are installed on the pilot's right console and on the right side of the observer's cockpit. Oxygen supply is stored in two 514-cubic-inch bottles, which may be installed on the cargo bay ceiling behind the observer's cockpit. For oxygen duration data, see figure 1-40.

OXYGEN REGULATOR

A CRU-44/A diluter-demand regulator panel (figure 1-41) is installed on the pilot's right console and on the right side of the rear cockpit as part of the observer's cockpit package. These regulators automatically supply the proper mixture of air and oxygen at all altitudes up to 30,000 feet.

Supply Lever

The oxygen supply lever must be positioned to ON to provide oxygen pressure in the regulator. The

CARGO BAY CONVERSION AND SIGNAL PACKAGES

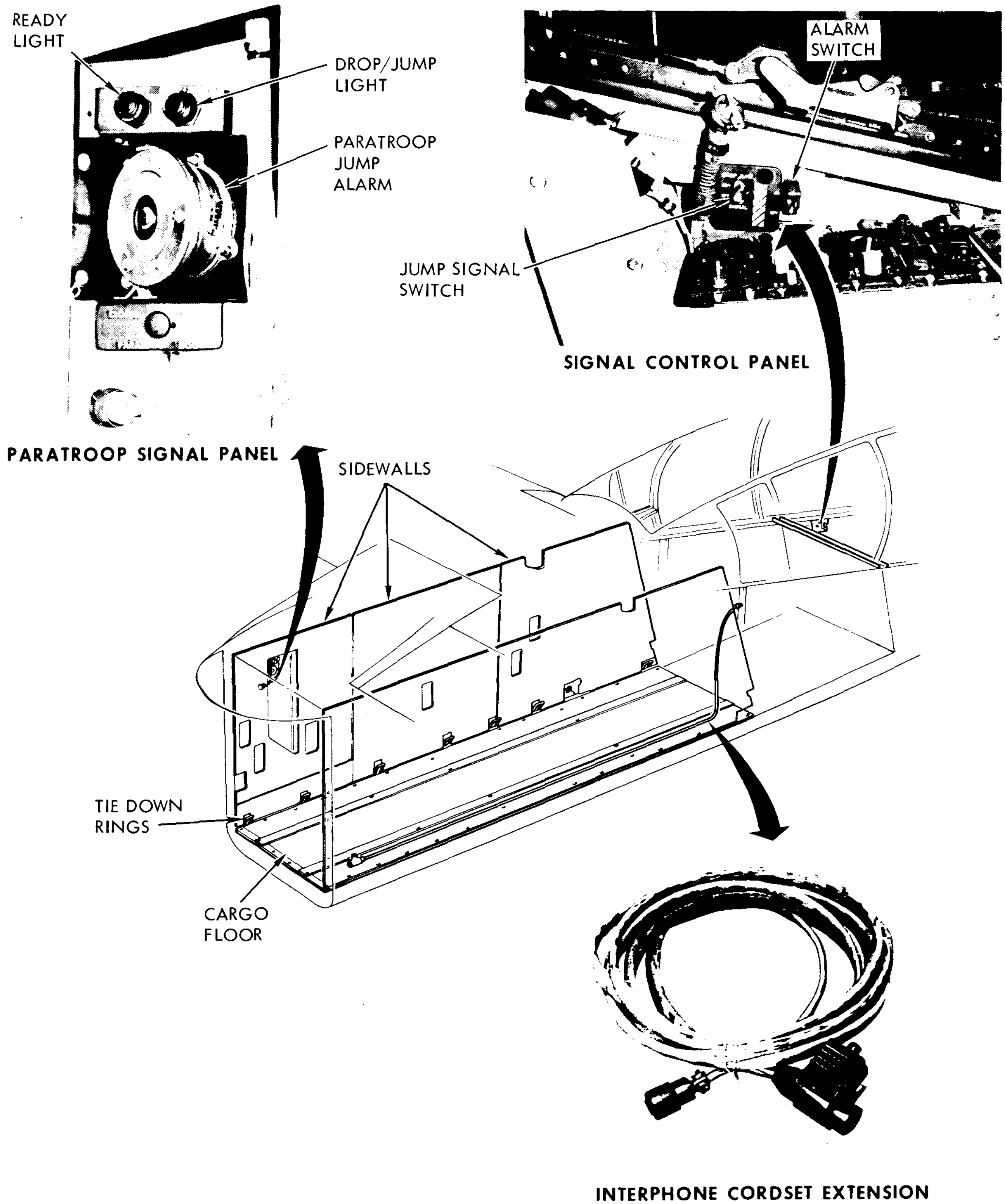


Figure 1-39

OXYGEN DURATION (HOURS)

TWO CREW MEMBERS
DOUBLE VALUES FOR SINGLE CREW MEMBER

ALTITUDE (FEET)	GAGE PRESSURE—PSI 1800	1500	1200	900	600	300	BELOW 300
NORMAL OXYGEN							
25,000	5.4	4.5	3.6	2.7	1.8	0.9	DESCEND
20,000	6.1	5.1	4.1	3.0	2.0	1.0	BELOW
15,000	7.4	6.2	5.0	3.7	2.5	1.2	10,000
10,000	9.9	8.2	7.4	4.9	3.7	1.8	FEET
100% OXYGEN							
25,000	4.3	3.6	2.8	2.1	1.4	0.7	DESCEND
20,000	3.3	2.7	2.2	1.6	1.1	0.5	BELOW
15,000	2.6	2.2	1.7	1.3	0.8	0.4	10,000
10,000	2.1	1.7	1.4	1.0	0.7	0.3	FEET

VA-1-40A

Figure 1-40

OFF position does not affect system pressure indication, which is reflected by the pressure indicator on the regulator panel.

Diluter Lever

The diluter lever is used to select normal regulator diluter-demand operation (NORMAL OXYGEN), or undiluted pure oxygen (100% OXYGEN). Operation in 100% OXYGEN position reduces the available oxygen duration. See figure 1-40. The 100% OXYGEN position should be used any time smoke or fumes are detected in the cockpit.

Oxygen Pressure Indicator

The oxygen pressure (OXYGEN P.S.I.) indicator on the regulator panel indicates the pressure in the oxygen supply bottles. The indicator should be checked for full service prior to flight on missions requiring oxygen. The indicator should also be checked periodically in flight to guard against inadvertent use of 100% OXYGEN, or a leak in the system.

Emergency Lever

The emergency lever is used to select NORMAL operation (spring-loaded to return from TEST MASK), to select EMERGENCY flow, or to check oxygen mask fit and system flow (TEST MASK position).

Flow Indicator

The flow indicator should blink white on each inhalation, returning to black on exhalation, indicating proper passage of air or oxygen through the regulator. Though this indicator does not indicate proper oxygen ratio or flow, lack of positive indication should be interpreted as a regulator malfunction. With the emergency lever in TEST MASK or EMERGENCY, the indicator remains in "white" condition.

OXYGEN REGULATOR

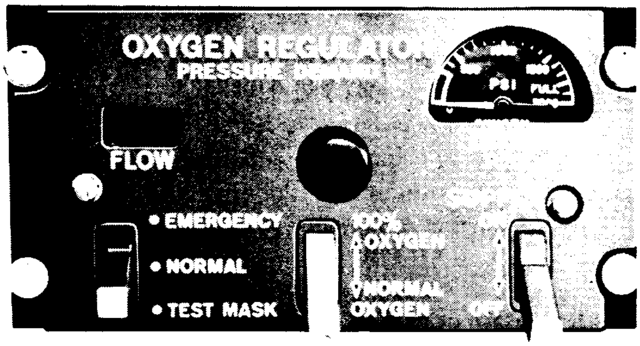


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Figure 1-41

OXYGEN SYSTEM CHECK

The following preflight check should be performed on all flights with the oxygen system installed:

P—PRESSURE—The pressure gage should read 1800 psi and should agree approximately with the other regulator pressure gage.

R—REGULATOR—Check regulator ON. Perform a blow-back check on the regulator hose for 5 seconds on both the NORMAL and 100% OXYGEN position. Little or no resistance to blowing indicates a leaking regulator diaphragm, faulty check valve in diluter air inlet, or a leak between regulator and quick-disconnect which requires corrective action. Hook up your mask and perform a pressure check. Place the emergency lever to the EMERGENCY position, take a deep breath and hold it. If mask leakage occurs, readjust mask and reaccomplish the check. The oxygen should stop flowing. If the mask appears to be properly fitted, but the oxygen continues flowing, the valve is not holding pressure and should be replaced. Return the emergency lever to NORMAL. If you cannot exhale, the valve is obstructed, defective, or improperly seated and should be corrected or replaced.

I—Indicator—With the diluter lever in 100% OXYGEN position, check blinker for normal operation.

C—Connections—Check all connections secure. Check regulator hose for kinks, cuts, or cover fraying. Check that male part of the quick-disconnect is not warped and the rubber gasket is in place. A 10- to 20-pound pull should be required to separate the two parts. Check mask hose properly installed to connector.

OXYGEN SYSTEM NORMAL OPERATION

During flight, check the system as follows:

1. Diluter—NORMAL OXYGEN.
2. Flow indicator—CHECK periodically for normal indications.
3. OXYGEN P.S.I. indicator—CHECK periodically for normal depletion.

OXYGEN SYSTEM EMERGENCY OPERATION

If symptoms of hypoxia occur, or with smoke or fumes in the cockpit, set the diluter lever to 100% OXYGEN. If necessary, set emergency lever to EMERGENCY. After the emergency is over, return the emergency lever to NORMAL, as supply will be rapidly depleted.

EMERGENCY EQUIPMENT

SURVIVAL KIT

A CNU-118/P rigid survival kit is installed in each ejection seat. The delivered kit contains standard survival equipment. On aircraft having T.O. 1L-10A-627 incorporated, a personnel locator beacon (AN/URT-33), which can be set for automatic or manual operation, is installed in the kit. In acft having T.O. 1L-10A-627 and/or 635, a PLB, which can be set for auto or man is installed in kit.

Kit Deployment Handle

A survival kit deployment handle is mounted on the right side of the survival kit. Pulling this handle with the kit in the seat releases the harness retaining straps from the kit and also releases the upper half of the kit from the lower half; the lower half of the kit retains the raft lanyard link. After ejection, this handle is pulled upward to deploy the survival kit and inflate the life raft. On aircraft having T.O. 1L-10A-610 incorporated, the survival kit includes a feature for selecting automatic deployment of the kit 4 seconds after seat/man separation during ejection. A sensor mechanism is attached to the forward right side of the survival kit body and contains decals showing AUTOMATIC and MANUAL positions for the sensor selector arm. The vertical position of the sensor selector arm selects automatic operation and the horizontal position selects manual operation.

Note

If AUTOMATIC operation fails to function properly, PULL the survival kit deployment handle to accomplish kit deployment.

COCKPIT ENCLOSURE

The unpressurized cockpit section (figure 1-42) is enclosed by a windshield and four hinged side doors. Entrance or exit from the cockpits may be accomplished through the upward swinging doors on both sides of the aircraft. All four doors are equipped with overcenter latch handles. The top panels are penetrated by the seats in the event of ejection.

CANOPY DOORS

The right canopy doors are normally used for entrance and exit of the flight crew. These doors are equipped with bungees which act to hold the doors in the fully open position. The pilot's doors are equipped with hold-open rods which may be used during ground operation. The left door rod holds the door approximately one-half open; the right door rod holds the door full open. These rods are secured with lever-released positive lock devices. After release and before closing the doors, the rods may be secured in spring clip retainers on the door frames.

Canopy Door Handles

All four doors are locked, closed, or unlocked by latch handles installed at the door bottom frames. Aircraft are equipped with canopy door locking indicators (figure 1-42). These mechanical indicators slide over the interior of the longerons providing an indication of locking pins being properly engaged.

CAUTION

It is possible for the mechanical indicator to be down over the longeron and the engaging pins not properly engaged.

The doors are unlocked from inside by grasping the handle and rotating upward (aft) until the indicator clears the longeron. The door is then free to rotate upward, the right side doors being raised by holding bungees. Locking operation is the reverse, with the handle being rotated forward (and overcenter) with the door fully down. The door locking indicator is positioned fully down over the longeron when the canopy door is locked.

STEPS AND HANDHOLDS

Folding steps and spring-loaded handholds are provided on the right side of the fuselage for access into the cockpit or onto the wing. See figure 1-42.

CAUTION

Do not use the canopy door bungees or braces as handholds for cockpit entry.

EJECTION SEATS

LW-3B ejection seats (figure 1-43) are installed. This type seat provides safe recovery under nearly all speed-altitude conditions. Once initiated, the entire ejection sequence is automatic. After the seat penetrates the top canopy panel and clears the aircraft, the recovery parachute is deployed by a ballistically operated thruster (figure 1-43), which forces the pilot chute canopy into the air stream. Forced deployment of the personnel parachute provides extremely rapid canopy inflation and low-altitude/low-speed recovery capability. With the observer's cockpit package installed, the seats are interconnected so that ejection initiated by the pilot will eject the aft seat after a 0.4-second delay of catapult initiators, which allows harness retraction to position occupant in the seat. Front seat ejection is delayed 0.4 second after aft seat ejection to allow seat separation. The total elapsed time for

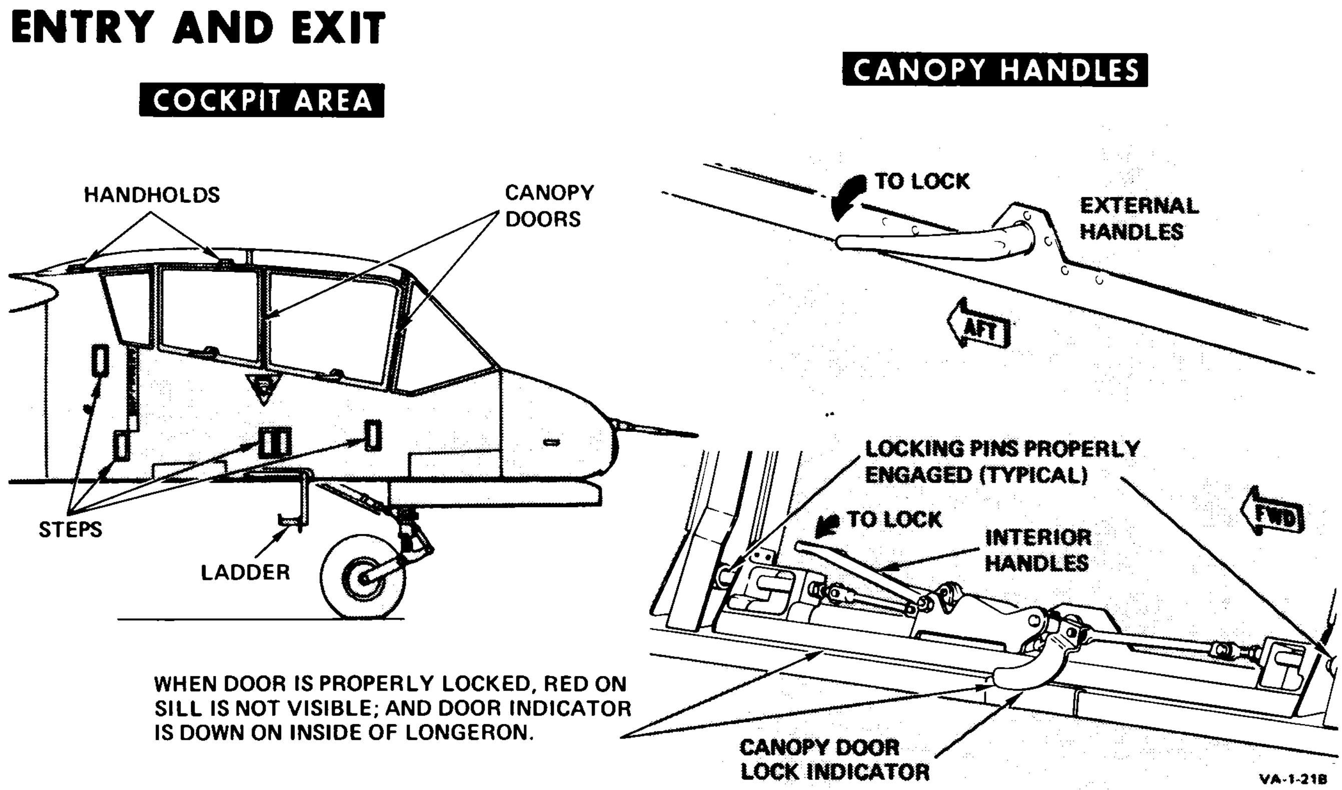


Figure 1-42

front seat ejection is 0.8 second. This total elapsed time delays front seat ejection, even if the aft seat is removed or ejected separately. No high-altitude oxygen system is provided.

WARNING

Alternate escape (overside bail-out) is NOT POSSIBLE due to the design and mounting of the recovery parachute, which is an integral part of the seat. The advantage of forced chute deployment and the reliability of dual systems outweigh the lack of an alternate bail-out capability.

RECOVERY PARACHUTE

A 28-foot, canopy parachute (figure 1-43) is mounted in a special elongated pack behind the seat back. The parachute canopy is forcibly deployed by a ballistic thruster (figure 1-43) which expels a 1-pound slug. The slug is tied to a lanyard, which is connected to the apex of the pilot chute. Deployment thruster operation, seat acceleration, and pilot chute action combine to provide rapid parachute deployment in both the high- and low-speed/altitude modes of ejection seat operation.

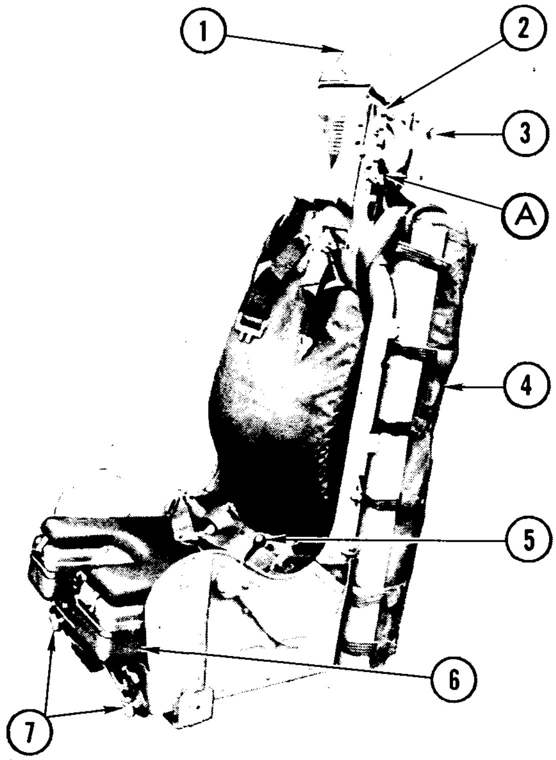
Note

The recovery parachute on the pilot's seat is mounted on the left side, and the observer's on the right side of the seat back. The effective offset in ejected mass center of gravity provides lateral separation of the two seats in the event of pilot-initiated dual ejection.

SPEED/ALTITUDE SENSOR

An ejection speed/altitude sensor operates with the aircraft pitot-static system, providing a 2.0-second time delay in the firing of the parachute thruster during ejections above 10,000 feet pressure altitude, or at speeds in excess of 200 knots. On ejection below 200 knots and/or 10,000 feet, a plunger on the sensor is extended, allowing contact with a striker (figure 1-43) on the seat, firing the short-delay car-

EJECTION SEAT



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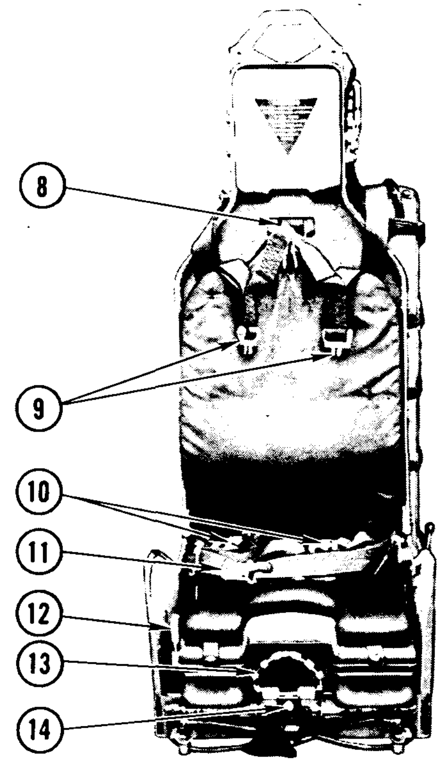

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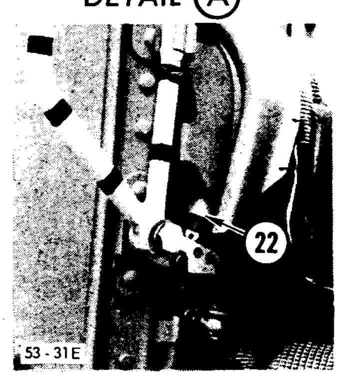
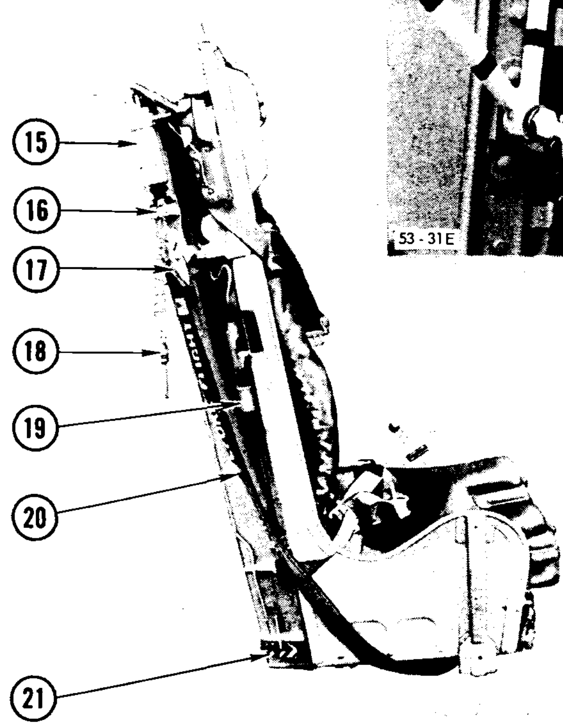
DETAIL A





53-28G

1. CANOPY BREAKER
2. PARACHUTE EMERGENCY RELEASE HANDLE
3. CATAPULT- ROCKET ATTACHMENT BOLT
4. RECOVERY PARACHUTE *
5. INERTIA REEL CONTROL HANDLE
6. SURVIVAL KIT
7. GAS LINE QUICK DISCONNECTS
8. SHOULDER HARNESS RELEASE
9. SHOULDER HARNESS FITTINGS
10. SURVIVAL KIT ATTACH FITTINGS
11. LAP BELT
12. SURVIVAL KIT RELEASE HANDLE
13. EJECTION D-RING
14. INITIATING SAFETY PIN
15. PARACHUTE DEPLOYMENT THRUSTER
16. PARACHUTE THRUSTER SAFETY PIN
17. SEAT/MAN SEPARATION LATCH
18. HIGH MODE STATIC LANYARD
19. INERTIA REEL GAS GENERATOR
20. SEAT SAFETY HARNESS (PIN FLAG)
21. SPEED/ALTITUDE SENSOR STRIKER (LOW MODE)
22. PARACHUTE EMERGENCY RELEASE HANDLE INTERLOCK

* PILOT'S SEAT SHOWN. OBSERVER'S PARACHUTE MOUNTED ON OPPOSITE SIDE.

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Figure 1-43

tridge (0.125 second). On ejection at speeds above 200 knots or at altitudes above 10,000 feet, the sensor plunger remains retracted and the long-delay (2.0 seconds) cartridge is fired by a static lanyard (figure 1-43) as the seat rises.

Note

The long-delay cartridge operates in both modes. On ejections below 10,000 feet and/or 200 knots, the short-delay sequence overrides long-delay operation.

Normally, the speed/altitude sensor will begin to show red in the window at about 3000 feet altitude and will show all red from 8,000 to 10,000 feet altitude. See figure 1-44.

WARNING

The ejection seat speed/altitude sensor automatic function is deactivated and only low mode sequence will be available. In low mode, the parachute will begin deployment immediately after ejection. Therefore, whenever possible, ejection should be delayed until below 10,000 feet pressure altitude and 235 KIAS to prevent possible injury to crew members.

HARNESS AND ATTACHMENTS

An integrated PCU-3P torso harness is used to provide crew/parachute-survival kit attachment. The integrated torso harness provides attaching points for the parachute risers and survival kit straps. The Koch upper fittings (figure 1-43) are the attaching points for the parachute risers/shoulder harness. The fly rings on the lower part of the harness are used to secure the survival kit. Seat/man retention is provided by the lap belt and shoulder-harness attachment points (figure 1-43). The seat/man separation is provided by the stretch of the parachute risers and release of lap belt end points and shoulder-harness attachments to seat.

WARNING

When a torso harness with the Personnel Lowering Device (PCU-11/P) attached is to be worn in flight, the ejection seat back cushion must be removed. When either the PCU-11/P or the seat cushion is being used, do not add any additional seat or back pad devices, as such added material may disturb seat/man center of gravity enough to cause severe tumbling and injury on ejections.

INERTIA REEL

A ballistically operated inertia reel provides crew member retention in an upright position during maneuvering, deceleration, and ejection. The reel may be manually locked and unlocked during normal use by the inertia reel lock handle. The reel mechanism is attached to the upper portion of the parachute harness by a strap which, when in the unlocked position, allows the crew member to lean forward. When locked by the handle or a 2- to 3-g deceleration, the reel prevents play-out. On ejection, the inertia reel ballistic device is actuated, retracting and restraining the crew member.

EJECTION SEAT CONTROLS

Seat Adjust Switches

A SEAT ADJUST switch is located above the right console (figure 1-7) in the pilot's cockpit and on the right side of the observer's cockpit (figure 1-8). The seats may be adjusted through a 5-inch vertical range.

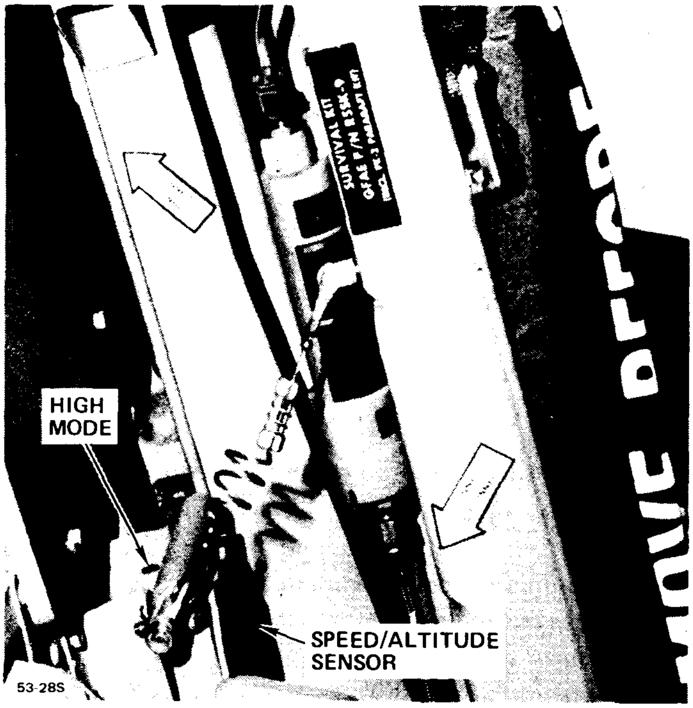
Ejection "D" Ring

An ejection "D" ring (figure 1-43) is mounted on the seat bucket between the crew member's legs. Ejection is initiated by pulling the ring upward about 2 inches, which fires a set of dual initiators. A "D" ring safety pin is provided for insertion when the aircraft is on the ground.

Inertia Reel Lock Handle

The inertia reel lock handle is mounted on the left side of the seat. Moving the handle to LOCKED (forward) prevents the crew member from leaning

SPEED/ALTITUDE SENSOR



NOTE: PILOT'S SEAT SHOWN. OBSERVER'S SPEED/ALTITUDE SENSOR MOUNTED ON OPPOSITE SIDE OF BULKHEAD

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Figure 1-44

forward. The reel may be unlocked by leaning back to remove tension from the reel and moving the handle aft to UNLOCK. If the reel is locked automatically, it may be unlocked by cycling the handle.

Parachute Emergency Release Handle

The parachute emergency release handle is located on the left side of the seat headrest. Should the parachute deployment thruster fail to fire, chute deployment and seat separation may be initiated by pulling this handle. Pulling the handle fully down fires a ballistic cutter which severs the lanyard between the chute canopy and the thruster slug. A spring-loaded lever (figure 1-43) holds the parachute emergency release handle in place until the ejection seat has left the aircraft. This prevents inadvertent operation of the parachute emergency release handle. Separate action also opens the parachute pack through a cable-operated rip cord. Deployment of the parachute then accomplishes the seat/man separation sequence.

Seat Safety Harness

Two safety pins are installed on the seat when not occupied for flight. One pin secures the ejection "D" ring and the other safeties the parachute deployment thruster on the aft right side of the pilot's seat and the aft left side of the observer's seat. These pins are connected by a red banner, which should be stowed after the crew member is strapped in. The observer's seat includes a survival kit hold-down bungee, which acts to retain and stabilize the kit in place when the seat is not occupied.

EJECTION SEAT OPERATION

On ejections below 10,000 feet and/or 200 knots, the recovery parachute is deployed immediately as the seat clears the cockpit. Above 10,000 feet and/or 200 knots, a 2-second delay in deployment thruster firing is provided for deceleration, prior to parachute deployment and seat separation. The thruster deploys the pilot chute and partially deploys the parachute canopy. Deployment of the chute automatically provides seat/man separation. Force on the risers from the inflating parachute separates the seat back from the seat bucket sufficiently to operate an overcenter device which releases the riser attach fittings from the inertia reel adapter fitting, freeing the upper riser adapter to leave the seat with the parachute risers. The same action also releases the lap belt end fittings. As the drag of the inflating parachute decelerates the crew member, the released seat assembly is carried upward and ahead, providing positive seat/man separation.

Automatic Emergency IFF

Ejection of the pilot's seat closes a switch which activates the emergency mode of IFF-SIF operation for emergency radar tracking purposes. When the ejection switch is open (seat installed), manual selection of the emergency mode is required. Ejection emergency IFF operation overrides all previously selected IFF modes excluding OFF and automatically selects the proper SIF code for emergency IFF interrogation.

RECOVERY CAPABILITY

Figure 1-45 shows the recovery capability of the LW-3B escape system in terms of required terrain clearance at initiation of ejection for successful recovery from various aircraft flight conditions. Altitudes shown are absolute minimums at which the system will consistently provide recovery capability. The recovery charts show initiation requirement for both pilot and observer.

To illustrate the use of the charts, assume the seat system is in the low mode, aircraft velocity is 200 KIAS, and a dive angle of 90 degrees exists. For both crewmen to be safely recovered, the pilot must initiate the system above 710 feet. The observer could initiate his system above 520 feet and safely recover. To depict the influence of sink rate, ground level recovery for both crewmen at 200 KIAS is possible with zero sink rate. However, with the system in low mode, aircraft velocity 200 KIAS, and a sink rate of 5,000 feet per minute, the pilot must initiate ejection above 96 feet for successful recovery.

MISCELLANEOUS EQUIPMENT

RELIEF TUBES

A relief tube is installed on the right side of the pilot's cockpit (figure 1-7). A removable rear cockpit relief tube (figure 1-8) is installed as part of the observer's cockpit.

REARVIEW MIRRORS

Two rearview mirrors are installed on the windshield bow.

MAP AND DATA CASES

A map and publications case is installed above the pilot's instrument panel. A map stowage case is installed on the left side of the rear cockpit as part of the observer's equipment package.

AIRCRAFT SERVICING

For servicing locations, see figure 1-46. For servicing procedures, refer to Section II.

MATERIAL SPECIFICATIONS

MATERIALS	MILITARY SPECIFICATIONS	FLIP CODES	NATO CODES
Fuel			
Primary	MIL-T-5624	JP-4	F-40
Alternate	MIL-T-5624	JP-5	F-44[1]
	JET A-1 (U.S. Commercial)	A-1	F-34
Emergency	MIL-G-5572	115/145 (AvGas)	F-22
Hydraulic Fluid	MIL-H-5606	None	H-515
Oil	MIL-L-23699	AVOIL	0-156
	MIL-L-7808		0-148
Oxygen Gaseous	MIL-0-27210 (ASG)	None	None
Nitrogen	MIL-N-6011, Grade A	None	None A
Oil, Fogging (smoke, tank)	MIL-F-12070	None	None tank)

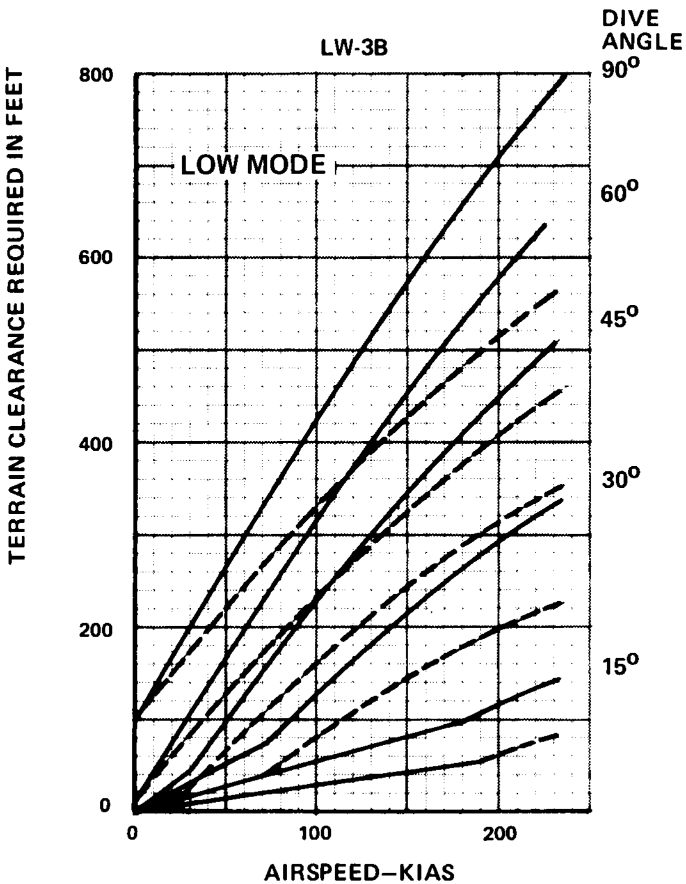
[1]Authorized for use if T-76 Power Plant Change No. 7 is incorporated

RECOVERY CAPABILITY DIVE ANGLE

ALTITUDE VS DIVE ANGLE

NOTE:
TERRAIN CLEARANCE REQUIRED IS MEASURED TO THE POINT OF INITIATION

——— PILOT'S
– – – – – OBSERVER'S



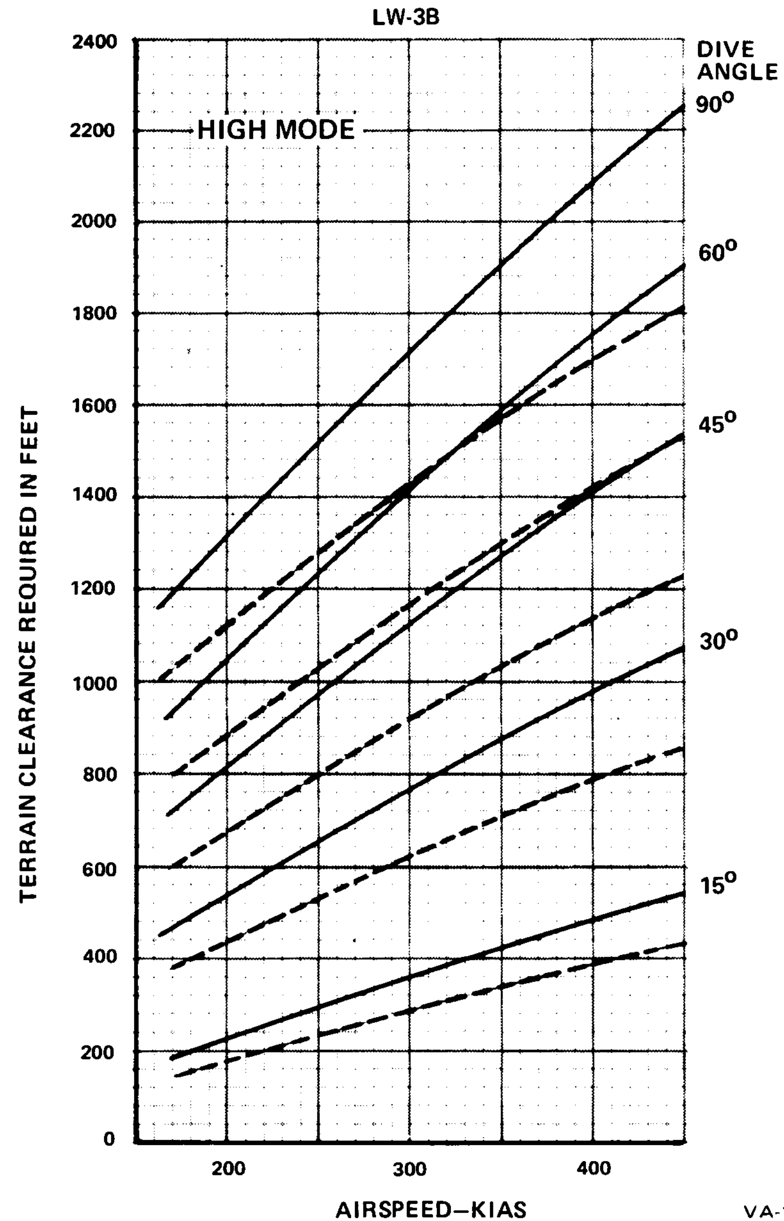


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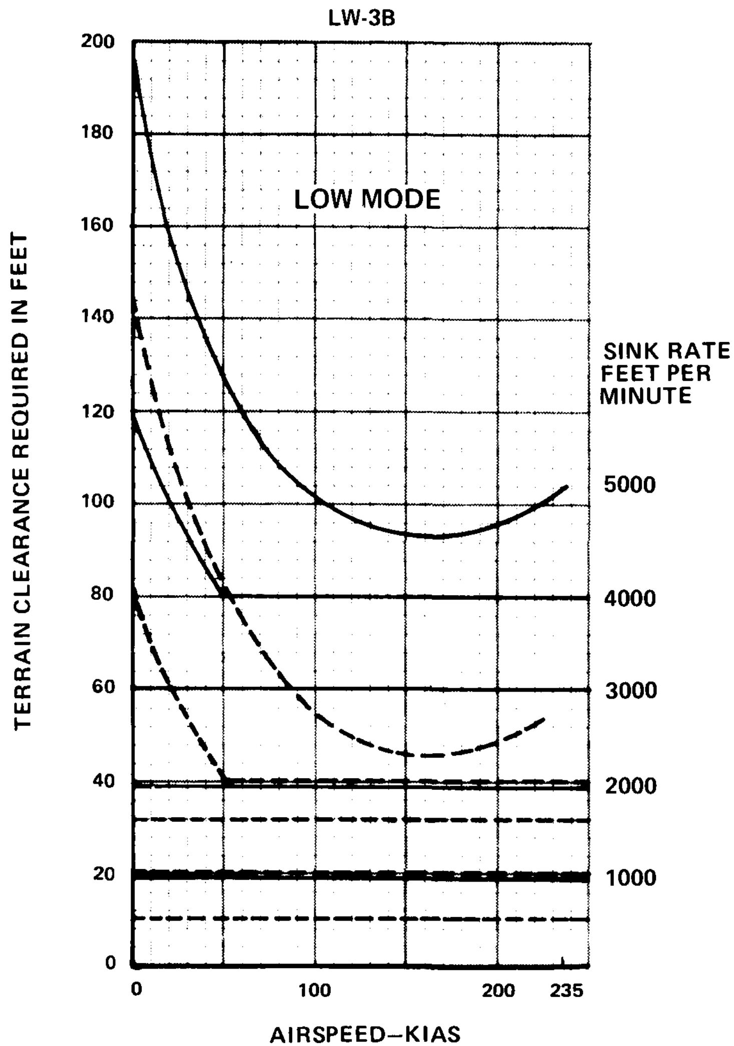
Figure 1-45 (Sheet 1 of 3)

RECOVERY CAPABILITY SINK RATE

ALTITUDE VS SINK RATE

NOTE :
TERRAIN CLEARANCE REQUIRED IS MEASURED TO THE POINT OF INITIATION



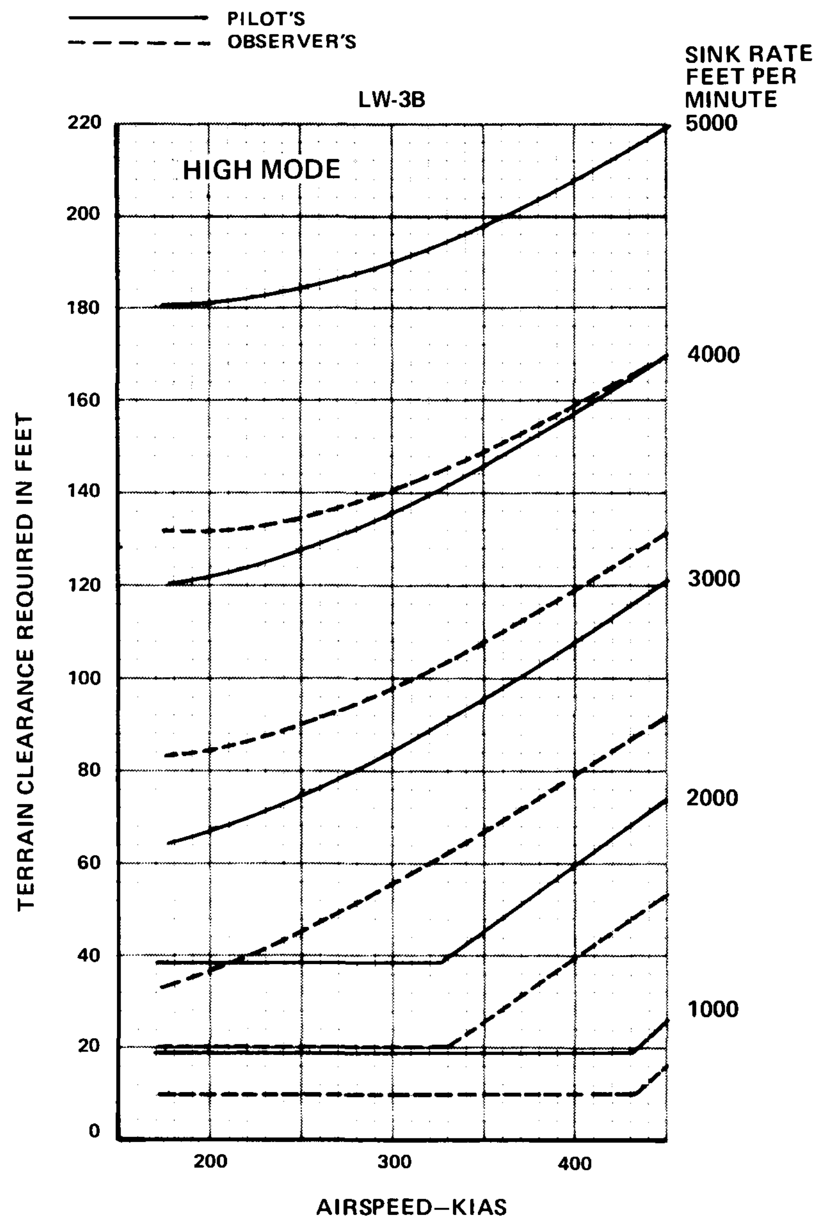


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Figure 1-45 (Sheet 2 of 3)

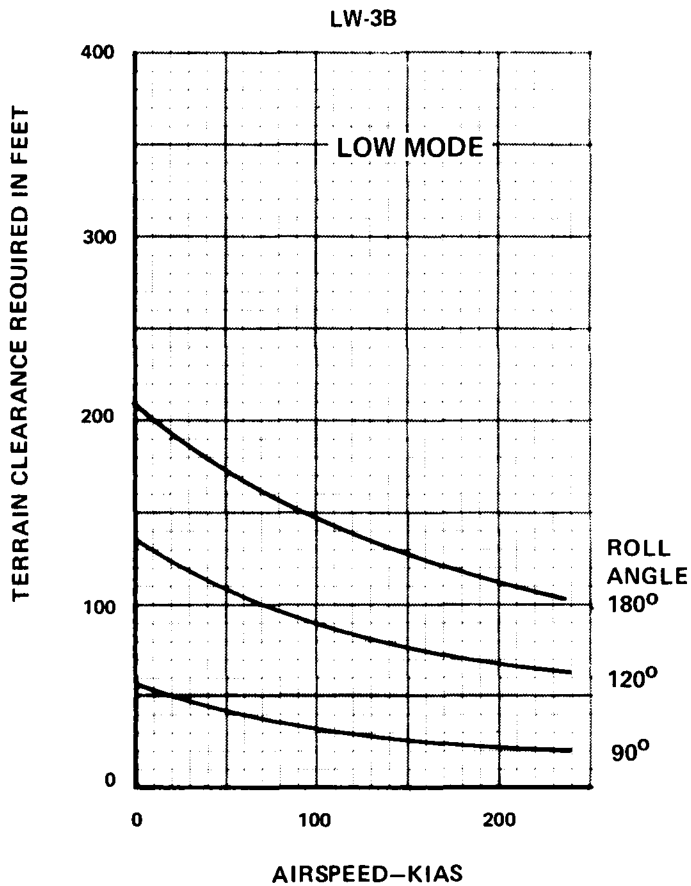
RECOVERY CAPABILITY

ALTITUDE VS ROLL ANGLE

ROLL ANGLE

NOTE:

1. TERRAIN CLEARANCE REQUIRED IS MEASURED TO THE POINT OF INITIATION
2. CURVES ARE FOR BOTH THE PILOT AND OBSERVER



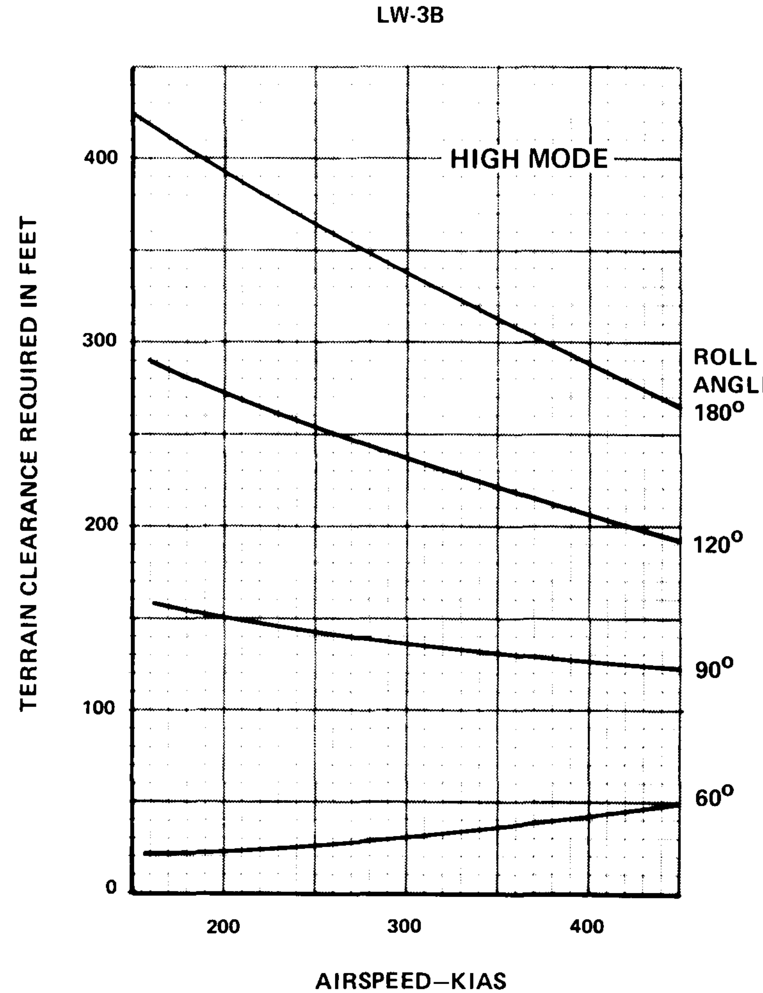


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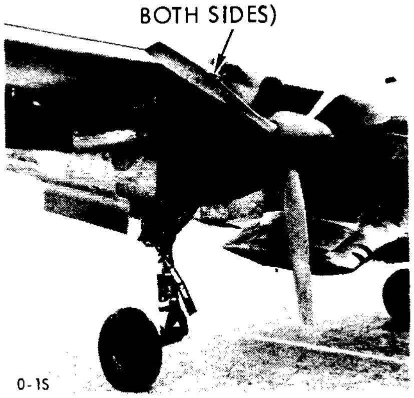
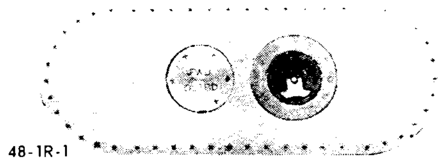
Figure 1-45 (Sheet 3 of 3)

SERVICING

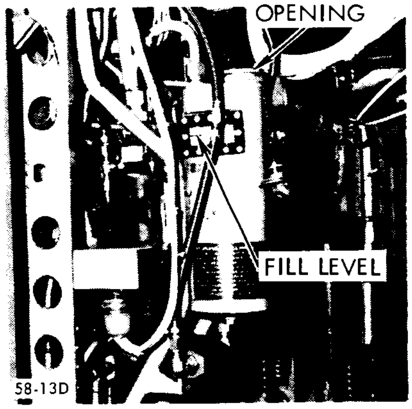


Ⓐ **OIL SYSTEMS**
EACH TANK-1.5 GALLONS

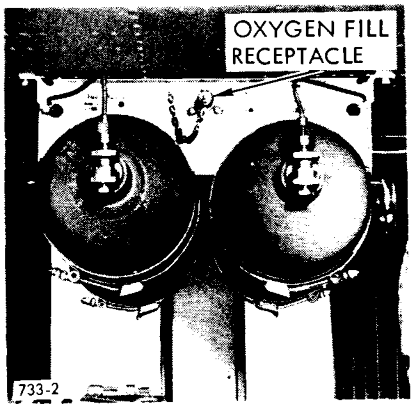


Ⓑ **REFUELING (GRAVITY FILL)**
TYPICAL FILLER CAP

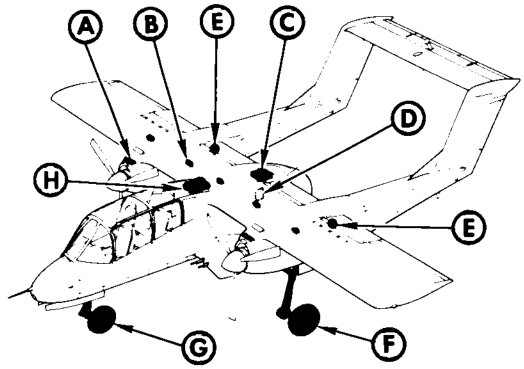
TANK	CAPACITY (GALLONS)
CTR WING TANK	40
LH OUTBD WING TANK	40
RH OUTBD WING TANK	40
LH INBD WING TANK	69
RH INBD WING TANK	69
TOTAL INTERNAL	258
DROP TANK	150*
(OR) DROP TANK	229*
TOTAL FUEL CAPACITY	408*
(OR)	487*

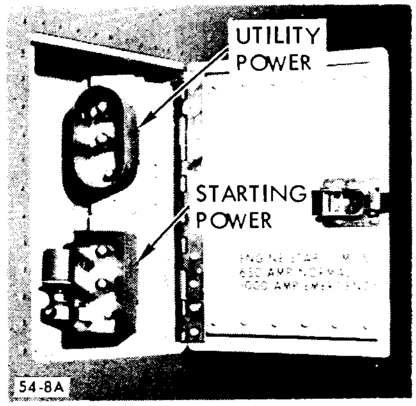


Ⓒ **HYDRAULIC SYSTEM**
SYSTEM (COMPLETE)-1.5 GALLONS
RESERVOIR-0.6 GALLON

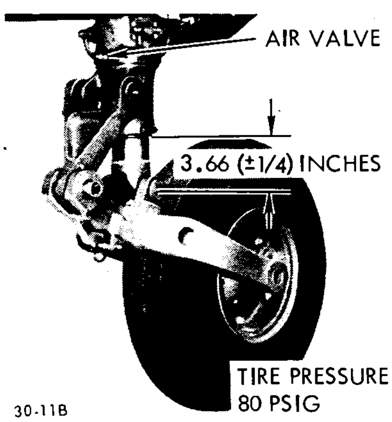


Ⓗ **OXYGEN** 1800(±50) PSI

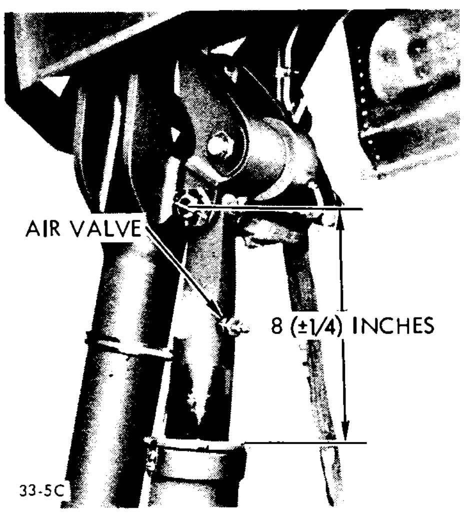




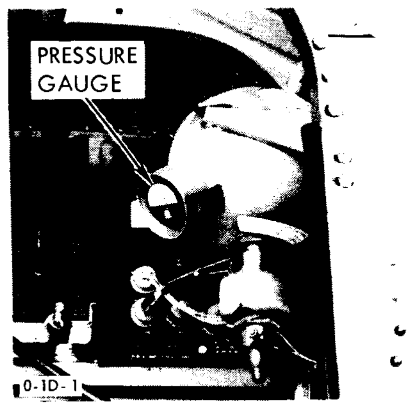
Ⓓ **EXTERNAL ELECTRICAL POWER**



Ⓖ **NOSE GEAR**



Ⓕ **MAIN GEAR**
TIRE PRESSURE 65 PSIG



Ⓔ **FIRE EXTINGUISHERS**
600 (+25/-0) PSI AT 70° F
(REPLACE BOTTLE WHEN BELOW REQUIRED PRESSURE)

* WITH DROP TANK FULL, REFER TO APPROPRIATE TEXT

VA-1-26C

Figure 1-46

NORMAL PROCEDURES

SECTION II—NORMAL PROCEDURES

TABLE OF CONTENTS

PREPARATION FOR FLIGHT

Note

Procedures in this section are coded as follows:
Uncoded—Applicable to pilot
(O)—Applicable to observer
(P,O)—Applicable to both crew members

FLIGHT CHARACTERISTICS

For aircraft flight characteristics, refer to Section VI.

FLIGHT RESTRICTIONS

For aircraft and engine operating limits, refer to Section V.

FLIGHT PLANNING

For performance data applicable to mission planning, refer to Appendix I.

TAKE-OFF AND LANDING DATA CARDS

Refer to Appendix I for information necessary to fill out a take-off and landing data card before flight.

WEIGHT AND BALANCE

Refer to Section V for weight and balance limits. For loading information, refer to the Manual of Weight and Balance Data (T.O. 1-1B-40). Ensure that a valid Form 365F is filed for the aircraft configuration to be flown and that the aircraft is properly loaded for the planned mission.

CHECKLISTS

For checklist program information, refer to the FOREWORD. AFR 60-9 should be consulted for mandatory requirements concerning use of checklists.

ABBREVIATED CHECKLIST

Your abbreviated checklist is in T.O. 1L-10A-1CL-1.

NIGHT FLYING

There are no specific techniques for flying at night which differ from those required for daylight operation. If a slight amount of canopy glare is noted in the rear cockpit, it can be relieved by dimming the instrument lights in the front cockpit. Before starting a night flight, be sure both crew members are equipped with an operable flashlight and all exterior lights are checked.

PREFLIGHT CHECK

SAFETY CHECK

On arrival at the aircraft, check the following items (figure 2-1):

1. Form 781—CHECK.

2. Canopy—OPEN, canopy brace latched.

SEAT SAFETY CHECK

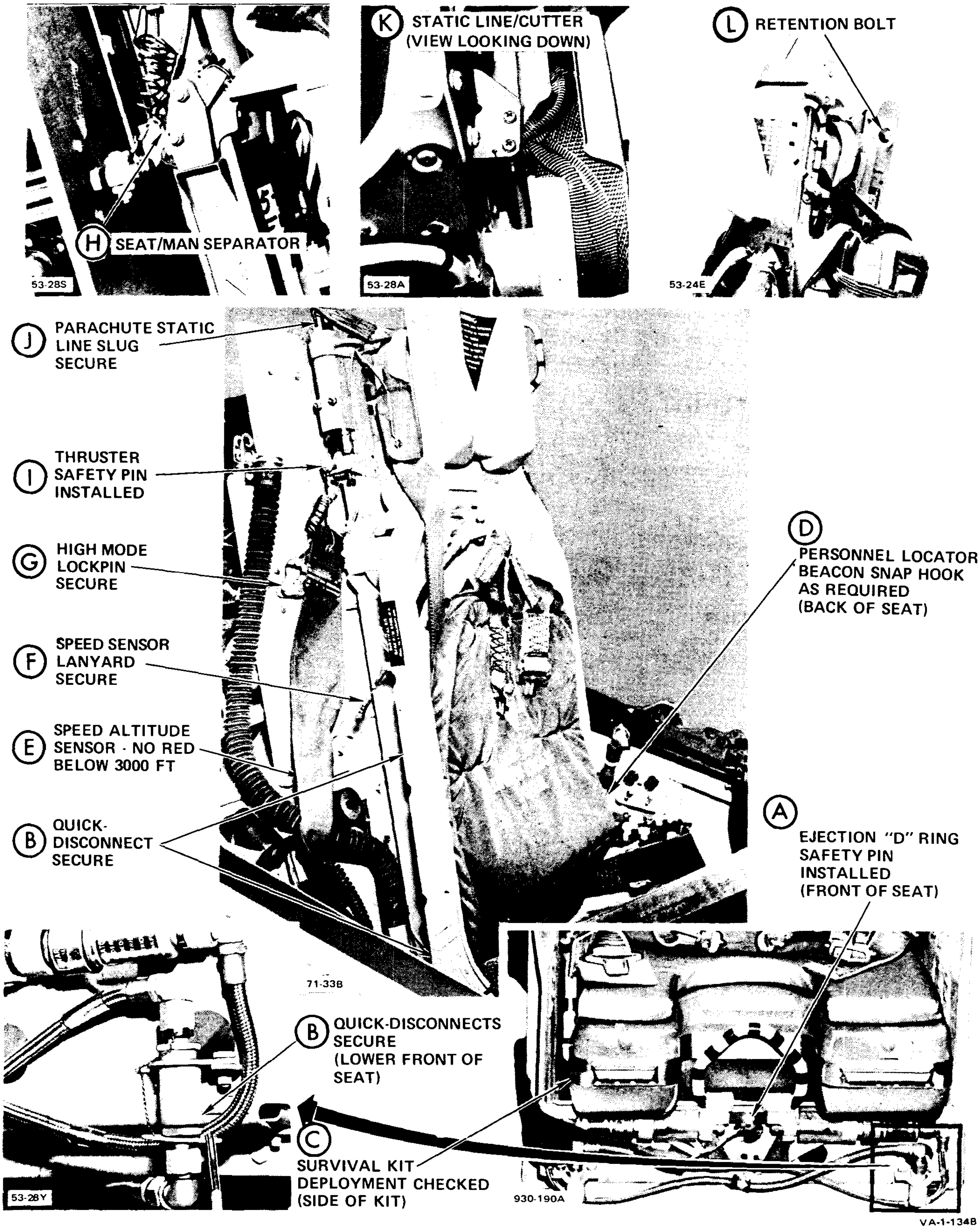


Figure 2-1

Note

Taxiing without canopy brace installed on the right canopy will cause oscillation which may cause the canopy bungee spring to bind.

3. Seat safety check (figure 2-1):

a. Ejection "D" ring safety pin–Installed (P, O).

b. Ejection seat quick-disconnects–Secure (P, O).

c. Survival kit deployment–CHECKED/SET (P, O).

(1) Snap hook lanyard connected to seat.

(2) Sensor selector arm–SET TO AUTOMATIC OR MANUAL.

d. Personnel locator beacon ~~snap hook~~–AS REQUIRED (P, O).

e. Speed/altitude sensor–NO RED SHOWING BELOW 3000 FEET (P, O).

f. Speed/altitude lanyard–SECURE (P, O).

g. High mode lockpin–SECURE (P, O).

h. Seat/man separator link–SECURE in place (P, O).

i. Thruster safety pin–INSTALLED (P, O).

j. Parachute static line slug–SECURE (P, O).

k. Static line/cutter–SECURE in cutter (P, O).

l. Catapult-rocket retention bolt–SECURE (P, O).

4. Oxygen quantity indicator–CHECK minimum for flight (P, O).

5. MASTER ARM–OFF.

6. BATTERY–OFF.

7. Gear handle–DOWN.

CAUTION

If the landing gear handle is not down, the landing gear will retract when electrical power is applied.

8. Required publications–ON BOARD (P, O).

9. Gust locks–REMOVED.

EXTERIOR INSPECTION

During the exterior inspection (figure 2-2), the aircraft should be checked for general condition, access doors and filler caps secured, and for hydraulic, oil, and fuel leaks, as well as for the following items:

1. Front cockpit canopy–CHECKED.
   Check canopy for general condition, cracks, crazing, etc.

2. Rear cockpit–SECURE (SOLO).

a. Seat pins–INSTALLED.

(1) Streamer clear of "D" ring and control column.

b. Loose equipment–STOWED.

c. Cushion bungee–INSTALLED.

d. FIRE PULL handles–IN.

e. FM COMM–Frequency SET and ON, if applicable.

f. EMERG IFF–NORMAL.

g. ARM MASTER–NORM*

Note

The ARM MASTER switch is located in rear cockpit only and must be placed in NORM position if solo, and use is anticipated.

h. Circuit breakers–CHECKED, aft and left of rear seat (P, O).

i. Canopy–CLOSED AND LOCKED, PINS IN.

3. Upper wing–CHECKED.
   Visually check fuel caps flush with wing and spoilers retracted.

4. Right propeller–CHECKED.

*Aircraft having T.O. 1L-10A-510 incorporated

EXTERIOR INSPECTION

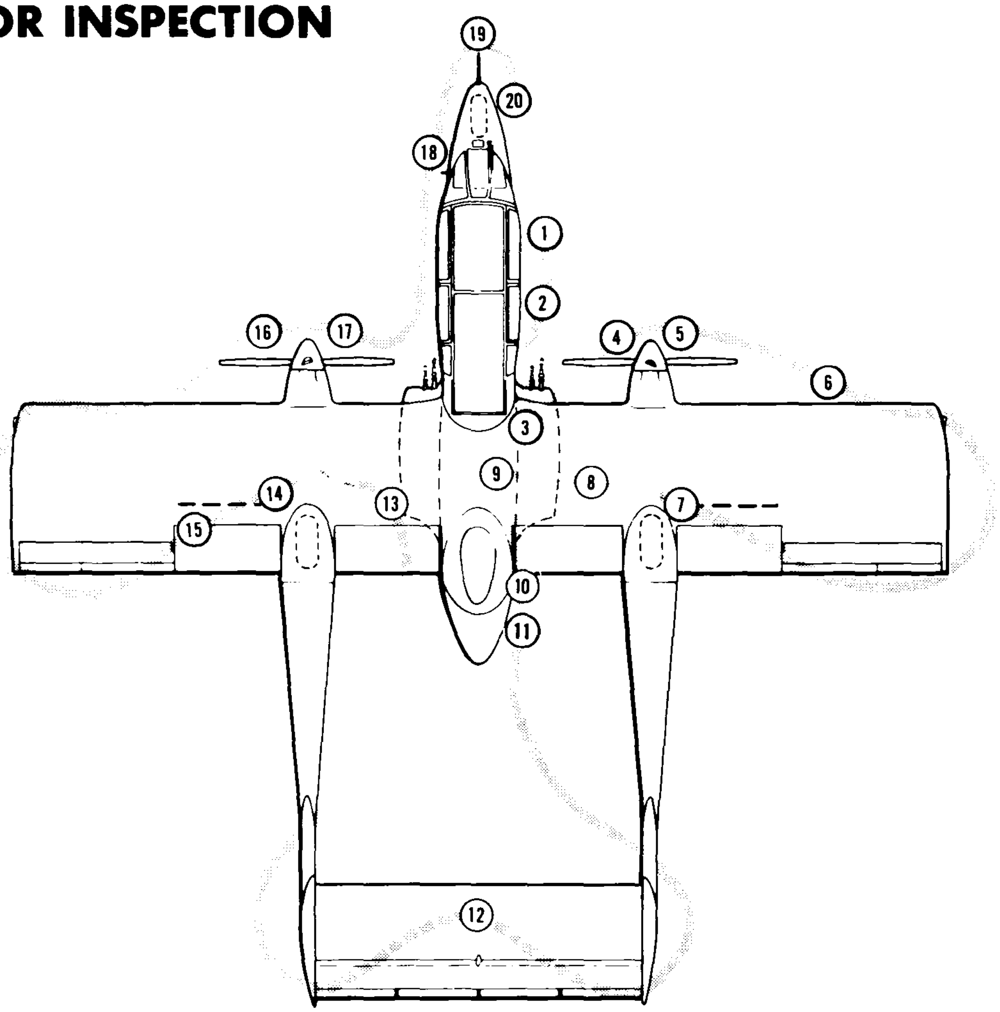


Figure 2-2

a. Blades—CHECK condition.
Rotate and check for freedom of movement (feathered or unfeathered).

b. Spinner and engine cowling—CHECK condition and security of mounting.

c. Check for oil leaks around propeller area.

5. Right engine—CHECKED.

a. Oil cap—SECURE.

b. Exhaust stack—CHECK condition and security of mounting, cover removed.

6. Right wing—CHECKED.
Check general condition of stall warning transducer, navigation light, and control surface.

7. Right main gear—CHECKED.

a. Wheel well—CHECK general condition.

b. Battery and avionics covers—SECURE.

c. Strut—CHECK general condition, inflation, and actuator for leaks.

d. Gear safety pin—REMOVED.

e. Wheel and tire—CHECK general condition.

8. Right sponson—CHECKED.
Access doors panels—SECURE.

9. External tank–CHECKED quantity, cap secure, connections, and safety pin removed.

10. External power receptacle door–SECURE (if not used).

11. Cargo bay–CHECKED.

 a. Cargo–SECURE.

 b. Hydraulic power package–STOWED.

 c. Door–CLOSED, LOCKED.

12. Tail boom, tail surfaces–CHECKED.
 Check tail booms, horizontal and vertical stabilizers, and control surfaces for general condition.

13. Left sponson–CHECKED.
 Check same as right side.

14. Left main gear–CHECKED.
 Check same as right side.

15. Left wing–CHECKED.
 Check same as right side.

16. Left engine–CHECKED.
 Check same as right engine.

17. Left propeller–CHECKED.
 Check same as right propeller.

18. Angle-of-attack probe–CHECKED.
 Check cover removed.

19. Nose of aircraft–CHECKED.

 a. Pitot cover–REMOVED.

 b. Pitot boom secure, opening free of obstructions.

 c. Landing light–CHECK security and condition.

 d. Windshield wiper–CHECKED in proper position.

20. Nose gear–CHECKED.

 a. Check general condition of wheel well area.

 b. Check strut for condition, security, and proper inflation.

 c. Gear safety pin–REMOVED.

 d. Wheel and tire–CHECK general condition.

COCKPIT CHECK

WARNING

Do not disturb parachute emergency release handle.

1. Thruster safety pin–REMOVED (P, O).

WARNING

Ensure that streamer is not routed through or entangled in the "D" ring handle.

2. Survival kit–ATTACHED (P, O).
 Fasten and tighten survival kit.

3. Riser attach fittings–SECURED (P, O).

4. Lap belt–SECURED (P, O).
 Fasten and tighten lap belt.

5. Personal leads–CONNECTED (P, O).

6. HF COMM–OFF.

7. ICS–SET (P, O).

8. VHF/FM COMM–OFF (P, O).*

9. Flaps–UP.

10. EXT LTS MASTER–EXT LTS.

11. Power levers–FLIGHT IDLE.

12. Condition levers–FUEL SHUT-OFF.

13. BATTERY–OFF.

14. Generators–ON.

*Provisions for No. 2 FM COMM installation in pilot's cockpit on aircraft having T.O. 1L-10A-536 incorporated

15. INST PWR–OFF.

16. AIR START–AUTO.

17. Gear handle–DOWN.

CAUTION

If the landing gear handle is not down, the landing gear will retract when electrical power is applied.

18. UHF COMM–OFF.

19. ARM MASTER–NORM (O).*

20. Clock–SET.

21. Sight FIL SEL–NO. 1.

22. GUNSIGHT DIMMING–OFF.

23. Alternate TACAN power–NO. 1 MSL.

24. TACAN–OFF.

25. FIRE PULL handles–IN (P, O).

26. EXT FUEL TRANS–OFF.

27. FUEL EMERG SHUT OFF–NORM.

28. PITOT HEAT–OFF.

29. Windshield wiper–OFF.

30. WING & TAIL lights–BRT.

31. FORM lights–AS REQUIRED.

32. Oxygen system–CHECKED (P, O).
Ensure the oxygen hose is firmly attached to the aircraft structure (or nylon strap provided by T.O. 1L-10A-631).

33. EMERG IFF–NORMAL (O).

34. IFF–OFF.

35. VHF/FM COMM–OFF.†

36. ADF–OFF.

37. COMPASS–SLAVED.

38. BLEED AIR–AS REQUIRED.

39. KY-28:

a. Mode knob–PLAIN.

b. POWER–OFF.

40. VHF/AM COMM–OFF.

41. Interior lights–AS REQUIRED (P, O).
Ensure the utility light is firmly inserted into its mounting bracket.

Note

Anytime the utility light or oxygen hose is removed for use during flight operations, the pilot should make certain the items are replaced securely.

42. Circuit breakers–CHECKED.

43. Access steps–CLOSED.

BEFORE STARTING ENGINES

1. BATTERY–ON.

2. ICS–CHECKED.

3. SEAT ADJ–ADJUSTED (P, O).

4. Rudder pedals–ADJUSTED.

5. Flight controls–CHECKED.
Check for full travel, freedom, and proper operation of all surfaces and spoilers.

6. Fire detector/warning lights–CHECKED.
Hold TEST switch in FIRE DET to test fire warning lights, then hold in WARN LTS to test all warning lights, caution lights, and rudder pedal shaker.

7. External power–IF REQUIRED.

8. INST PWR–INV NO. 1.
Check INST PWR caution light out.

*Aircraft having T.O. 1L-10A-510 incorporated
†Aircraft having T.O. 1L-10A-536 incorporated

9. Radio—ON.
   Turn on primary voice communication.

10. Attitude indicator—CHECKED (P, O).

11. Fuel quantity indicator—CHECKED.

    a. Check indicator by holding FUEL GAGE TEST switch to TEST, then release. Indication should decrease, then return to initial indication.

    b. Check fuel quantity.

Note

Prior to starting, both propellers should be on the locks.

UNFEATHERING PROPELLERS

1. Condition lever—FUEL SHUT-OFF.

2. Power lever—FULL REVERSE.

3. AIR START—CRANK.
   Hold in CRANK until stops are heard or blades reach full reverse position, then release to AUTO.

4. Power lever—FLIGHT IDLE.

STARTING ENGINES

1. Brakes—SET.

2. Power levers—FLIGHT IDLE.

3. Condition levers—FUEL SHUT-OFF.

4. Propeller—CLEAR AND UNFEATHERED.

5. Starter—START.
   Check start ignition light on.

CAUTION

- The starters are limited to four consecutive 15-second motoring periods with a 1-minute cooling period between attempts. A fifth attempt must be preceded by a 5-minute cooling period.

- The ignition system is not continuous duty. Limits are 2 minutes ON, 3 minutes OFF, 2 minutes ON, and 23 minutes OFF.

WARNING

Should the electrical external power unit fail on initiating engine start (BATTERY switch ON, engine START switch held momentarily in start), the engine selected will be motored by the starter if the external unit plug is extracted from the receptacle. To prevent undesired engine rotation, hold the applicable START switch in ABORT, and/or move the BATTERY switch of OFF in the event of a bog-down failure of the external power unit.

6. Condition lever—NORMAL FLIGHT AT 10% RPM.

   a. If no light-off within 15 seconds, abort start.

   b. Monitor EGT (815°C maximum) and RPM.

   c. At 50% to 53% RPM check:

      (1) Oil pressure indication.
      (2) Start ignition light out.
      (3) EGT/TIT shift.
      (4) Fuel boost light out.

7. RPM—STABILIZE approximately 80% to 90%.

8. Propeller–UNLOCK.

   a. Smoothly retard power lever to reverse range, then return to GROUND START.

   b. Check:
      (1) RPM–STABILIZED approximately 67%.
      (2) Oil pressure–50 psi minimum.

9. Prior to starting other engine, check voltammeter for 75 amps or less (battery starts only).

10. GUNSIGHT–CHECK FOR OPERATION (if applicable).

11. Repeat steps 4 through 8 for other engine.

After both engines are started:

12. External power–DISCONNECT (if applicable).

13. Generator caution lights–OUT.

GROUND SHUTDOWN

Aborted/Hung Start

If at any time during a normal ground start, the pilot decides to abort the start, or if rpm fails to increase or stops increasing before the normal start sequence is completed, proceed as follows:

1. Condition lever–FUEL SHUT-OFF.

2. Starter–ABORT.

Hot Start

For hot start procedure, refer to ENGINE FIRE/HOT START, in Section III.

GROUND OPERATION

For pertinent data required for ground operations, see figure 2-3.

BEFORE TAXI

1. INST PWR–CHECKED.

   Select INV NO. 2.
   Check INST PWR caution light OUT and reselect INV NO. 1.

2. TRIM–CHECK.

   a. TRIM SELECT–ALT.
   Check system operation.

   b. TRIM SELECT–NORM.
   Check system operation return to neutral.

3. Radios and navigation equipment–ON, as required.

4. IFF–STBY.

5. COMPASS–SET.
   Set BDHI to proper heading with AN/ASN-75 control.

6. Ejection seat "D" ring safety pin–REMOVED AND STOWED (P, O).

7. Altimeter–SET.

8. Chocks–REMOVED.

TAXI CHECK

Normal taxi procedure is to control direction and speed with modulated reverse and asymmetrical thrust. Nose wheel steering and brakes may be used as necessary.

WARNING

Dragging the brakes will cause overheating and brake failure.

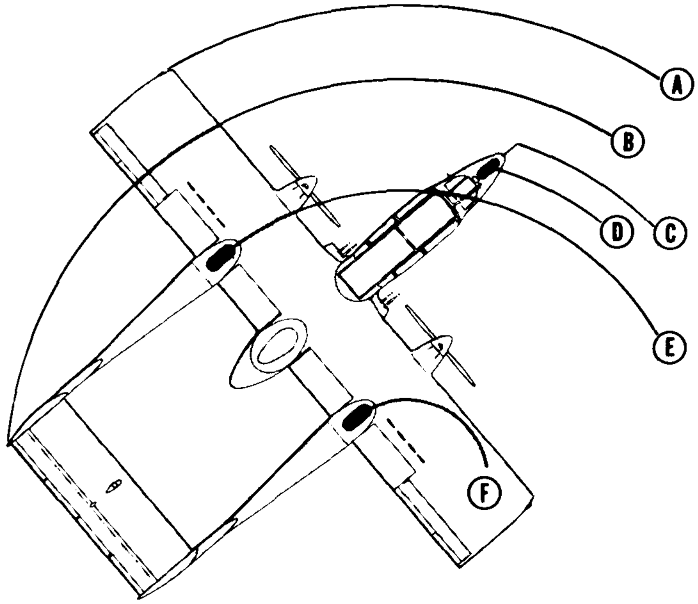
1. Brakes–CHECKED.

2. Nose wheel steering–CHECKED.

3. Flight instruments–CHECKED.

   Check BDHI and turn-and-slip indicator for proper operation.

GROUND OPERATION



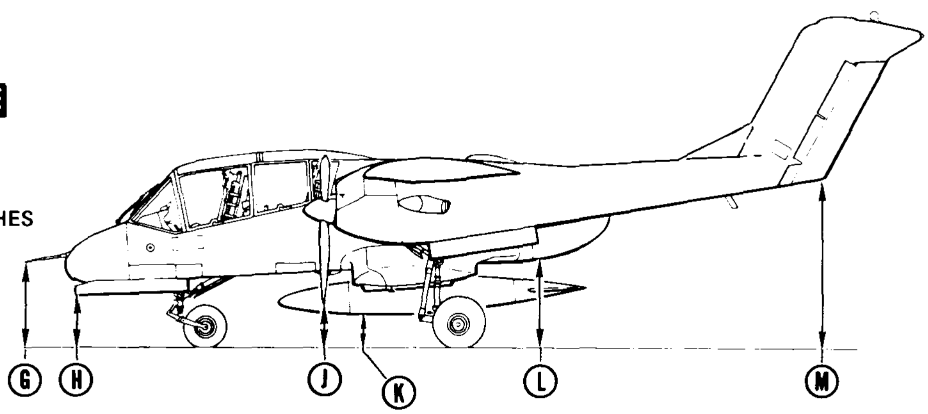
TURN RADIUS

BASED ON SPEED OF 3 KNOTS

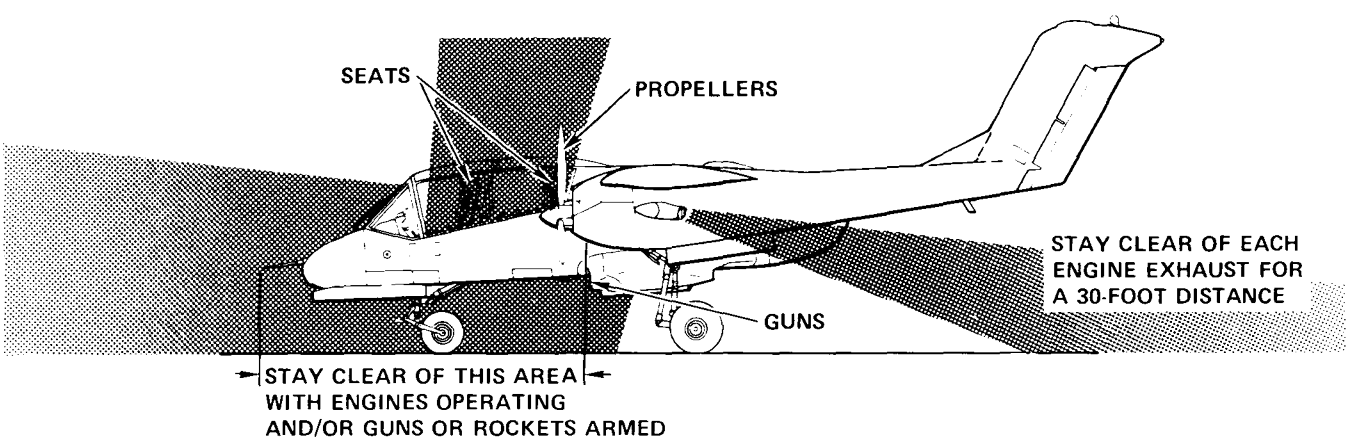
- (A) WING TIP - 33.2 FEET
- (B) VERTICAL - 28.6 FEET
- (C) PITOT BOOM - 25.8 FEET
- (D) NOSE WHEEL - 22.7 FEET
- (E) LEFT MAIN WHEEL - 20.6 FEET
- (F) RIGHT MAIN WHEEL - 5.6 FEET

GROUND CLEARANCE

- (G) PITOT BOOM - 47 INCHES
- (H) NOSE WHEEL DOORS - 28 INCHES
- (J) PROPELLERS - 23.5 INCHES
- (K) EXTERNAL FUEL TANK
  150 GALLON–18 INCHES
  230 GALLON–9.5 INCHES
- (L) CARGO DOOR - 52 INCHES
- (M) RUDDERS - 94 INCHES



DANGER AREAS



VA-1 30B

Figure 2-3

4. Yaw damper—CHECK.

   a. Hold YAW DAMPER switch in TEST. Check for rudder pedal movement opposing aircraft turns.

5. Navigation aids—CHECKED.
   Ground check navigational aids. Check bearing pointer against known bearing.

6. External fuel transfer—CHECKED.

BEFORE TAKE-OFF

1. Trim—SET.
   Set elevator trim as desired and check AILERON and RUDDER trim neutral lights ON.

2. Flaps—SET.
   Note operation of HYD PUMP indicating light.

3. Navigation aids—SET for departure.

4. Shoulder harness—AS REQUIRED (P,O).

5. PITOT HEAT—ON, as required.

6. IFF set—AS REQUIRED.

7. ANTI COLLISION light—ON.

8. Feed tank—CHECK 260 TO 280 POUNDS.

9. TAKE-OFF AND LANDING DATA—REVIEW.

10. Flight controls—CHECK.
    Check for freedom of movement and full travel.

11. Canopy—CLOSED, LOCKED, PINS IN (P, O).

12. Canopy door lock indicators—CHECK (P, O).
    Check that indicators are down over longerons on all canopy doors.

LINE-UP CHECK

1. Flight instruments—CHECK (P,O).

   a. Attitude indicator—ERECT, SET, OFF flag not visible.

   b. BDHI—CHECKED against runway heading.

2. Condition levers—T.O./LAND (RPM 94% minimum).

3. Power levers—ADVANCE.
   Advance power levers to maximum allowable engine limits for ambient conditions. Allow instruments to stabilize and check for normal indications.

TAKE-OFF

CAUTION

Left main tire failure may damage the ground safety switch linkage causing loss of nose wheel steering and the extension of the reverse gate solenoid.

A no-flap take-off is recommended when runway length, terrain clearance, or operational requirements are not a factor. The no-flap configuration affords a more favorable safety margin between lift-off speed and single-engine minimum control speed, especially at high gross weight and high ambient temperature conditions. Directional control with rudder alone is adequate and accurate under most conditions immediately on brake release. However, use nose wheel steering as necessary.

WARNING

Wake turbulence is a hazard to be anticipated and planned for during take-off behind another aircraft or in the vicinity of an operating helicopter. Wake turbulence dissipation/displacement is a function of elapsed time, prevailing wind speed and direction. During calm conditions, severe turbulence generated by large aircraft can persist for as long as 10 minutes. If possible, delay take-off to ensure dissipation/displacement of turbulence. When it is necessary to take off behind another aircraft, become airborne well before its lift-off point and climb above its flight path. Lift off beyond the touchdown point of a landing aircraft.

CAUTION

Check engine torque and temperature indications during take-off, retarding the power levers as necessary to avoid exceeding limits as speed increases.

Take off as follows:

1. Advance power to maximum available within limits, check engine instruments, and release brakes.
2. Use rudder and/or nose wheel stering.
3. When speed approaches 5 knots below take-off speed recommended in Appendix I, use positive back stick pressure to rotate to lift-off attitude.

CROSSWIND TAKE-OFF

For crosswind component, refer to the wind component chart in Appendix I. Use nose wheel steering as required during take-off run until directional control can be maintained with rudder. Aileron into the wind and or slightly higher torque on the upwind engine will assist in maintaining wings level; however, reducing power on the downwind engine will result in significantly increased take-off distance. Delay rotation until airspeed approaches recommended take-off speed. Apply back pressure to make a positive break from the ground.

INSTRUMENT TAKE-OFF

Complete the normal procedures. If taxiing and taking off in visible moisture, the windshield wiper should be on as required and pitot heat should be turned on before taxiing into take-off position. When lined up, check BDHI and magnetic compass against the runway heading. Smoothly advance power levers to MILITARY and after completing checks, release the brakes. Use rudder or nose wheel steering as required. During the take-off run, maintain runway alignment by outside reference as long as possible. As visual references are lost, the BDHI becomes the primary reference for heading control. At 5 knots below recommended take-off speed (Appendix I), apply stick back pressure to establish a take-off attitude of 8 to 10 degrees nose high on the attitude indicator. When the altimeter and vertical velocity indicator reflect a definite climb, retract the landing gear. Retract the flaps above 110 KIAS. Maintain a 500- to 1000-foot-per-minute climb until best climb speed is attained.

AFTER TAKE-OFF

1. Gear—UP.
   When safely airborne, retract the gear. Raising the gear improves single-engine performance significantly.

2. Flaps—UP.
   After gear is up and locked. Above 110 KIAS retract flaps.

Note

Do not exceed 155 KIAS unless the gear and flaps are fully retracted.

3. Hydraulic pump—LIGHT OUT.

WARNING

Failure of the hydraulic pump to stop running after a hydraulic demand will result in overheating the pump and fluid, eventually causing pump failure or loss of fluid into the cargo bay presenting a fire hazard. The hydraulic pump should not be allowed to run continuously.

CLIMB

For climb speed schedules and climb performance data, refer to Appendix I and proceed as follows:

1. Condition levers—AS REQUIRED.

CAUTION

For selection of NORMAL FLIGHT position, retard levers one at a time, when at a safe altitude. Do not inadvertently select FUEL SHUT-OFF.

2. Oxygen—AS REQUIRED.

3. YAW DAMPER—AS REQUIRED.

4. EXT FUEL TRANS—ON, as applicable.

   a. Turn on external fuel transfer switch for 1 minute to prime the transfer pump.

   b. When fuel quantity permits, check external fuel transfer.

CAUTION

Internal fuel quantity must be carefully monitored during fuel transfer since there is no fuel venting overboard indication.

INSTRUMENT CLIMB

Turns should not be attempted below 500 feet above the terrain on instruments and bank angle should not exceed 20 degrees while establishing the recommended climb schedule.

CRUISE

For cruise performance data, refer to Appendix I, and proceed as follows:

1. Condition levers—NORMAL FLIGHT.

2. Power levers—AS REQUIRED.
   Set rpm to maintain desired airspeed.

FUEL MANAGEMENT

External fuel tank operation should be checked on the ground and at least once during each 5000 feet during climb. This will insure the fuel transfer pump retains its prime for transfer during cruise flight. For fuel transfer, internal fuel should be reduced to approximately 1000 to 1200 pounds before turning the tank on. Since the rate of transfer is higher than normal cruise fuel flow, internal fuel quantity will rise. Monitor internal fuel during transfer since there is no fuel venting overboard indication. The transfer pump should be turned off when internal fuel quantity reaches approximately 1500 pounds. The fuel transfer pump is lubricated by the fuel and when internal fuel quantity continues to drop with the pump on, it should be turned off. On aircraft having T.O. 1L-10A-541 incorporated, the pump should be turned off when the EXT FUEL TRANSFER light illuminates. Flight planning of fuel requirements is essential and must include alternative courses of action should the external tank not feed. Refer to Appendix I for data.

INSTRUMENT CRUISE

After level-off, it may be necessary to hold climb power until cruising airspeed is established. A maximum angle of bank of 30 degrees is normally used for instrument flight; however, the aircraft can easily be controlled in turns up to 60 degrees of bank. Handling characteristics are good on instruments within all normal speed ranges given in Appendix I.

Navigation Equipment

Installed avionics equipment permits navigation and approaches using TACAN and nondirectional beacons (NDB). For operation of electronic equipment, refer to Section I. VHF and UHF equipment are limited to line-of-sight reception and flight should be conducted at altitudes high enough to receive stations enroute. LF ADF, UHF-ADF, marker beacon equipment, and IFF can be used to supplement other navigation equipment.

FLIGHT CHARACTERISTICS

For flight characteristics data, refer to Section VI.

DESCENT

Prior to descent:

1. Approach procedures—REVIEW, as required.
2. CKPT AIR/DEFR—AS REQUIRED.
   Use as necessary to prevent fogging.
3. Altimeter—SET.
4. Power levers—AS REQUIRED.

INSTRUMENT APPROACHES

For instrument approach purposes, the OV-10A is a category B aircraft.

TACAN, NDB (ADF), or radar approaches (figures 2-4, 2-5, and 2-6) may be made. Instrument approaches are not difficult because of excellent stability and low stalling speeds. Proper trim technique is very important during approaches. With each change of power, attitude, configuration, or airspeed, retrimming is required. A typical instrument approach is shown in figure 2-6. (Indicated holding and approach airspeed may be increased not to exceed gear and flap limitations.)

Note

If turbulence is encountered during thunderstorm activity, delay approach, if possible, until the storm passes.

HIGH ALTITUDE PENETRATION (TYPICAL)

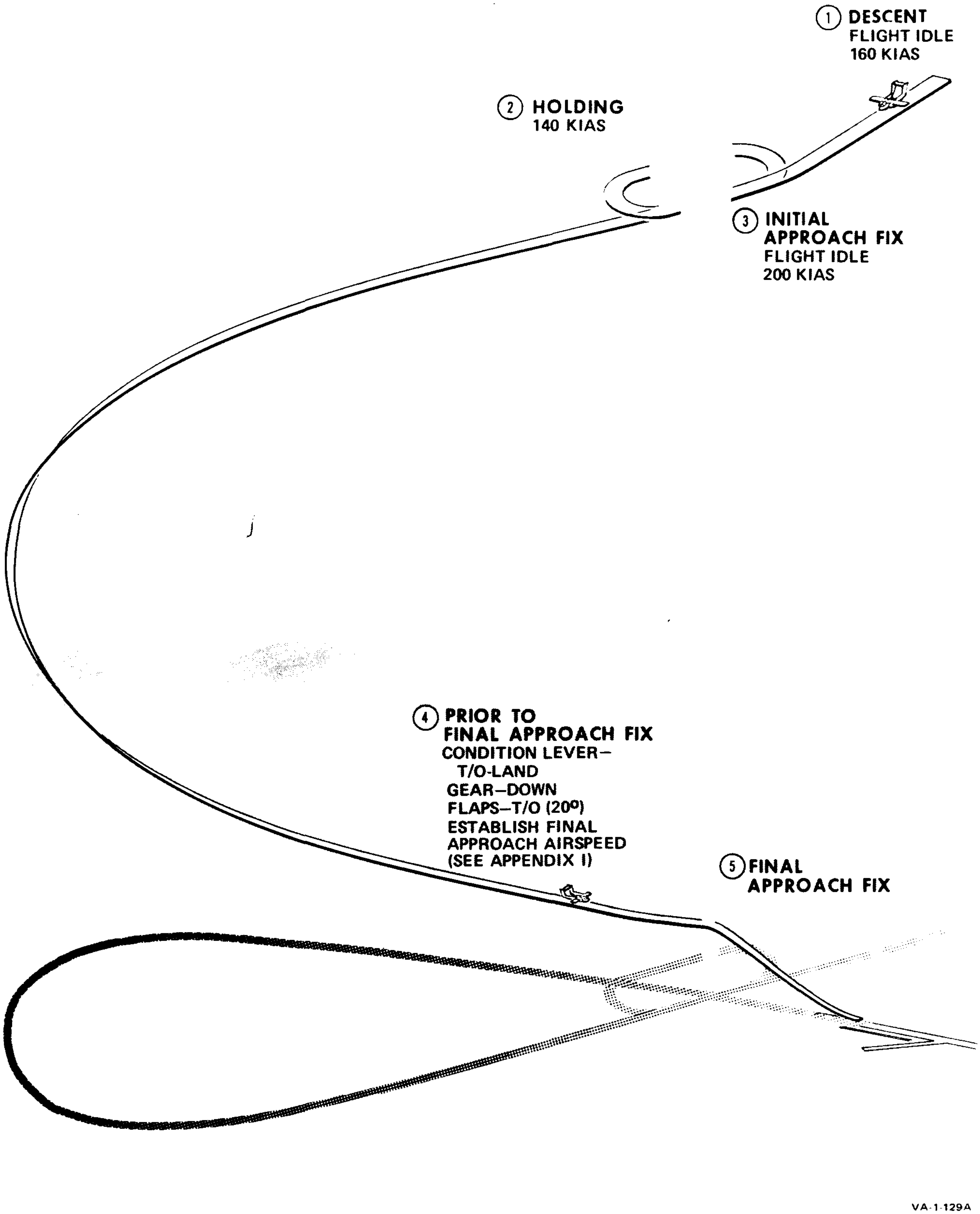
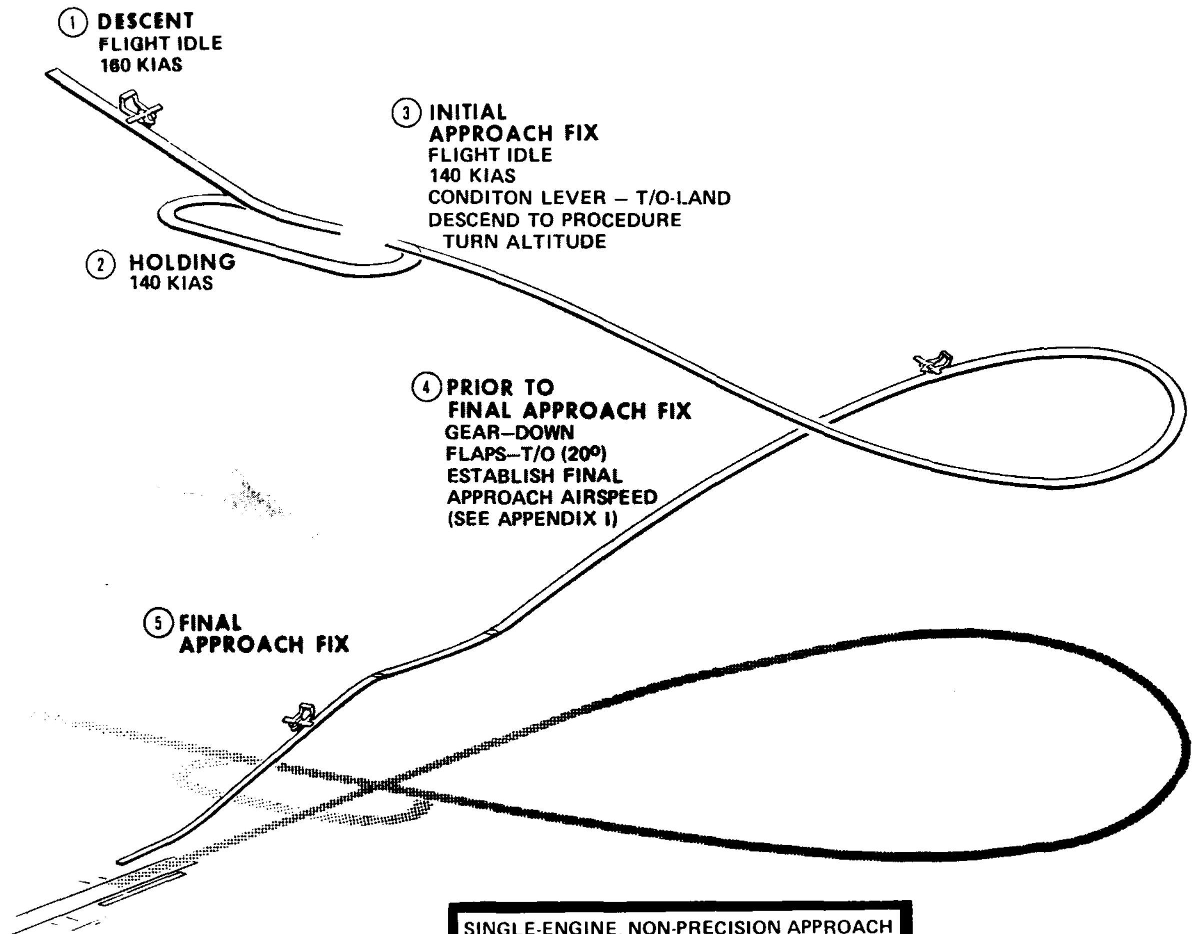


Figure 2-4

LOW ALTITUDE APPROACH (TYPICAL)



SINGLE-ENGINE, NON-PRECISION APPROACH

THE LANDING GEAR SHOULD BE LOWERED AT THE FINAL APPROACH FIX. FLAP EXTENSION MAY BE DELAYED UNTIL LANDING IS ASSURED. MAINTAIN A MINIMUM OF 100 KIAS ON FINAL APPROACH UNTIL FLARE (110 KIAS MINIMUM IN NO FLAP CONFIGURATION) FOR GROSS WEIGHTS UP TO 10,000 POUNDS. FOR HIGHER GROSS WEIGHTS, REFER TO SECTION III, SINGLE-ENGINE/FLAME-OUT LANDING.

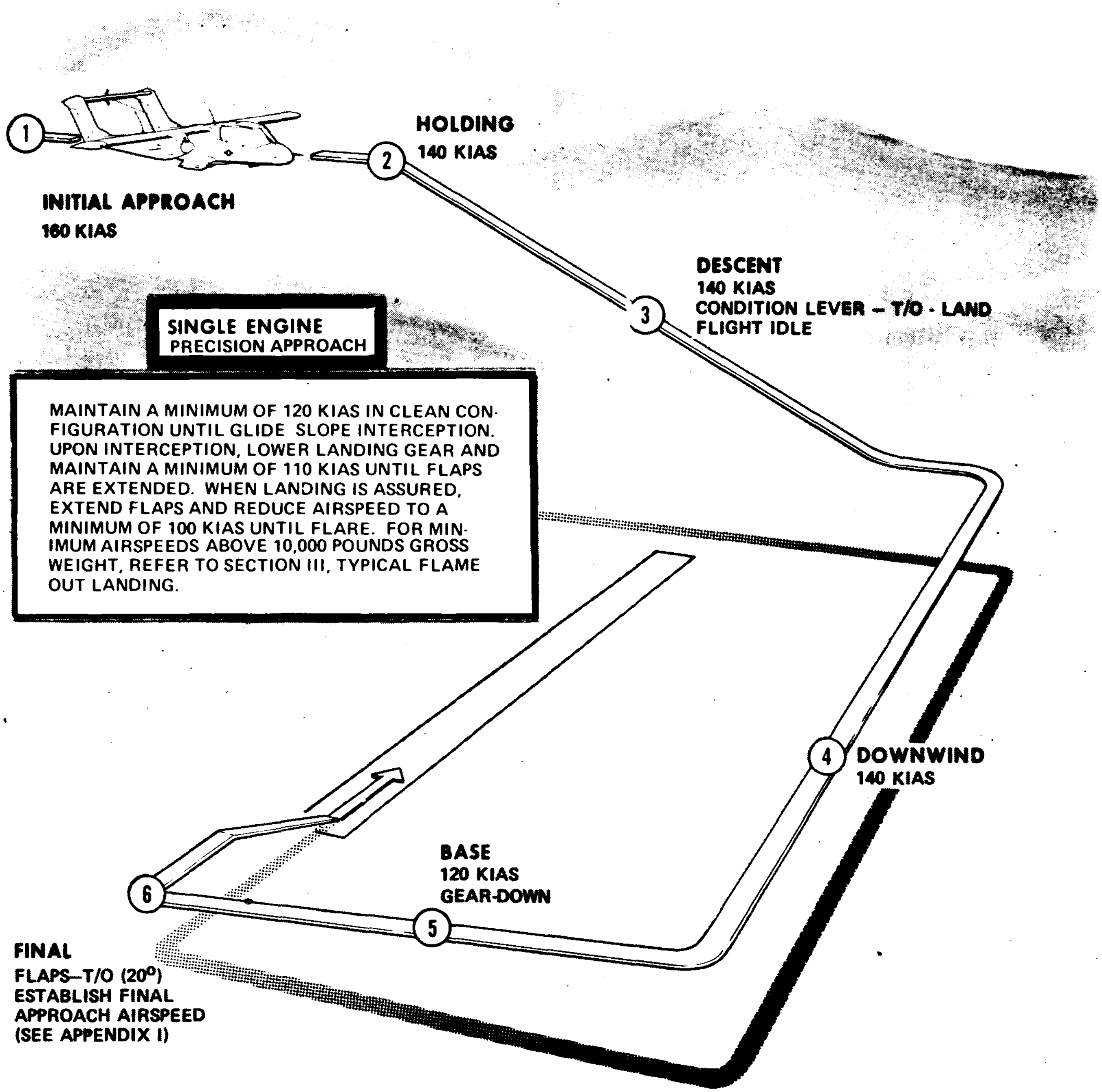
WARNING

LEVEL FLIGHT MAY NOT BE MAINTAINED UNDER CERTAIN GROSS WEIGHT/OAT COMBINATIONS WITH THE LANDING GEAR EXTENDED. UNDER SUCH CONDITIONS, DELAY LANDING GEAR EXTENSION UNTIL LANDING IS ASSURED.

VA 1 1308

Figure 2-5

RADAR APPROACH (TYPICAL)



NOTE FOR STRAIGHT IN APPROACHES, ACCOMPLISH BEFORE LANDING CHECKLIST PRIOR TO GLIDE SLOPE INTERCEPTION.

VA-1-67C

Figure 2-6

BEFORE LANDING

1. Condition levers—T.O./LAND.
   Advance both levers at same time.

2. Shoulder harness—AS REQUIRED (P,O).

3. YAW DAMPER—OFF.

4. Hydraulic system—CHECK.
   Depress STEER button, check that hydraulic pressure caution light illuminates and goes out.

5. Gear—DOWN.

6. Flaps—AS REQUIRED.

7. Landing light—AS REQUIRED.

GO-AROUND/MISSED APPROACH

1. Power levers—ADVANCE, as required.

CAUTION

Monitor engine indicators to avoid exceeding torque and temperature limits.

2. Gear—UP, as required when ground or obstruction clearance is assured.

3. Flaps—UP, as required.

   (Stop at T/O position if full flaps used, full up at 110 KIAS).

For missed approach, establish climb in accordance with INSTRUMENT TAKE-OFF procedures. Power may be reduced to avoid excessive pitch attitudes.

LANDING

CAUTION

Left main tire failure may damage the ground safety switch linkage causing loss of nose wheel steering and the extension of the reverse gate solenoid.

NORMAL LANDING

Typical landing procedures are shown in figure 2-7. For an overhead pattern, retard power at the break to arrive on downwind at less than 155 KIAS. Extend the gear, and then extend the flaps as desired. As the flaps extend, a slight pitch trim change may be expected and power must be increased to maintain speed. As airspeed approaches the recommended base airspeed, initiate the turn to final using power as necessary to control the descent rate. The base turn should be planned so that the angle of bank is decreasing as the aircraft nears the final approach course. Level the wings on final at an altitude that will insure a power-on approach at a descent rate of 850 fpm or less. If available, VASI should be used for glide path information. Pitch, power, altitude, and descent rate should be included in the cross-check to confirm aircraft performance and progress throughout the final approach. The aircraft is designed to land from an approach of this type without a flare and power reduction. However, if desired, only a slight change in pitch and power is required for flare and touchdown. After touchdown, lower the nose and select reverse thrust as desired, exercising caution not to exceed engine limits. Nose wheel steering may be used for directional control if desired; however, directional control can easily be maintained using rudder and light differential braking.

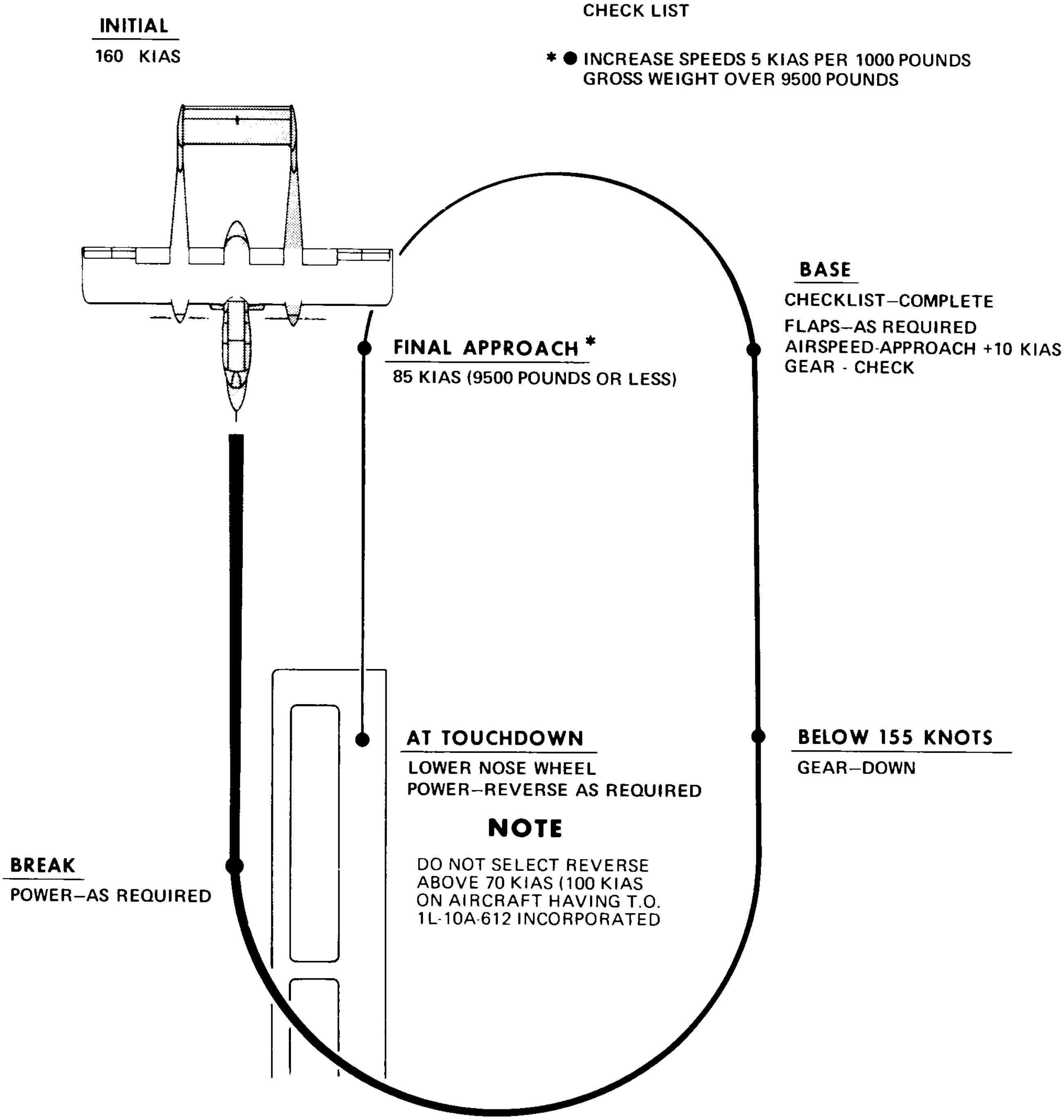
WARNING

Wake turbulence is a hazard to be anticipated and planned for during landing behind another aircraft or in the vicinity of an operating helicopter. Wake turbulence dissipation/displacement is a function of elapsed time, prevailing wind speed and direction. During calm conditions, severe turbulence generated by large aircraft can persist for as long as 10 minutes. If possible, delay landing to ensure dissipation/displacement of turbulence. When it is necessary to land behind another aircraft, remain above its approach path and land beyond its touchdown point. Touch down before the lift-off point of a departing aircraft.

TYPICAL OVERHEAD LANDING PATTERN

NOTE

- PERFORM THE BEFORE LANDING CHECK LIST
- * INCREASE SPEEDS 5 KIAS PER 1000 POUNDS GROSS WEIGHT OVER 9500 POUNDS



NOTE

REFER TO APPENDIX 1 FOR RECOMMENDED FINAL APPROACH AND LANDING SPEEDS

VA-1-32D

Figure 2-7

TYPICAL RECTANGULAR LANDING PATTERN

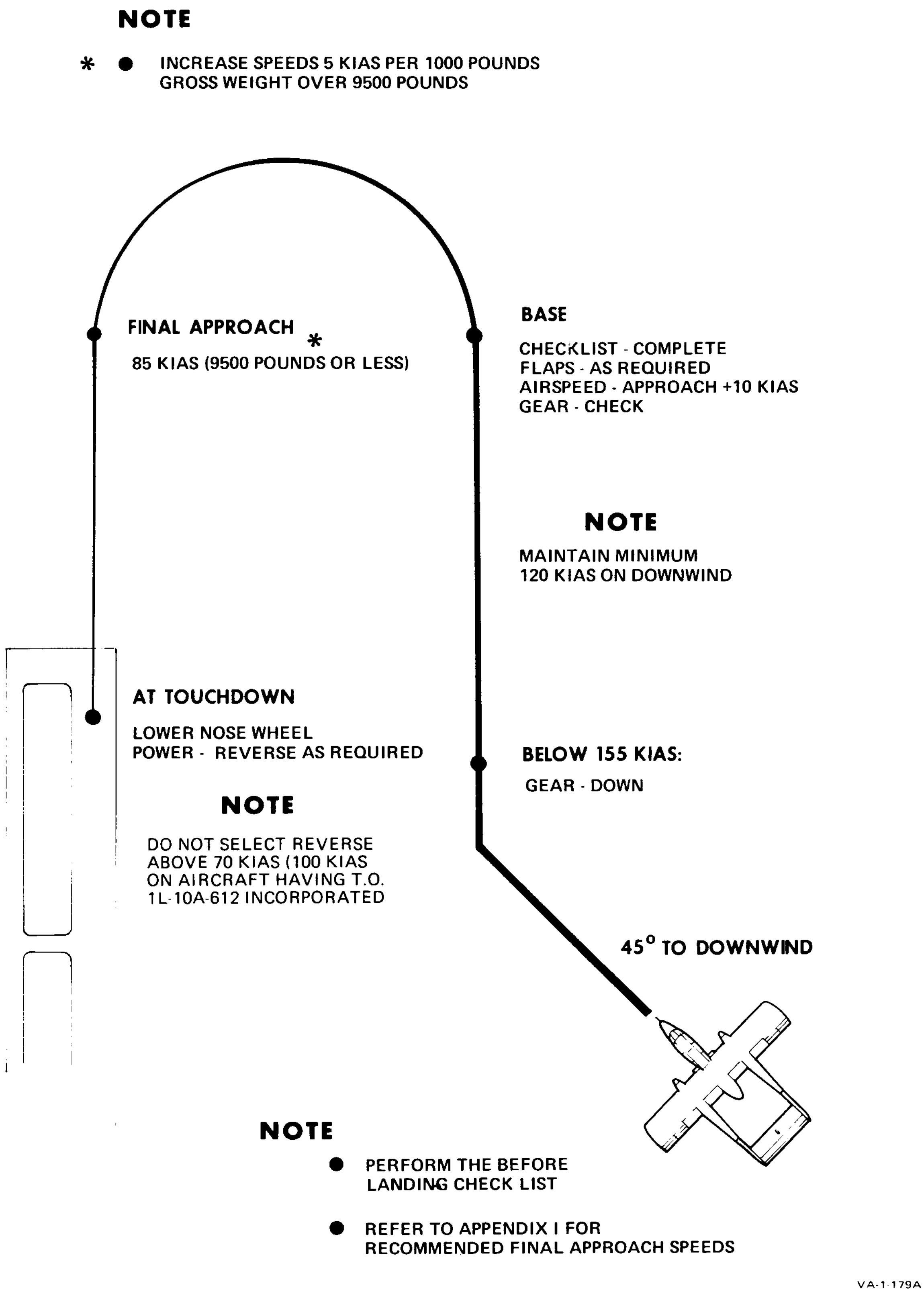


Figure 2-8

Note

- Rapid power changes result in large lift changes due to the amount of wing and tail surface directly in the propeller wash envelope. Approach speed and glide slope control are simplified by making small, smooth power changes.
- Torque setting and glide slope angle are primary for airspeed control on final approach. With propeller rpm being relatively constant, changes in airspeed and power setting do not result in the sound variations normally expected.

CAUTION

- Ensure that the condition levers are in the T.O./LAND position for all landings. After landing, the power levers shall not be retarded below the GROUND START position until airspeed is below 70 (100*) KIAS. When FULL REVERSE is required (below 70 or 100* KIAS), the power levers will be retarded to FULL REVERSE smoothly but rapidly; do not modulate thrust until FULL REVERSE (99% to 100% rpm) has been obtained. If rpm decreases to 94% during reverse thrust operation, power levers shall be immediately advanced to prevent further rpm decay and engine overtemperature.
- Do not attempt to maintain a nose-high attitude for aerodynamic braking below approximately 50 knots. Loss of pitch control authority in a nose-high attitude may cause overrotation and damage to the rudders. If overrotation is encountered, apply brake pressure to rotate the aircraft nose down to the normal attitude.

TOUCH-AND-GO LANDINGS

Touch-and-go landings can only be made when authorized or directed by the major command concerned.

1. FLAP handle–T/O (if 40-degree flaps are extended).
2. Power levers–ADVANCE SMOOTHLY TO MILITARY AND EXECUTE NORMAL TAKE-OFF.

CAUTION

Monitor engine indicators to avoid exceeding torque and temperature limits.

3. After take-off move landing gear handle up; above 110 KIAS raise flaps and execute normal climb procedures.

CROSSWIND LANDING

Refer to the crosswind chart in Appendix I to determine crosswind limit component. Adjust position of the downwind for wind to avoid overshooting the final approach. The normal (wing-down) approach procedure is effective, but may produce easily controllable lateral oscillations under gusting conditions. After touchdown, retract flaps as soon as practicable; hold the stick into the wind and use differential reverse thrust and nose wheel steering for directional control.

SLIPPERY RUNWAYS

Refer to Section VII.

AFTER LANDING

When clear of runway:

1. Flaps—UP.

*Aircraft having T.O. 1L-10A-612 incorporated

2. Landing light—AS REQUIRED.
3. Condition levers—NORMAL FLIGHT.
4. IFF—OFF.
5. ANTI COLLISION light—OFF.
6. EXT FUEL TRANS switch—OFF.
7. Trim—NEUTRAL
8. Ejection seat "D" ring safety pin—INSTALLED (P,O).

WARNING

The observer must not release his harness fittings until cleared by the pilot after the front seat is safe. An inadvertent ejection by the pilot will eject the rear seat even with all rear seat safety pins installed.

9. Nonessential radios and navigation equipment—OFF

CAUTION

If hot brakes are suspected, have brakes checked prior to taxiing into the parking area. If brakes are hot, do not shut the engine down until fire equipment is present. The fuel drain is located just forward of the main gear and upon shutdown, fuel may atomize causing a possible fire.

SHUTDOWN

1. PARKING BRAKE—SET.
2. Power levers—GROUND START.
3. Condition levers—FUEL SHUT-OFF.

Note

For shutdown with propellers feathered, pull condition levers full aft to FEATHER and omit step 4.

4. Power levers—FULL REVERSE.
   a. Hold in full reverse until propeller stops.
   b. Check that propeller blades move to and stop at the flap pitch position.
5. Radio and navigation equipment—OFF (P,O).
6. INST PWR—OFF.
7. Exterior lights—OFF.
8. BATTERY—OFF.

BEFORE LEAVING AIRCRAFT

1. Wheel chocks—IN PLACE.
2. PARK BRAKE—RELEASE, as required.
3. Oxygen—100% and OFF (P,O).
4. Thruster safety pin—INSTALLED (P,O).
5. Control gust lock—INSTALLED, as required.
6. Canopy—CLOSED, as required.
7. Form 781—COMPLETE.

Note

The flight crew shall also make entries into Form 781 indicating when any flight limits are exceeded.

STOL OPERATIONS

Optimum short-field take-off and landings (STOL) are achieved only through practice and should be made only by experienced OV-10A pilots. Short-field technique should be perfected under controlled conditions on a hard-surface runway before being applied to unprepared surfaces or operational environments. The objective of safely stopping the aircraft in shortest feasible distance or within the confines of a staging area depends on variables such as landing surface condition, obstacle heights, aircraft weight, center of gravity, existing weather (including wind, temperature, and pressure altitude), etc. Generally, a three-point full stall landing should be utilized on a rough surface maintaining full aft stick to prevent nose-over tendencies. If terrain roughness is not a primary concern, a two-point touchdown may be utilized at minimum speeds. Normally, all landings should be accomplished into the wind to reduce landing distance; however, if severe contours are present on the landing surface, wind considerations may be secondary.

WARNING

The airspeeds for STOL (20-degree flaps) and maximum performance (40-degree flaps) are based on minimum single-engine control speed. Engine failure at these airspeeds will result in a yaw and roll into the failed engine. Full rudder deflection and almost full aileron deflection will be required immediately to maintain a wings-level attitude. In the STOL or maximum performance configuration, the aircraft cannot maintain level flight with only one engine operating. Loss of one engine will result in an increased rate of descent and a crash landing. A more rapid yaw and roll and a higher rate of descent are generated in the maximum performance (40-degree flaps) configuration. For either configuration, existing conditions of runway remaining, altitude at engine loss, and surrounding terrain will dictate whether a crash landing or ejection is required for survival.

Short-field Landing Technique

The following procedures are recommended for short-field landings:

1. If possible, make a high "drag" over the intended landing spot to evaluate general conditions and obstacles in the landing area, followed by a low "drag" to evaluate the landing surface.

2. If feasible, enter on downwind leg, holding normal airspeeds.

3. On final, establish and maintain minimum STOL approach speed for gross weight as computed from Appendix I. Use power to control rate of descent.

4. Concentrate on minimum safe clearance of obstacles.

5. When safely over all obstacles (or at a predetermined height over the end of the runway for practice approaches), establish sink rate in accordance with FLIGHT LIMITATIONS in Section V.

Note

Do not "cut" power and do not flare.

6. Land the aircraft firmly on all three wheels, use forward stick pressure and, simultaneously, rapidly retard the power levers to FULL REVERSE and apply maximum brakes without skidding.

CAUTION

With reverse thrust selected, prevailing conditions of dust or precipitation can result in momentary obstruction of visibility.

Note

If a go-around is necessary while 40 degrees of flaps are extended, retract the flaps to the 20-degree (T/O) position after advancing the power lever.

STRANGE-FIELD PROCEDURES

At bases where maintenance personnel are not familiar with the aircraft, ensure that postflight and preflight inspections are accomplished in accordance with the Aircraft Scheduled Inspection and Maintenance Requirements Manual (T.O. 1L-10A-6) or the Preflight—Basic Postflight Inspection Work Cards (T.O. 1L-10Z-6WC-1).

AIRCRAFT SERVICING

EXTERNAL POWER

Starting units should be capable of providing 28-volt d-c power at a minimum of 600 amperes and at a maximum of 1000 amperes for peak loads.

CAUTION

Use of higher rated units may cause damage to the starter-generators.

PRIMARY, ALTERNATE, AND EMERGENCY FUELS

The primary fuel used is JP-4. The alternate fuel used is JP-5. When primary/alternate fuels are not available, aviation gasoline, Grade 115/145 (MIL-G-5572) may be used as an emergency fuel. See figure 2-9.

Note

The only authorized emergency fuel is aviation gasoline, Grade 115/145 (MIL-G-5572).

REFUELING

Refueling is accomplished manually through tank filler receptacles. To refuel the aircraft, proceed as follows:

1. Fuel source and aircraft—GROUNDED.
2. Aircraft and nozzle—GROUNDED.
3. Fuel vent outlets—OPEN.
4. Wing tank drains—CLOSED.
5. Remote water drain—CLOSED (valve in cargo compartment).
6. All electrical equipment—OFF.
7. External tank—FILL, as required.
   Filler cap—SECURE.

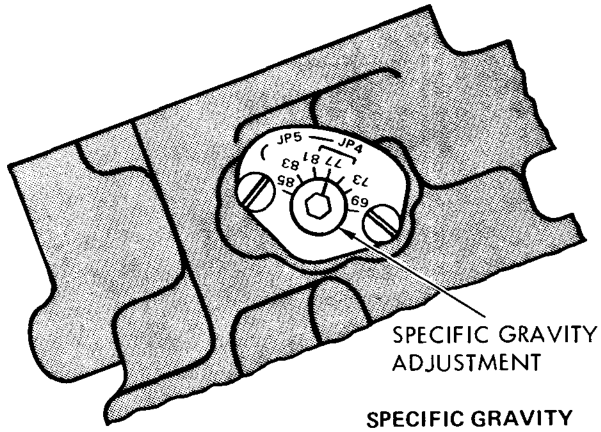
Note

Unless special procedures are followed to elevate the nose of the aircraft, the centerline external fuel tank (150 gallons) will accept approximately 122 gallons of fuel.

8. Center wing tank—FILL to bottom of standpipe.
   Filler cap—SECURE.
9. Inboard wing tanks—FILL to bottom of standpipes.
   Filler caps—SECURE.

FUEL CONTROL

Caution TO ENSURE PROPER ENGINE OPERATION, THE SPECIFIC GRAVITY SETTING OF THE FUEL CONTROL SHOULD BE RESET WHENEVER THE TYPE OF FUEL IS CHANGED.



FUEL USED	SPECIFIC GRAVITY SETTING
MIL-T-5624, JP-4	0.77
MIL-T-5624, JP-5	0.83
MIL-G-5572, GRADE 115/145	0.71

VA-1-132A

Figure 2-9

10. Outboard wing tanks—FILL to bottom of standpipes.
    Filler caps—SECURE.

OIL SYSTEMS

Use turbine oil (MIL-L-23699 or MIL-L-7808). MIL-L-23699 and MIL-L-7808 oil should be mixed only in case of emergency. Should oils be mixed, drain oil system and service with either MIL-L-7808 or MIL-L-23699 at first opportunity. To service the engine oil tanks, proceed as follows:

Note

When a propeller is cranked out of feather after engine shutdown, the oil tank will indicate approximately 2 quarts low. This is because oil used by the unfeathering pump is not returned to the oil tank until the engine is started.

1. Oil filler—UNLOCK AND PULL.
2. Check—FILL, as required.

SECTION III—EMERGENCY PROCEDURES

TABLE OF CONTENTS

INTRODUCTION

This section includes procedures to be followed to correct an emergency condition. The procedures, if followed, will insure safety of the pilots and aircraft until a safe landing is made or other appropriate action is accomplished. Multiple emergencies, adverse weather, and other peculiar conditions may require modification of these procedures. Therefore, it is essential that pilots determine the correct course of action by use of common sense and sound judgment. Procedures appearing in **BOLDFACE** capital letters are considered critical action. Procedures appearing in other letters are considered noncritical action. Each is defined as follows:

NONCRITICAL ACTION

Those actions which contribute to an orderly sequence of events and improve the chances for the emergency action to be successful.

CRITICAL ACTION

Those actions which must be performed immediately without checklist reference if the emergency is not to be aggravated, and injury or damage is to be avoided. To assist the pilot when an emergency occurs, three basic rules are established which apply to most emergencies occurring while airborne which should be remembered by each pilot.

1. MAINTAIN AIRCRAFT CONTROL.
2. ANALYZE THE SITUATION AND TAKE PROPER ACTION.
3. LAND AS SOON AS CONDITIONS PERMIT OR EJECT IF NECESSARY.

ABBREVIATED CHECKLIST

Your emergency abbreviated checklist is in T.O. 1L-10A-1CL-1.

GROUND OPERATION EMERGENCIES

ENGINE FIRE OR FIRE PULL LIGHT (NACELLE FIRE) DURING START/ HOT START

1. **CONDITION LEVERS - FEATHER.**
2. **AIR START SWITCH - CRANK.**
   a. Hold switch in CRANK position to shut off fuel enrichment and ignition.
   b. Allow starter to continue rotating engine in effort to extinguish fire.
3. **START SWITCH - ABORT.**
   Move switch to ABORT position momentarily to stop engine rotation.

If fire persists or FIRE PULL light illuminated:

4. FIRE PULL light–PULL.
5. FIRE EXT–AGENT.
6. External power–DISCONNECT, if used.
7. BATTERY switch–OFF.
8. Ground egress–ACCOMPLISH.

ENGINE FIRE OR FIRE PULL LIGHT (NACELLE FIRE) DURING SHUTDOWN

1. Power lever–GROUND START.
2. BATTERY switch–ON.
3. START switch–START.
4. AIR START switch–CRANK.
   a. Hold switch in CRANK position to shut off fuel enrichment and ignition.
   b. Allow starter to continue rotating engine in effort to extinguish fire.

If fire persists or FIRE PULL light illuminated:

5. FIRE PULL light–PULL.
6. FIRE EXT–AGENT.
7. START switch–ABORT.
8. BATTERY switch–OFF.
9. Ground egress–ACCOMPLISH.

EMERGENCY GROUND EGRESS

Should emergency ground egress become necessary, install ejection seat safety pin and disconnect personal leads if time permits. Retain helmet and exit by the right canopy door, if possible. Egress while propellers are rotating is not recommended.

1. Condition levers–FEATHER.

CAUTION

If propellers are on the flat pitch locks, they will NOT feather.

2. Survival kit release handle–PULL.

WARNING

Do not pull CNU-118P kit handle unless kit is firmly in seat or aircrew will remain attached to kit contents.

3. Lap belt–OPEN.
4. Riser attach fittings–RELEASE.
5. Canopy–OPEN.
6. BATTERY switch–OFF (if time permits).
7. Abandon aircraft.

SINGLE-ENGINE FLIGHT CHARACTERISTICS

The aircraft power plant installation incorporates a negative torque sensing (NTS) feature in order to reduce propeller drag if engine failure occurs. The NTS system will drive the propeller to a near-feathered condition if a negative torque is applied to the engine by the propeller (such as from loss of fuel or control failure). Provisions are not made for catastrophic failure of the propeller or gearbox. Engine failure characteristics in which the NTS system is in operation are as follows:

1. Yaw excursion into the failed engine. The rate of this excursion is dependent on flight speed in relation to single-engine stall speed. The nearer to stall, the more rapid the excursion in yaw.
2. Rapid roll-off into the failed engine coupled with a rapid nose-down pitch movement.

The minimum airspeed (no yaw, pitch, or roll excursions) is nearly the same for the negative torque sensing condition as for the full feather condition; however, the pilot should select the FEATHER position of the condition lever once engine failure has been determined.

NTS FAILURE

Aircraft response to engine failure with the NTS system inoperative will greatly magnify the characteristics as previously described. In this event, emphasis should be placed on moving the proper condition lever to the FEATHER position to relieve the asymmetric drag as soon as possible.

MINIMUM SINGLE-ENGINE CONTROL SPEED

The minimum single-engine control speed is that airspeed where sudden loss of one engine (NTS system operating) requires full lateral and directional control input to fly the aircraft in a straight path over the ground with wings level; however, the aircraft will descend. Slowing the aircraft 1 to 2 knots below this speed results in loss of directional control. The minimum single-engine control speed is essentially the same as the power-off stall speed. The minimum single-engine control speeds for various gross weights are depicted in figure A6-3. As in any twin-engine conventional aircraft, yaw excursion following engine failure is the most important concern to the pilot. Though initial aircraft motion following engine failure may appear to the pilot as an uncontrollable excursion in roll, it must be remembered that the aircraft is in fact yawing and the *rudder* is the primary recovery control. It is important to increase airspeed which will result in more effective lateral-directional control. As airspeed approaches stall speed, the violence and rapidity of the roll and yaw will increase and the aircraft may not be controllable with rudder and aileron inputs against the rolling tendency. The aircraft will roll into a spiral in spite of maximum control deflections. The proper corrective action to stop the roll in its incipient stages is to retard the power lever of the operable engine to attain a more nearly balanced thrust condition, lower the nose to attain a safe airspeed (altitude permitting), and reapply power on the operable engine.

WARNING

Should engine failure occur at or near stall speed, or if the aircraft is stalled during single-engine operations at altitudes below 1000 feet AGL, safe recovery may not be possible, depending on pilot proficiency and aircraft configuration.

MINIMUM SAFE SINGLE-ENGINE SPEED

The minimum safe single-engine speed is defined as that airspeed required to maintain wings level and a 100 fpm rate of climb with one engine at maximum power. This speed is a function of aircraft gross weight and outside air temperature. These speeds are depicted in figure A6-3. Numerous factors influence the aircraft flyaway capability during single-engine operations. These include delay in reducing drag (such as failing to raise the gear or jettison the stores), inadvertently increasing drag by premature initiation of a climb or allowing airspeed to decrease below the minimum safe speed. At high gross weights and temperatures, the pilot must raise the gear and jettison the stores to obtain a more favorable minimum safe speed which will increase flyaway capability. Once the aircraft is stabilized and trimmed, handling characteristics with one engine shut down and the propeller feathered are good. Exercise caution and carefully cross-check airspeed, vertical velocity, and altitude. The airspeed differential for rudder shaker operation may decrease to within 1 knot above stall speed.

TAKE-OFF EMERGENCIES

TWO-ENGINE ABORT

1. Power levers–REVERSE THRUST AS REQUIRED.
2. Brakes–AS REQUIRED.
3. Maintain directional control by use of rudder/nose wheel steering, brakes, and asymmetrical reverse thrust. To gain the maximum effectiveness from nose wheel steering, apply firm forward stick pressure during all reverse thrust operations.

WARNING

- Jettison of external stores is recommended only as a last resort, due to probability of stores decelerating with the aircraft.
- If take-off cannot be aborted safely due to obstructions or other factors, immediate ejection is recommended.

CAUTION

Left main tire failure may damage the ground safety switch linkage causing loss of nose wheel steering and the extension of the reverse gate solenoid.

ENGINE FAILURE/GROSS POWER LOSS ON TAKE-OFF

If engine failure/gross loss of power occurs at any time during take-off roll, the take-off must be aborted. It is impossible to take off/fly away on single engine. If failure occurs above refusal speed and take-off cannot be aborted safely due to obstructions or other factors, immediate ejection is recommended. During mission planning, the pilot should refer to Appendix I for minimum safe single-engine speeds. Maximum refusal speed for runway available should also be computed. This is obtained from the Take-off Distance chart, refusal speed segment. Refusal speed is the maximum airspeed at which a take-off can be safely aborted, using brakes only, in the runway available. At speeds above normal refusal speed, it is recommended that the power levers be retarded immediately to GROUND START, rudder and brakes be applied to regain and maintain directional control and stop the aircraft. Very careful use of low power reverse thrust on the operating engine may prove effective, but only if surface conditions provide sufficient braking co-efficient to prevent skidding of the opposing wheel. Apply aileron to assist in directional control and/or counteract roll.

ONE-ENGINE ABORT

1. Power levers–GROUND START.
2. Brakes–AS REQUIRED.
3. Maintain directional control by use of rudder/nose wheel steering, brakes and single-engine reverse thrust.

Note

To gain the maximum effectiveness from nose wheel steering, apply firm forward stick pressure during all reverse thrust operations.

WARNING

- If take-off cannot be aborted safely due to obstructions or other factors, immediate ejection is recommended.
- Jettisoning of external stores is recommended only as a last resort due to the probability of stores decelerating with the aircraft.

ENGINE FAILURE/FIRE AFTER LIFT-OFF

Should an engine failure occur immediately after take-off, the aircraft will yaw and roll rapidly into the failed engine. Immediately apply *full rudder* and full aileron to level the wings. (A reduction of power on the operating engine may be necessary.) The best possible course of action, runway/terrain and/or aircraft control permitting, is to re-land the aircraft if the gear is down. If any of these conditions cannot be met, eject immediately *(reducing power on the operable engine may be necessary to right the aircraft to improve ejection success).* If the engine failure occurs after gear retraction has been initiated, the best possible course of action, aircraft control permitting, is to fly away. The external stores must be jettisoned *immediately* to insure a flyaway capability. In the event of a fire, if airspeed is critical and a gross loss of power is not evident, the pilot may elect to maintain maximum power on both engines until a safe single-engine airspeed is attained. In either situation, a failure or fire, a premature climb will result in a loss of airspeed and significantly degrade aircraft controllability.

During mission planning, the pilot shall compute his minimum single-engine control speed and that airspeed required to maintain level flight. Refer to MINIMUM SINGLE-ENGINE SPEEDS charts in Appendix I.

WARNING

If for any reason a safe recovery cannot be made or if a fire is accompanied by a gross loss of power, EJECT IMMEDIATELY.

If take-off is continued, proceed as follows:

1. **GEAR - UP.**
   This step should be immediate to reduce the minimum single-engine control speed.

2. **STORES - JETTISON.**

3. **CONDITION LEVER - FEATHER.**

If fire persists or FIRE PULL light illuminated:

4. FIRE PULL light–PULL.

5. FIRE EXT–AGENT.

6. If still on fire–EJECT OR LAND IMMEDIATELY.

7. Flaps–UP (when practical to reduce drag).

8. Power lever–FLIGHT IDLE.

When all obstructions have been cleared, accelerate to best climb speed. Control pressures should be trimmed out to assist in maintaining coordinated flight.

NOSE TIRE FAILURE
ON TAKE-OFF

If a nose tire fails early in the take-off run, take-off should be aborted, using differential reverse thrust and light wheel braking as required for directional control. Reverse thrust will act to lighten loads on the nose gear at low speeds. Nose wheel steering may prove ineffective during rollout.

Note

Leave the gear extended after take-off to prevent possible gear well damage and to permit a pre-landing visual inspection.

MAIN TIRE FAILURE
ON TAKE-OFF

If a main tire fails during take-off run, abort take-off, use rudder/nose wheel steering, brakes, and differential reverse thrust as required. Apply firm forward stick pressure to gain maximum effectiveness from nose wheel steering. If a main tire fails just prior to lift-off, it may be desirable to continue take-off and reduce gross weight prior to landing.

CAUTION

Left main tire failure may damage the ground safety switch linkage causing loss of nose wheel steering and the extension of the reverse gate solenoid.

Note

When take-off is continued, leave the gear extended to prevent possible wheel well damage and to provide pre-landing visual inspection.

IN-FLIGHT EMERGENCIES

ENGINE FAILURE/FIRE IN FLIGHT

Should an engine failure/fire occur in flight, gear and flaps, if extended, should be retracted and rudder and engine instruments/warning lights checked to determine which engine has failed. In symmetrical flight, rudder pressure will be opposite the failed engine.

1. **CONDITION LEVER - FEATHER.**
   Feathered propeller rotation up to approximately 60 rpm is not unusual.

If fire is evident or FIRE PULL light illuminated:

2. FIRE PULL light–PULL.

3. FIRE EXT–AGENT.

4. If still on fire–LAND OR EJECT IMMEDIATELY.

If flight is continued:

5. Operative engine power lever–ADVANCE AS REQUIRED.

6. Maintain airspeed above minimum safe single-engine speed.

7. Stores–JETTISON (if required).
   The pilot should consider the weight and drag effects of external stores on aircraft performance. While in flight or during the landing phase, if any doubt exists concerning aircraft performance, the stores should be jettisoned.

8. Attempt air starts.
   Do not attempt to start the failed engine if a fire or mechanical malfunction is apparent.

If air starts are not attempted, proceed as follows:

9. FUEL EMERG SHUT OFF switch–SHUT OFF.

10. Power lever–FLIGHT IDLE.

11. Land as soon as practical.

FAILURE OF BOTH ENGINES IN FLIGHT

Simultaneous failure of both engines is rarely encountered. Should such a condition occur at low altitude, EJECT. If altitude permits, proceed as follows:

1. Maintain 130 KIAS.
2. Fuel quantity–CHECK.
3. Attempt air starts.

Note

Engines may be started simultaneously.

WARNING

If air starts cannot be obtained and optimum flame-out landing is not feasible, EJECT at least 2000 feet above the terrain.

ENGINE AIR START

Air starts may be obtained below 20,000 feet over a wide range of airspeeds.

1. Condition lever–FUEL SHUT-OFF.

2. Power lever–Halfway between FLIGHT IDLE and MILITARY.

3. AIR START switch–ON.
   Check START IGN ON light ON. Upon moving the AIR START switch to ON, the propeller will unfeather and the propeller should commence windmilling.

CAUTION

- Do not actuate the engine START switches while in flight. Actuation of a START switch to the START position transfers all electrical power to the start bus, making it impossible to unfeather a propeller and will result in failure of the operating generator. Placing the engine START switch in the ABORT position will restore electrical power to the primary bus.

- On aircraft having T.O. 1L-10A-546 incorporated, electrical power is removed from the ground START switches while the aircraft is airborne.

4. Condition lever–NORMAL FLIGHT AT 10% RPM.
   Light-off is primarily noted by a rise in EGT. Drag pulses will occur during acceleration through approximately 80% rpm.

5. AIR START switch–AUTO.

UNSUCCESSFUL AIR START

In the event of an unsuccessful air start attempt, proceed as follows:

1. Condition lever–FEATHER (failed engine).

2. AIR START switch–AUTO.
   Check START IGN ON light OFF. Whenever ignition is applied to an engine with EGT less than 450 (±50)°C, the START FUEL MODULE feature provides a fuel path to the engine by passing the engine main fuel shutoff valve. This fuel flow is provided independent of the position of the condition lever.

3. FUEL EMERG SHUT OFF switch–SHUT OFF (failed engine).

4. Power lever–FLIGHT IDLE.

PROPELLER/ENGINE OVERSPEED

If engine rpm limits are exceeded on the ground, shut down the engine. If rpm limits are exceeded in flight, proceed as follows:

1. Power lever–RETARD.

2. Airspeed–DECREASE.
   Increase pitch attitude and slow airspeed as necessary to decrease rpm within limits. If rpm cannot be maintained within limits, proceed as follows:

3. Condition lever–FEATHER.
   Ensure power lever is in FLIGHT IDLE.

SPIN RECOVERY

Normally, the OV-10A will not spin unless direct action to enter a spin is taken by the pilot. However, if a spin is entered, proceed as follows:

Erect Spin Recovery

1. Power levers–FLIGHT IDLE (gate).

2. Rudder–FULL AGAINST SPIN.

3. Elevator–NEUTRAL TO SLIGHTLY FORWARD.

4. Aileron–NEUTRAL.

5. When rotation ceases, neutralize rudder, allow build-up to safe airspeed, and recover from dive.

Inverted Spin Recovery

1. Condition levers–FEATHER.

2. Rudder–FULL AGAINST SPIN.

3. Stick–NEUTRAL.

4. When rotation ceases, neutralize rudder and recover from dive.

For detailed spin characteristics, refer to Section VI.

[redacted]

The LW-3B ejection seat affords exceptional escape capability. See figure 3-1. Common sense should be used in establishing ejection minimums to increase ejection capability and reliability. If time permits, the pilot should notify other crew members to eject. The following rules are presented as a guide for establishing ejection criteria:

- Under controlled, wings-level conditions, eject at least 2000 feet above the terrain if feasible.
- Under spin or dive conditions, eject at least 2500 feet above the terrain if feasible.
- Ejection above 18,000 feet is not recommended due to increased parachute opening shock at the higher altitudes.

WARNING

The ejection seat speed/altitude sensor automatic function is deactivated and only low mode sequence will be available. In low mode, the parachute will begin deployment immediately after ejection. Therefore, whenever possible, ejection should be delayed until below 10,000 feet pressure altitude and 235 KIAS to prevent possible injury to crew members.

Prior to Ejection

If time and altitude permit before ejection, perform the following:

1. Notify other crew member of decision to eject.

2. IFF MASTER knob–EMER.

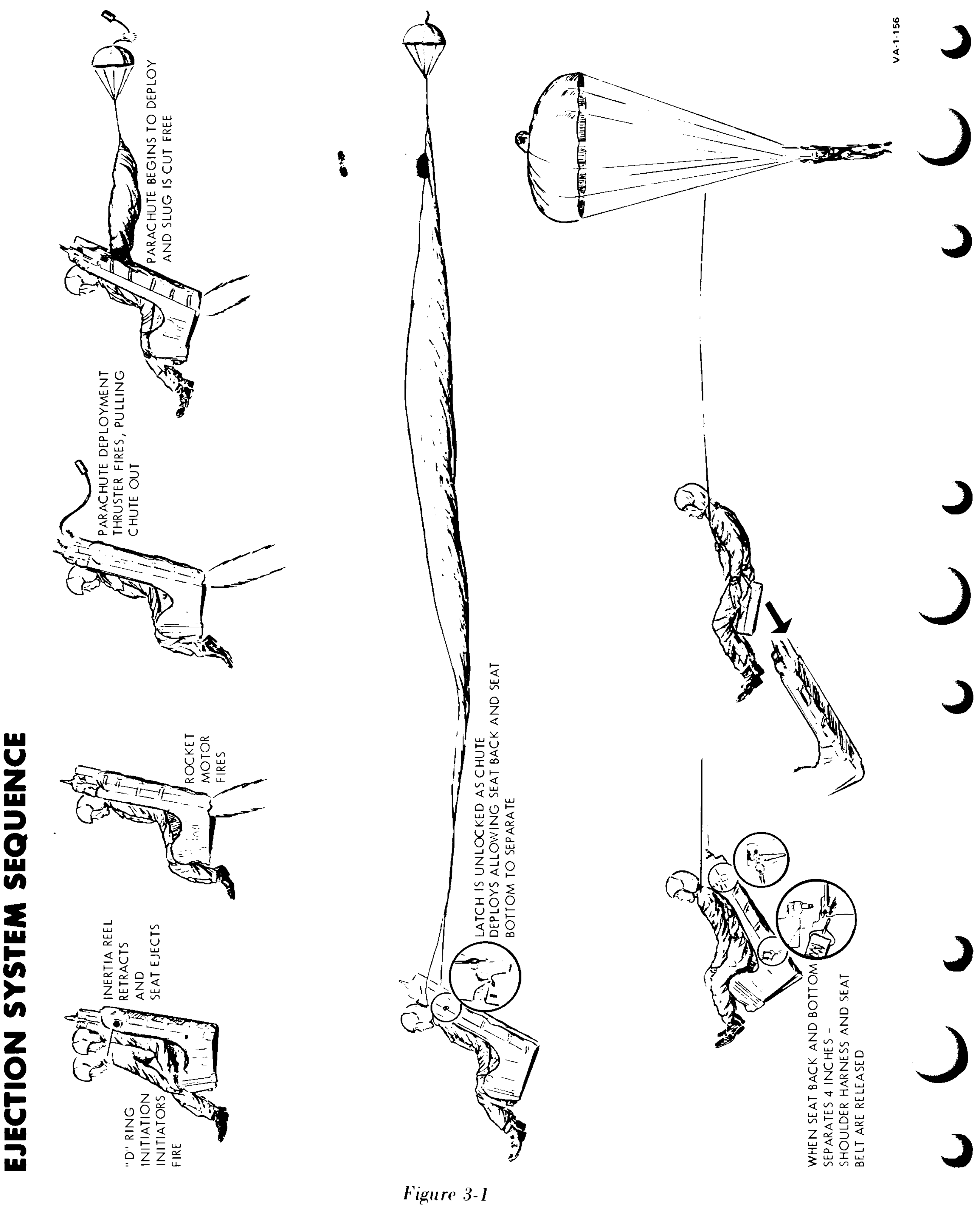

EJECTION SYSTEM SEQUENCE
"D" RING INITIATION INITIATORS FIRE
INERTIA REEL RETRACTS AND SEAT EJECTS
ROCKET MOTOR FIRES
PARACHUTE DEPLOYMENT THRUSTER FIRES, PULLING CHUTE OUT
PARACHUTE BEGINS TO DEPLOY AND SLUG IS CUT FREE
LATCH IS UNLOCKED AS CHUTE DEPLOYS ALLOWING SEAT BACK AND SEAT BOTTOM TO SEPARATE
WHEN SEAT BACK AND BOTTOM SEPARATES 4 INCHES - SHOULDER HARNESS AND SEAT BELT ARE RELEASED
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Figure 3-1

3. Transmit MAYDAY and intentions.

4. Survival kit automatic release–AS REQUIRED.

5. Helmet–VISOR DOWN AND CHIN STRAP SECURE.

6. Steer aircraft away from populated areas.

7. Oxygen hose–DISCONNECT.

8. Trade excess airspeed for altitude (100 KIAS minimum).

Ejection Procedure

1. **EJECTION "D" RING - PULL.**

WARNING

Unejected bail-out is not possible.

After Ejection

After clearing the aircraft, the parachute emergency release handle should be actuated as a back-up procedure for automatic parachute deployment. The helmet visor and oxygen mask may be removed if face protection is not necessary as the surface is approached. As soon as possible, inspect the canopy and risers and perform the four-line release as required. If parachute landing is to be made in open areas or water, the seat kit automatic release function may be used followed by manual release as back-up during descent. If landing will be in trees, the seat kit should be retained to avoid raft/kit and tree entanglement. When a water landing is expected, the life preserver unit (LPU) shall be inflated prior to landing.

After Landing

Upon landing, the parachute risers should be released to preclude dragging. If landing will be in trees during daylight, release the parachute risers only after hooking up the personnel letdown device. If landing will be in water, release the parachute risers immediately upon touchdown and swim clear of the descending canopy to avoid riser/canopy entanglement. Retrieve the life raft, inflate manually by pulling lanyard if necessary and board as soon as possible. Retrieve all equipment and secure as required to prevent loss. Turn off the personnel locator beacon.

WARNING

If automatic seat separation does not occur after parachute deployment, DO NOT RELEASE LAP BELT. Land seated with legs extended and slightly bent at the knees. If landing in water, release lap belt and parachute riser release fitting upon water entry. Survival kit release and raft inflation should then be accomplished as soon as possible since the LPU may not support the added weight of a water-soaked kit.

ELECTRICAL FIRE

Circuit breakers and fuses isolate most electrical circuits, automatically interrupting power to prevent fire in the event of a short circuit. If electrical fire does occur, usually accompanied by acrid fumes, ozone smell, and smoke, go to 100 percent oxygen, if available, and proceed as follows:

1. Generators–OFF.

2. BATTERY switch–OFF.

3. RAM AIR knob–PULL FULL OUT.

4. All electrical equipment–OFF.

5. BATTERY switch–ON.

6. Generators–RESET separately.

7. Voltammeter–CHECK during generator reset.

8. Defective equipment–ISOLATE.

   a. Turn on electrical equipment individually while checking ammeter for a high load.

   b. Turn defective equipment off and leave off.

SMOKE OR FUMES ELIMINATION

If smoke or fuel fumes enter the cockpit, go to 100 percent oxygen, if available, and proceed as follows:

1. BLEED AIR–EMERG OFF.
2. RAM AIR knob–PULL, as desired.
3. Cockpit air vents–OPEN.
4. If electrical fire is suspected, refer to ELECTRICAL FIRE, in this section.

WARNING

All odors not identifiable by the flight crew shall be considered toxic. GO TO 100 PERCENT OXYGEN, if available. Properly ventilate the aircraft and land as soon as practicable. Do not take off when unidentified odors are detected.

OIL SYSTEM FAILURE

Impending failure of an engine oil system may be indicated by fluctuating or abnormal oil pressure, engine rpm, and torque. Should impending failure of an oil system be suspected, the affected engine should be shut down as soon as possible. Loss of oil pressure eventually results in initiation of automatic feathering of the propeller accompanied by uncontrolled rise in temperature. Intentionally placing the condition lever to FEATHER provides an earlier and a smoother propeller feathering drag transient than that produced by the torque sensing system. If oil system failure occurs, proceed as follows:

1. Condition lever–FEATHER.
2. Power lever–FLIGHT IDLE.
3. Land as soon as practicable.

FUEL SYSTEM FAILURES

Fuel Boost Caution

Illumination of a FUEL BOOST caution light indicates reduced output of the respective fuel boost pump. Should one or both lights come on, ejector pump transfer may not be available (descent to lower altitude may correct problem). Proceed as follows:

1. FUEL GAGE SELECT–FEED.
2. Plan to land before feed tank quantity reaches FUEL FEED warning, regardless of total fuel on board.

Fuel Feed Warning

Illumination of the FUEL FEED warning light indicates that the level of fuel in the engine feed tank has dropped to approximately 50 pounds, and may indicate that only this amount of fuel is usable before flame-out will occur. Should the FUEL FEED warning light illuminate, proceed as follows:

1. Power levers–RETARD to minimum practical torque and rpm and reduce speed to obtain a nose-high attitude.
2. Remain at current altitude until a suitable landing area is accessible.
3. Land as soon as possible, using a flame-out landing.
4. Monitor feed tank quantity, and prepare for complete flame-out.

External Tank Transfer Failure

Should fuel from the external tank fail to transfer, the electrically driven transfer pump has likely cavitated. Operation of the pump may be regained by moving the EXT FUEL TRANS switch repeatedly from OFF to ON and/or porpoising the aircraft. External tank fuel is not recoverable in the event of a failed pump.

REDUCED SPOILER SYSTEM FAILURE

If the spoiler system light SPOILER AUTH illuminates, determine by full lateral stick deflection, at moderate speed (180 to 200 KIAS) whether spoiler authority has been reduced. If spoiler authority has been reduced, approximately

40 percent of normal roll control is lost. Caution should be taken to avoid conditions requiring high roll response, and crosswind component for landing is limited to 10 knots.

CANOPY OPEN IN FLIGHT

1. Airspeed–REDUCE TO 90 KIAS.
2. FLAP handle–T/O.
3. Canopy–CLOSED, if possible.

Note

Yawing toward the open canopy will reduce the force required to close and lock the door (left door–left rudder).

CAUTION

If canopy is lost in flight, slow flight the aircraft for handling characteristics before landing.

WARNING

Rear cockpit occupant should never attempt to close canopy in flight due to proximity to propeller.

4. Land as soon as practicable.
5. Approach speed–10 KIAS ABOVE NORMAL.

MAXIMUM GLIDE

The maximum glide distances available with both propellers feathered are shown in figure 3-2. These distances are obtained under no-wind conditions by maintaining 130 KIAS. When this speed is maintained, the glide ratio of the clean aircraft is approximately 11 to 1. Thus, for every 5000 feet of altitude lost, about 9 nautical miles are covered.

Note

With the landing gear extended, glide distance is reduced to approximately 6 nautical miles per 5000 feet.

LANDING EMERGENCIES

EMERGENCY LANDINGS

The "zero-zero" capability of the LW-3B ejection seat should always be considered when faced with an actual power-off emergency, especially at night, in weather, or over unknown terrain. A landing with complete loss of power should be attempted only under optimum conditions. If conditions (altitude is not available) or if factors of weather or terrain or operative engine power are such that a successful emergency landing is doubtful, ejection is recommended. If conditions are favorable, single-engine/flame-out landing may be attempted.

WARNING

- In the event of a complete electrical failure, landing gear emergency extension procedure will be required, flaps will be unavailable, and spoiler travel will be restricted.
- An attempted single-engine/flame-out landing behind another aircraft or in the vicinity of an operating helicopter is not recommended due to probable wake turbulence. When possible, request the recovery base controlling agency to terminate take-off and landings as early as possible to reduce the probability of wake turbulence. When it is necessary to land behind another aircraft, remain above its approach path and land beyond its touchdown point. Touch down before the lift-off point of a departing aircraft.

Note

The following minimum airspeeds are recommended if T/O flaps are extended. Increase these speeds 10 knots if flaps are not lowered.

GROSS WEIGHT	KIAS	N/F
10,000 and below	100	110
11,000	110	120
12,000	115	125

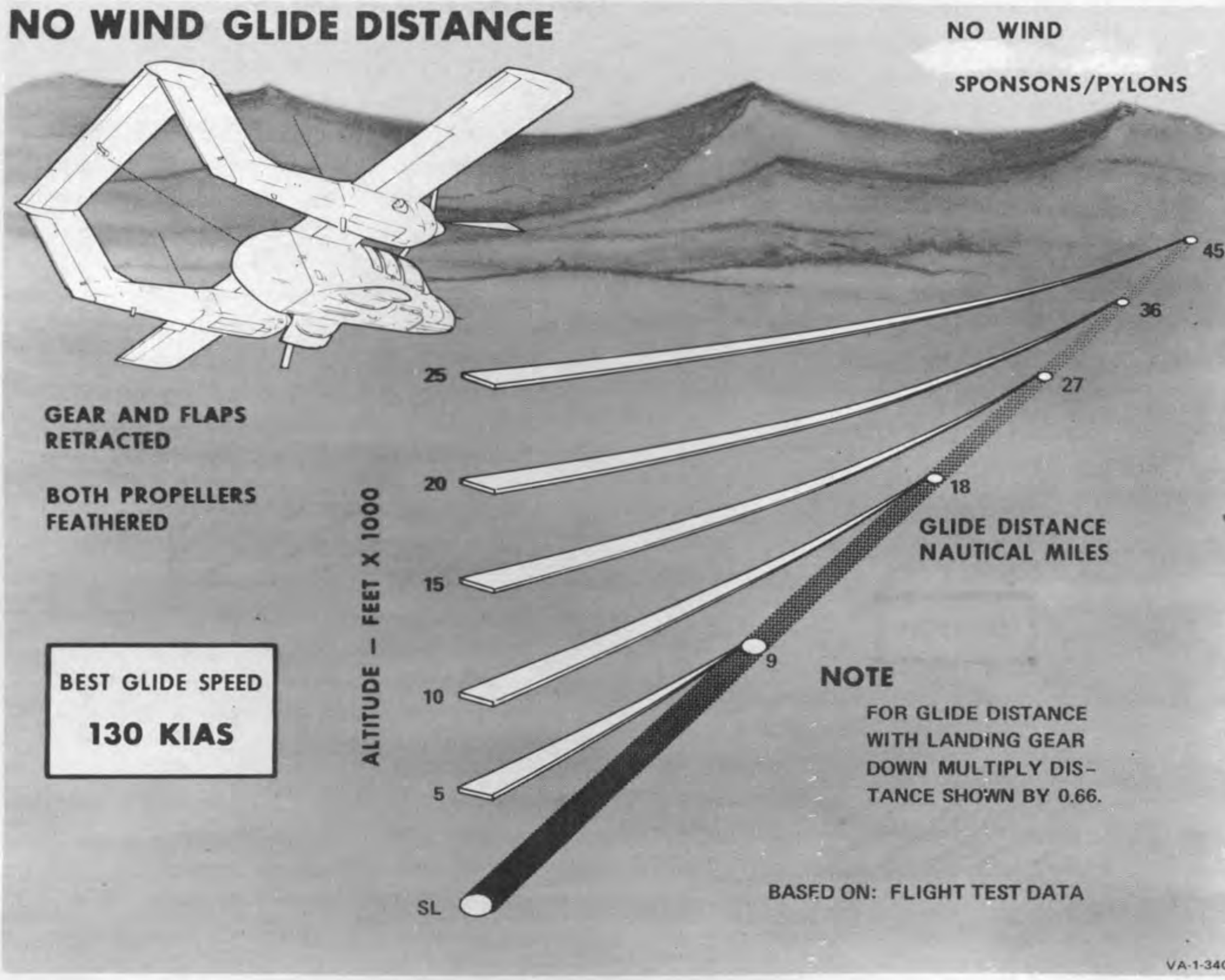

Figure 3-2

FLAME-OUT LANDING

The recommended flame-out landing is depicted in figure 3-3. The pattern should be established to enter at the high-key point, however the pattern may also be initiated at either low key or base as altitude permits. Attempt to complete all air start efforts before reaching high key so that full attention may be given to accomplishing a successful flame-out landing. Further air starts may be attempted but primary attention should be devoted to proper execution of the landing.

Note

This does not preclude air start attempts when flame-out occurs below low key.

Approach to High Key

1. Complete BEFORE LANDING checklist through step 4.
2. Airspeed–130 KIAS.

High Key

High key should be at 2500 feet AGL minimum and slightly to the side of the intended touchdown point. Upon arrival at high key, accomplish the following:

1. Gear–DOWN, as required.
2. Flaps–AS REQUIRED.
3. Airspeed–100 KIAS minimum.

TYPICAL FLAME-OUT LANDING (10,000 POUNDS)

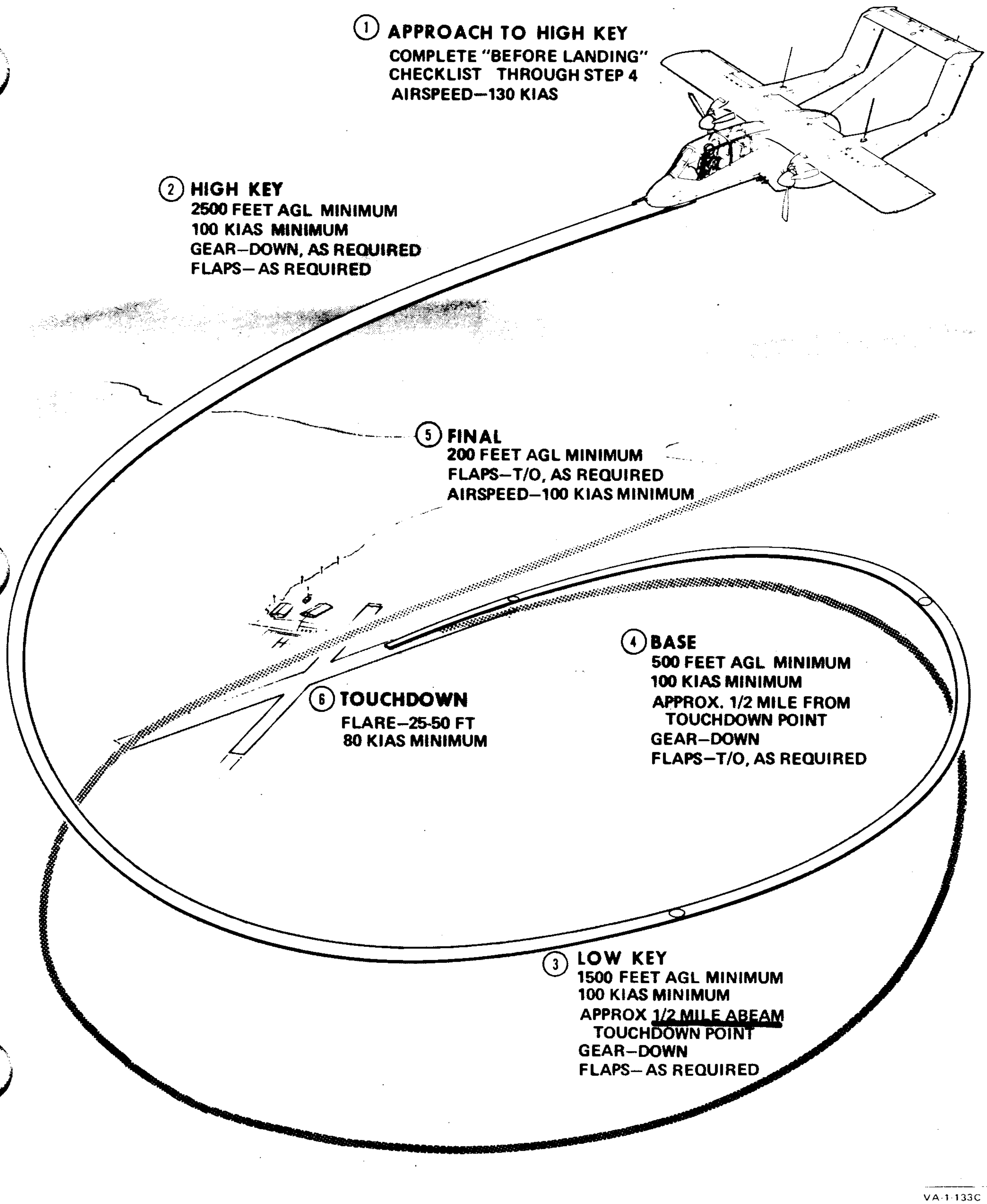

Figure 3-3

Note

- Gear and flaps may be delayed as required.
- Establish approximately 25 degrees of bank, depending on wind conditions, to arrive at the optimum low key point.

Low Key

Low key should be approximately 1/2 mile abeam the touchdown point at 1500 feet AGL minimum. Continue the turn, airspeed 100 KIAS minimum.

Base

The base is approximately 1/2 mile from the intended touchdown point at 500 feet AGL minimum. On base, vary angle of bank as required to line up with the runway. Airspeed 100 KIAS minimum.

Final

The aircraft should be aligned with the runway at 200 feet AGL minimum. Slipping, or "S" turns may be used to dissipate excess altitude. Airspeed 100 KIAS minimum until flare.

Touchdown

Flare should be started at 25 to 50 feet AGL and airspeed decreased to 80 KIAS minimum.

SINGLE-ENGINE LANDING

The recommended single-engine landing is presented in figure 3-4. The pattern should be established to enter a downwind; however, this does not preclude entry on a base leg or accomplishing the landing from a straight-in approach. The recommended pattern maneuvering airspeed is 120 KIAS minimum. Shallow bank angles should be used during all turns.

Approach to Pattern

1. Complete BEFORE LANDING checklist through step 4.
2. Set the rudder trim at neutral and exert the necessary rudder pressure for coordinated flight. Maintaining the rudder trimmed for asymmetric power will cause adverse yaw at touchdown.

Downwind

1. Establish downwind approximately 1 mile from the runway.
2. Pattern altitude 1000 feet AGL minimum.

Base

1. The base leg should be established approximately 1 mile from the intended touchdown point.
2. Gear—DOWN.
3. Flaps—AS REQUIRED.

WARNING

Level flight may not be maintained with the landing gear extended under certain gross weight/OAT conditions. If level flight is required under these conditions, the gear may be delayed until the landing is assured.

Final

1. Minimum airspeed—100 KIAS.
2. Flaps—AS REQUIRED.
3. Intercept the VASI glide slope, if available.

Note

If continued operation of the remaining engine is in doubt, use of the overhead flame-out landing pattern should be considered.

SINGLE ENGINE LANDING PATTERN (TYPICAL)

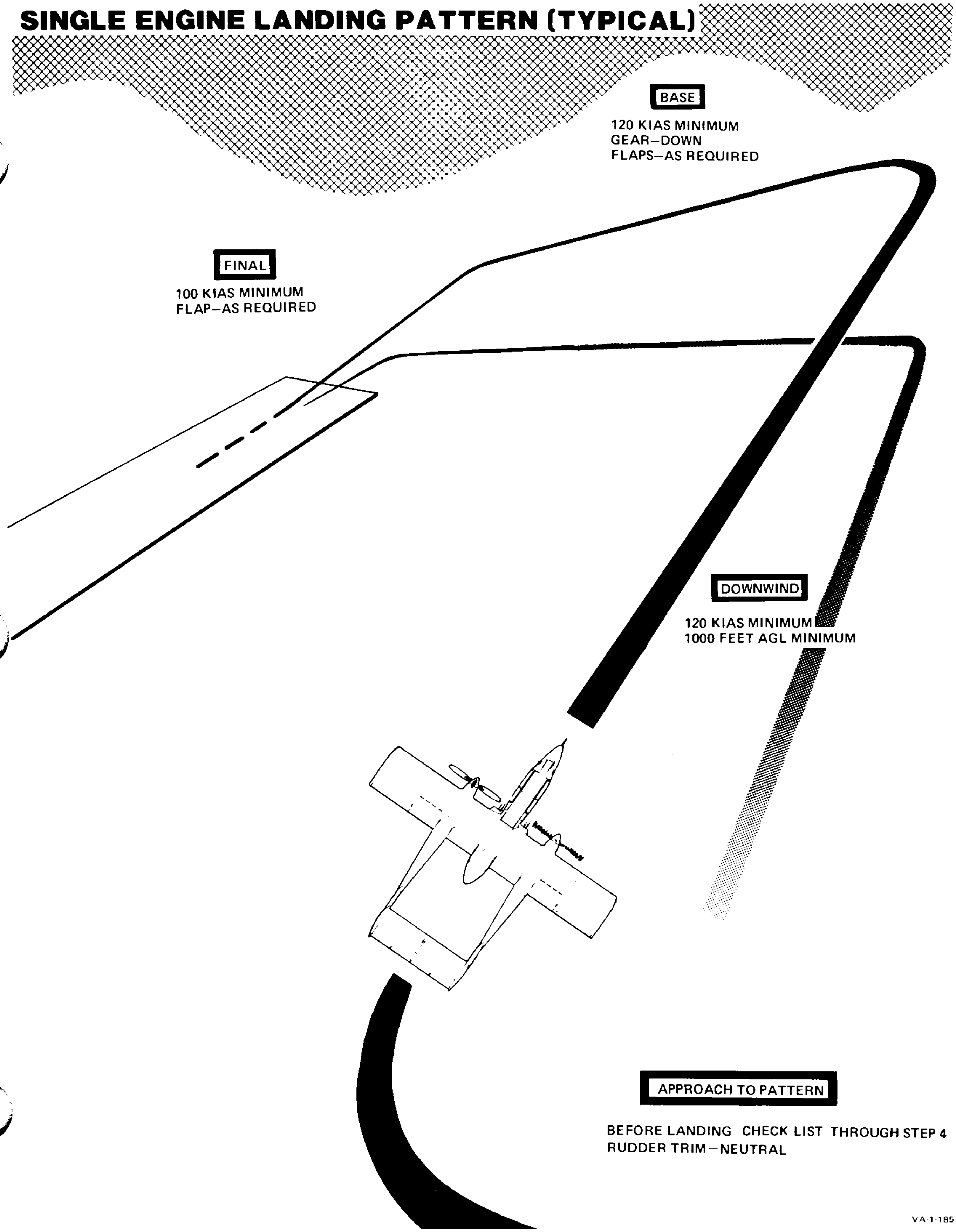

Figure 3-4

LANDING GEAR EMERGENCY EXTENSION

Emergency extension of the landing gear is accomplished by using the normal procedure, with the following additions:

1. Landing gear handle–DOWN, below gear limit speed (above 120 KIAS).
2. Airspeed–REDUCE TO 120 KIAS.
3. Increage "g" if required to lock main gear.

WARNING

Gear cannot be raised after emergency extension, if hydraulic system has failed.

LANDING WITH UNSAFE GEAR

The capability of the landing gear to extend by gravity and bungee force should make the instance of unsafe or partial landing gear emergencies a rarity. If an unsafe condition is indicated, have the gear visually checked and proceed with the applicable procedure.

Note

If conditions such as runway length, fire fighting and rescue equipment are not favorable, consider ejection rather than a hazardous landing attempt.

Unsafe Gear Indication or Confirmed Unsafe Nose Gear

1. Stores–JETTISON.
2. Shoulder harness–LOCKED.
3. Make a normal landing approach.
4. Nose gear STEER button–DEPRESS just prior to touchdown.
   Hold button depressed until gear safety pins are installed or a gear collapses.
5. Condition levers–FEATHER, just prior to touchdown.

Note

An increase in airspeed is likely due to feathering.

WARNING

If nose gear collapses, DO NOT USE BRAKES. Gently lower nose to runway prior to loss of elevator control.

Land straight ahead. Stop aircraft and install gear pins prior to moving aircraft.

6. BATTERY switch–OFF.

Main Gear Unsafe with Nose Gear Up or Down

In the event of a confirmed unsafe main gear, the landing area should be foamed and gear-up landing should be made. If this condition exists, proceed as follows:

1. Gear–UP.
2. Stores–JETTISON.
3. Shoulder harness–LOCKED.
4. BATTERY switch–OFF.
5. Condition levers–FEATHER, prior to touchdown.
   Plan to touch down just short of foam, if applied.

DITCHING

Ditch only as a last resort. Deceleration forces will be quite high. These forces may cause disintegration of the windscreen and canopy resulting in possible injuries to crew members. The aircraft can also be expected to sink rapidly as forward motion is lost. Safety studies show that when compared to ditching, ejections offer much higher chances of survival. Therefore, ditching is recommended only in the event ejection is not possible. If ditching is unavoidable, proceed as follows:

1. Follow radio distress procedure.

2. Stores–JETTISON.

3. Loose equipment–STOW.

4. G-suit hose and communications cord–DISCONNECT.

5. Survival kit straps and lap belt–CHECK TIGHT.

6. Oxygen–100% OXYGEN, if used.

7. Gear–UP.

8. FLAP handle–DOWN.

9. Shoulder harness–LOCK.

10. Fly power-on approach, if possible.

Note

Use normal approach speeds to maintain full control. Unless wind is high or the surface is rough, plan to approach parallel to the swell pattern and attempt to touch down along a wavecrest just after the crest passes. If high wind or rough surface prevails, best procedure is to approach into the wind, attempting to touch down on the falling side of a wave.

11. Condition levers–FEATHER, before impact.

12. Continue to "fly" the aircraft until forward motion stops.

13. Oxygen masks–OFF.

14. Lap belt–OPEN.

15. Parachute riser quick-release fittings–RELEASE.

WARNING

Releasing the lower (ejector snap) fittings results in departure from the aircraft without the survival kit. Do not pull release handle on "KOCH" survival kit, as contents will be left in the aircraft.

16. Canopy–OPEN.

17. Abandon aircraft.

BRAKE FAILURE

Should a single brake failure occur during landing, allow a free landing ground roll if runway length permits. Use rudder/nose wheel steering for directional control and reverse thrust as required to stop the aircraft. Should complete failure of the brake system occur, proceed as follows:

1. Use rudder and nose wheel steering (if available) for directional control.

2. Use reverse thrust to stop, modulated as required to assist directional control.

3. Wheels–CHOCKED.

4. Condition levers–FEATHER.

CAUTION

Do not attempt to taxi the aircraft with partial or complete brake failure.

OTHER LANDING EMERGENCIES

TIRE FAILURES

Tire failures rarely occur when proper preflight inspections are accomplished and recommended landing and braking techniques are used. Following a tire failure, directional control and braking present the greatest problems. Aircraft structural damage, broken lines, and related fire potential must also be considered. The degree of difficulty depends on such variables as gross weight, speed, which tire fails, and availability of effective nose wheel steering. The following information is presented to assist in coping with each individual situation.

Note

Nose wheel steering may prove entirely ineffective during rollout with tire failure.

Nose Tire Failure on Landing

For landing with a failed nose tire, gross weight should be reduced as much as practical and normal approach and touchdown accomplished. Maintain directional control with rudder and light differential braking while using reverse thrust to stop. Nose wheel steering may be completely ineffective with a flat or shredded nose tire. Reverse thrust will lighten loads on the nose gear as speed decreases.

Main Tire Failure on Landing

For landing with a failed main tire, reduce gross weight as much as practical and make a normal approach, planning to touch down on the side of the runway opposite the failed tire. After touchdown, apply firm forward stick pressure and use rudder/nose wheel steering, differential reverse thrust and light braking to control and stop the aircraft. Heavy braking to intentionally fail the remaining main tire is not recommended.

CAUTION

Left main tire failure may damage the ground safety switch linkage causing loss of nose wheel steering and the extension of the reverse gate solenoid.

FLAP ALTERNATE OPERATION

In the event the flaps fail to respond to normal selection, depress the nose wheel STEER button. If the flaps remain inoperative, proceed as follows:

1. FLAP handle–HOLD.

2. ALT FLAPS switch–AS REQUIRED.
   Place ALT FLAPS switch in UP, DOWN, or move to HOLD as required.

Note

Alternate extension of flaps may require up to 1 minute.

ASYMMETRICAL FLAP CONDITION

In the event an asymmetric flap condition develops, attempt to correct the situation by reversing the wing flap lever. If the condition is corrected by this method, do not attempt to change flap settings and recover. Aircraft control can be maintained under the worst condition of one side flaps fully extended by use of differential power, full aileron, and large rudder deflections. Perform a controllability check.

MISCELLANEOUS EMERGENCIES

TRIM SYSTEMS FAILURE

Failure or runaway of a normal trim system (pitch, roll, or rudder) requires that the ALT position of the TRIM SELECT switch be selected, and that only the alternate trim switches be used. Should trim failure be encountered, proceed as follows:

1. TRIM SELECT switch–ALT.

2. Alternate trim switches–TRIM, as required.

CAUTION

Failure of both the normal and alternate pitch trim systems may require excessive control pressures. Perform a controllability check to determine the best aircraft configuration and airspeed for landing.

HYDRAULIC SYSTEM FAILURE

Failure of the hydraulic system, due to either pump malfunction or a broken line, would be noted by failure of the gear to retract or the flaps to operate on selection and illumination of the HYD PRESS warning light on the pilot's service panel. Should this occur, the nose wheel STEER button should be depressed to check for failure of a normal gear or flap electrical circuit. If systems operate normally through the nose wheel STEER button, failure due to an electrical circuit malfunction has occurred. In the event of pump failure or hydraulic fluid loss, landing gear emergency extension and alternate flap extension procedure must be used.

CAUTION

Retraction of the landing gear must not be attempted with hydraulic system failure.

Hydraulic Pump Shutoff Failure

If the hydraulic pump fails to shut off, proceed as follows:

1. HYD PUMP CONT circuit breaker–PULL.

Note

Power may be temporarily restored to the system to lower gear and flaps and then removed again.

WARNING

Failure of the hydraulic pump to stop running after a hydraulic demand will result in overheating the pump and fluid, eventually causing pump failure or loss of fluid into the cargo bay presenting a fire hazard. The hydraulic pump should not be allowed to run continuously.

GENERATOR FAILURE

Should one generator fail, the applicable GEN caution light will illuminate, and, on selection of the applicable ammeter select (AM SEL) switch position, the voltammeter reads 0 volts. In this case, all electrical loads are being supplied by the remaining generator. In the event of a generator failure, proceed as follows:

1. Reduce electrical load.

2. Applicable generator–RESET.

3. If generator will not reset–TURN OFF GENERATOR AND LAND AS SOON AS PRACTICABLE.

BOTH GENERATORS OUT

Should failure of both generators occur, all equipment serviced by the monitor buses is deenergized and all power is provided by the batteries and the No. 1 inverter. Proceed as follows:

1. All unnecessary electrical equipment–OFF.

2. Generators–RESET.

3. If neither generator will reset, turn off both generators and land as soon as possible.

4. BATTERY switch–EMERG, as required.
   EMERG recovers secondary bus powered equipment through battery power.

Note

- Assuming fully charged batteries, emergency power for essential systems is available for 60 minutes. This includes interior lights, anti-collision light, inverter and UHF radio ON, and communicating 1 minute out of each 5-minute period.

- Placing the landing gear handle in the down position also restores secondary d-c bus power.

INSTRUMENT POWER FAILURE

Failure of the primary a-c bus is indicated by illumination of the INST PWR caution light and failure of BDHI. Should the INST PWR caution light illuminate, proceed as follows:

1. INST PWR switch–INV NO. 2.

Note

Failure of the No. 2 inverter results in loss of TACAN and illumination of the INST PWR caution light on selection of INV NO. 2.

ENGINE CHIP DETECTOR

If chip detector light illuminates, monitor for further indications of impending engine failure and land as soon as practical. When engine operation is no longer required for a safe landing, shut down the engine.

CARGO BAY DOOR OPEN IN FLIGHT

If aircraft exhibits low-frequency oscillations and/ or cargo bay noises, the cargo bay door may be open. Land as soon as possible.

STRUCTURAL DAMAGE/ CONTROLLABILITY CHECK

In the event of structural damage, or when aircraft controllability is in question, a landing configuration control speed check shall be accomplished at or above 3000 feet AGL. Slow the aircraft to a minimum airspeed of 100 KIAS. The minimum approach speed will be 10 KIAS higher than the observed minimum control speed, or 100 KIAS, whichever is higher.

EMERGENCY JETTISON

Methods of jettison are as follows:

1. STORES EMER REL button—PUSH.
   This button releases all external stores as long as battery bus power is available and the aircraft is airborne.

2. EMER ST JETT handle—PULL.
   This handle mechanically releases all external stores except the centerline store on the ground or in flight.

Note

If any external store has not been released after use of the preceding procedures, attempt to release it by use of the normal select drop system. During emergency jettison, all stores should be dropped unarmed.

WARNING, CAUTION, AND ADVISORY LIGHT FUNCTIONS

Warning, caution, and advisory light functions and corrective action to be taken are shown in figure 3-5.

EMERGENCY RESCUE

For emergency rescue procedures, see figure 3-6.

WARNING, CAUTION, ADVISORY LIGHT FUNCTIONS

LIGHT	CONDITION	CORRECTIVE ACTION
WHEELS WARNING	ANY GEAR NOT EXTENDED AND LOCKED; EITHER CONDITION LEVER AT T.O./LAND AND: 1. POWER LEVERS RETARDED, OR 2. FLAPS EXTENDED 30 DEGREES OR MORE	ADVISORY
OVERTEMP WARNING	ENGINE TURBINE INLET TEMPERATURE ABOVE 996-1000°C	REDUCE POWER. LAND AS SOON AS POSSIBLE.
OVERTORQUE CAUTION	ENGINE TORQUE ABOVE 2200 POUNDS–FEET	RETARD POWER UNTIL TORQUE IS WITHIN LIMITS.
FIRE WARNING	OVERHEAT OR FIRE IN NACELLE	EXECUTE EMERGENCY PROCEDURE.
FUEL FEED WARNING	LESS THAN 50 POUNDS FUEL IN FEED TANK	LAND AS SOON AS POSSIBLE.
L CHIP, R CHIP WARNING	IRON-METALLIC PARTICLES ON CHIP DETECTOR	MONITOR ENGINE INSTRUMENT. LAND AS SOON AS PRACTICAL.
SPOILER AUTHORITY	SYSTEM MALFUNCTIONING IF LIGHT STAYS ON	ADVISORY
START IGN ON CAUTION	EITHER ENGINE STARTER ON OR IGNITION OPERATING	ADVISORY
L GEN, R GEN CAUTION	GENERATOR OFF LINE	RESET. IF GEN WILL NOT RESET, TURN OFF.
FUEL LOW CAUTION	LESS THAN 205-236 LBS FUEL IN CENTER WING TANK	REDUCE POWER. LAND AS SOON AS POSSIBLE.
INST POWER CAUTION	PRIMARY AC BUS POWER FAILURE	SELECT OTHER INVERTER.
L FUEL BOOST, R FUEL BOOST	FUEL BOOST PUMP MOTIVE FLOW OUTPUT LOW	LAND BEFORE FUEL FEED LIGHT ILLUMINATES.
EXT FUEL TRANSFER	FUEL FLOW LESS THAN 2 GPM	ADVISORY
IFF CAUTION	MODE 4 INTERROGATIONS RECEIVED BUT REPLIES NOT GENERATED	ADVISORY
LANDING GEAR UNSAFE (PILOT'S GEAR HANDLE)	GEAR NOT LOCKED IN SELECTED POSITION	RECHECK GEAR
HYDRAULIC PRESSURE	LESS THAN 200 PSI ON DEMAND	ADVISORY
HYDRAULIC PUMP	HYDRAULIC PUMP OPERATING	ADVISORY

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Figure 3-5

EMERGENCY RESCUE

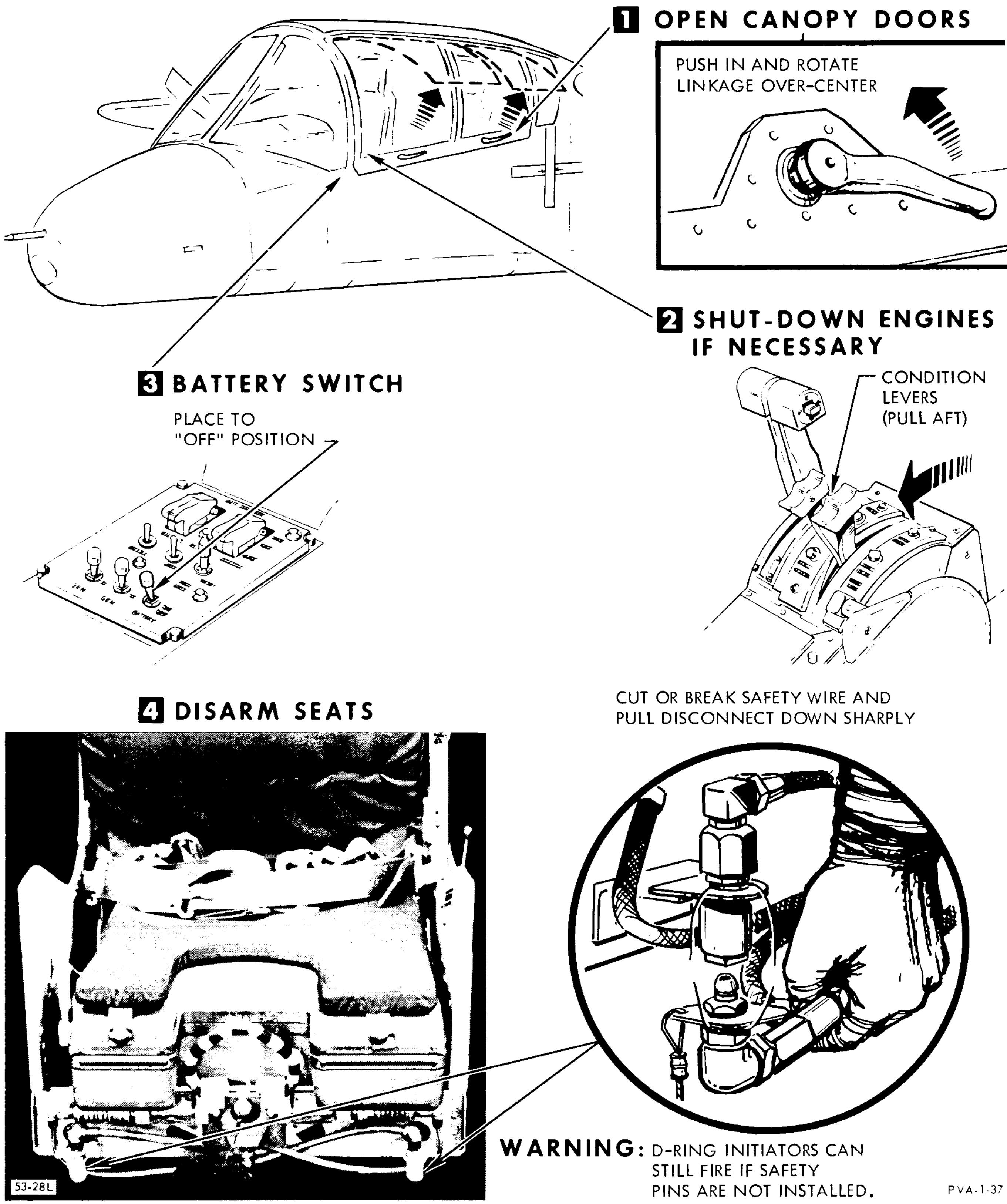


Figure 3-6 (Sheet 1 of 2)

5 DISCONNECT CREWMEN

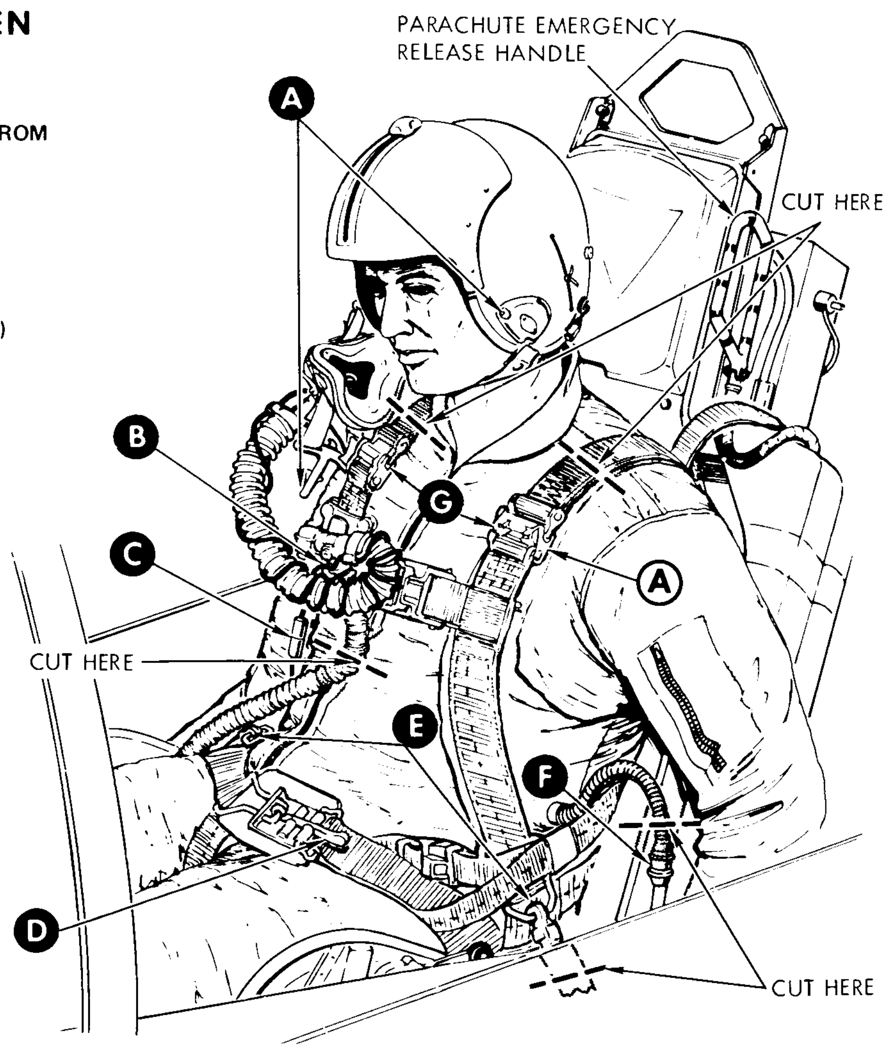
- A REMOVE MASK, IF WORN
- B PULL AIRCRAFT OXYGEN HOSE FROM HARNESS ADAPTER FITTING
- C DISCONNECT RADIO CORD
- D OPEN LAP BELT
- E OPEN KIT FITTINGS BY PULLING DEPLOYMENT HANDLE (R.H. SIDE)
- F DISCONNECT G-SUIT
- G RELEASE RISER FITTINGS

OR

CUT AT INDICATED LOCATIONS

WARNING

WHILE DISCONNECTING CREWMAN, AVOID INADVERTENTLY PULLING PARACHUTE EMERGENCY RELEASE HANDLE



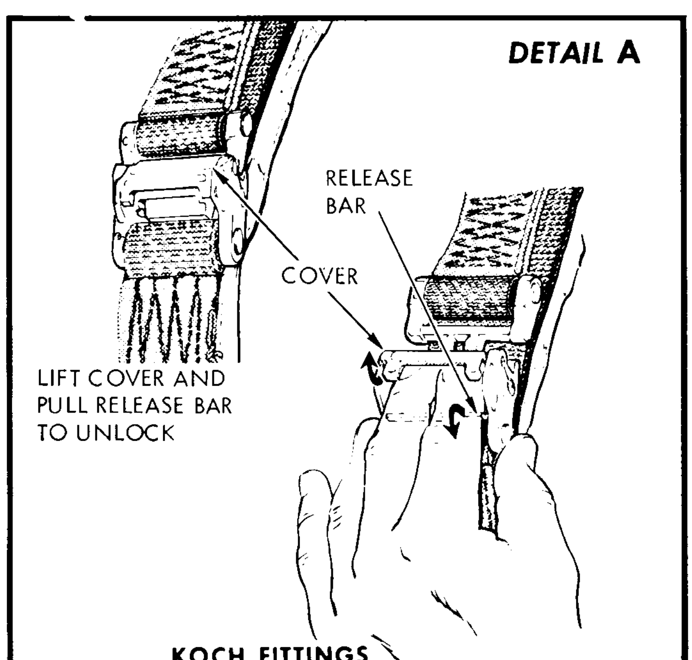


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Figure 3-6 (Sheet 2 of 2)

CREW DUTIES

SECTION IV – CREW DUTIES

Not applicable to this aircraft.

OPERATING LIMITATIONS

SECTION V — AIRCRAFT OPERATING LIMITATIONS

TABLE OF CONTENTS

INTRODUCTION

This section presents operating limitations applicable to military aircrews.

INSTRUMENT MARKINGS

Instrument markings are presented in figure 5-1.

ENGINE LIMITS

IGNITION SYSTEM LIMITS

The ignition system duty limits are 2 minutes ON, 3 minutes OFF, 2 minutes ON, and 23 minutes OFF.

STARTER LIMITS

The engine starters are limited to four consecutive, 15-second motoring periods with a 1-minute cooling period between attempts. A fifth motoring attempt must be preceded by a 5-minute cooling period.

MILITARY POWER

Military power is defined as the maximum power available which does not exceed the limits of 101% rpm, TIT/EGT, or torque. See figure 5-1. Operation at Military power is restricted to a maximum of 30 minutes.

Note

> Military power may be attained at less than full-forward power lever position and is dependent on ambient conditions and engine or power management system adjustments.

NORMAL POWER

Normal power is defined as the maximum continuous power available which does not exceed the non-time-limited values of either TIT/EGT or torque. See figure 5-1.

RPM LIMITS

For engine rpm limits, see figure 5-1. RPM is not time-limited up to 101%. Operation between 101% and 103% is limited to 1 minute regardless of torque setting. If 103% rpm is exceeded in flight, reduce torque to minimum practical and land as soon as feasible. An engine inspection must be accomplished if any of these limits are exceeded.

ENGINE TEMPERATURE LIMITS

The amount and duration of any engine overtemperature operation must be recorded so that the prescribed engine inspection can be performed.

Turbine Inlet Temperature

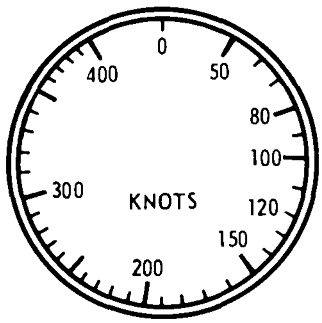
For engine turbine inlet temperature (TIT) limits, see figure 5-1.

Turbine Inlet Temperature Rejection Limits

The maximum allowable (TIT) is 1004°C. Any steady-state reading (more than 5 seconds) at a temperature of 1005°C or above, or transient above 1020°C, is cause for engine rejection.

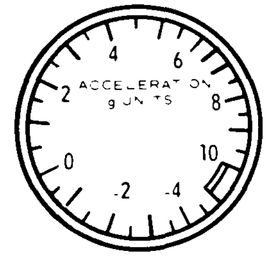
INSTRUMENT MARKINGS

AIRSPEED INDICATOR



LIMIT - 350 KIAS

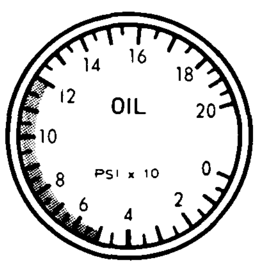
ACCELEROMETER



+6.5 (CLEAN) TO 9700 POUNDS

-1.0 (CLEAN) TO 9700 POUNDS

OIL PRESSURE INDICATOR

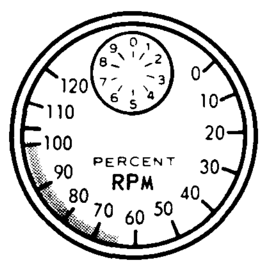


50 PSI (MINIMUM-IDLE RPM)

50–120 PSI (NORMAL RANGE)

120 PSI (MAXIMUM)

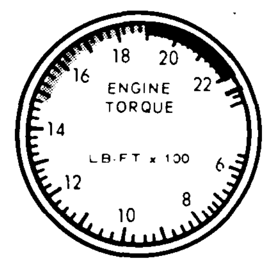
ENGINE RPM INDICATORS



101–103% 1 MINUTE

101% OR LESS NO LIMIT

ENGINE TORQUE INDICATORS

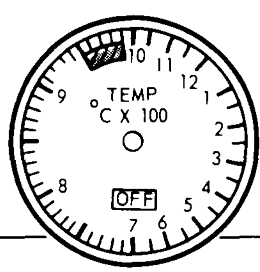


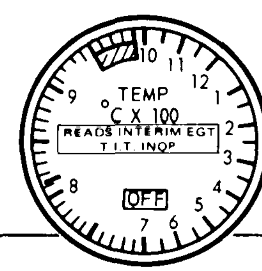
(shaded)	0-1878	NO LIMIT
(black)	1879-2200	30 MINUTES
	2200-2240	45 SECONDS

REVERSE THRUST TORQUE LIMITS

0-1680	NO LIMIT
1680-1926	5 SECONDS

TURBINE INLET TEMPERATURE INDICATORS





TIT OPERATIVE		EGT
1040°C (815°C EGT)	START PEAK EGT (1 SECOND LIMIT)	815°C
961°C OR LOWER	NORMAL POWER (NO TIME LIMIT)	543°C*
962°C - 1004°C	MILITARY POWER (30 MINUTE LIMIT)	544°C* - 581°C*
1020°C	ACCELERATION TRANSIENT LIMIT (5 SECONDS OR LESS)	593°C*

*For other than Standard Day conditions, refer to figures 5-2, 5-3 and 5-4 for EGT corrections.

VA-1-58C

Figure 5-1

Note

Starting TIT system peaks may reach a maximum of 1040°C for a 1-second maximum time. For other temperature and time limits, see figure 5-1.

Exhaust Gas Temperature Limits

Exhaust gas temperature (EGT) limits, and the corrections required for OAT, rpm, airspeed, and pressure altitude for aircraft not having turbine inlet temperature (TIT) incorporated, are shown in figures 5-2 through 5-4.

Note

The data (figures 5-2 and 5-3) are valid only for aircraft equipped with interim EGT systems. EGT limits must be corrected for OAT, rpm, airspeed, and pressure altitude. Refer to EGT LIMITS CORRECTION, in this section.

EGT Limits Correction

To derive EGT limits, see figures 5-2 and 5-4 and proceed as follows:

1. Using figure 5-2, determine the maximum allowable or maximum continuous (figure 5-3) limit EGT for existing ambient temperature and rpm.
2. Enter figure 5-4 with flight altitude and indicated airspeed to determine the amount and direction of the EGT limit correction.
3. Subtract or add the correction to arrive at the proper EGT limit.

EXAMPLE:

a. Ambient temperature—16°C (60°F).

b. Limit EGT at 100% rpm—581°C.

c. Altitude—5000 feet; IAS—300 knots.

d. Correction—25°C.

e. Corrected EGT limit—556°C.

Exhaust Gas Temperature Rejection Limits

Any steady-state reading (more than 5 seconds) above the maximum allowable temperature is cause for engine rejection. To determine transient temperature limit, add 12 degrees to all temperatures along each rpm line of figure 5-2. Temperatures above the transient limit are cause for engine rejection.

TORQUE LIMITS

Engine torque limits are shown in figure 5-1. Torque is not time-limited up to 1878 pound-feet. Operation between 1879 and 2200 pound-feet is limited to a 30-minute duration. Operation between 2201 and 2240 pound-feet is limited to 45 seconds for acceleration transients. If 2240 pound-feet is exceeded on the ground for any duration, shut down the engine. If 2240 pound-feet is exceeded in flight, reduce torque to minimum practical and land as soon as feasible. For reverse thrust operation, transient peaks to 1926 pound-feet are permissible for 5 seconds. Reverse thrust torque settings up to 1680 pound-feet are not time-limited.

WARNING

Maximum allowable torque indicator difference between engines is 250 pound-feet. Power on the high-torque engine may be reduced to obtain this difference if the average torque of the two engines meets the take-off torque requirements.

OIL PRESSURE LIMITS

Oil pressure limits are shown in figure 5-1. Minimum acceptable oil pressure is 50 psi at idle rpm and 90 psi at take-off power. Maximum oil pressure limit is 120 psi.

Note

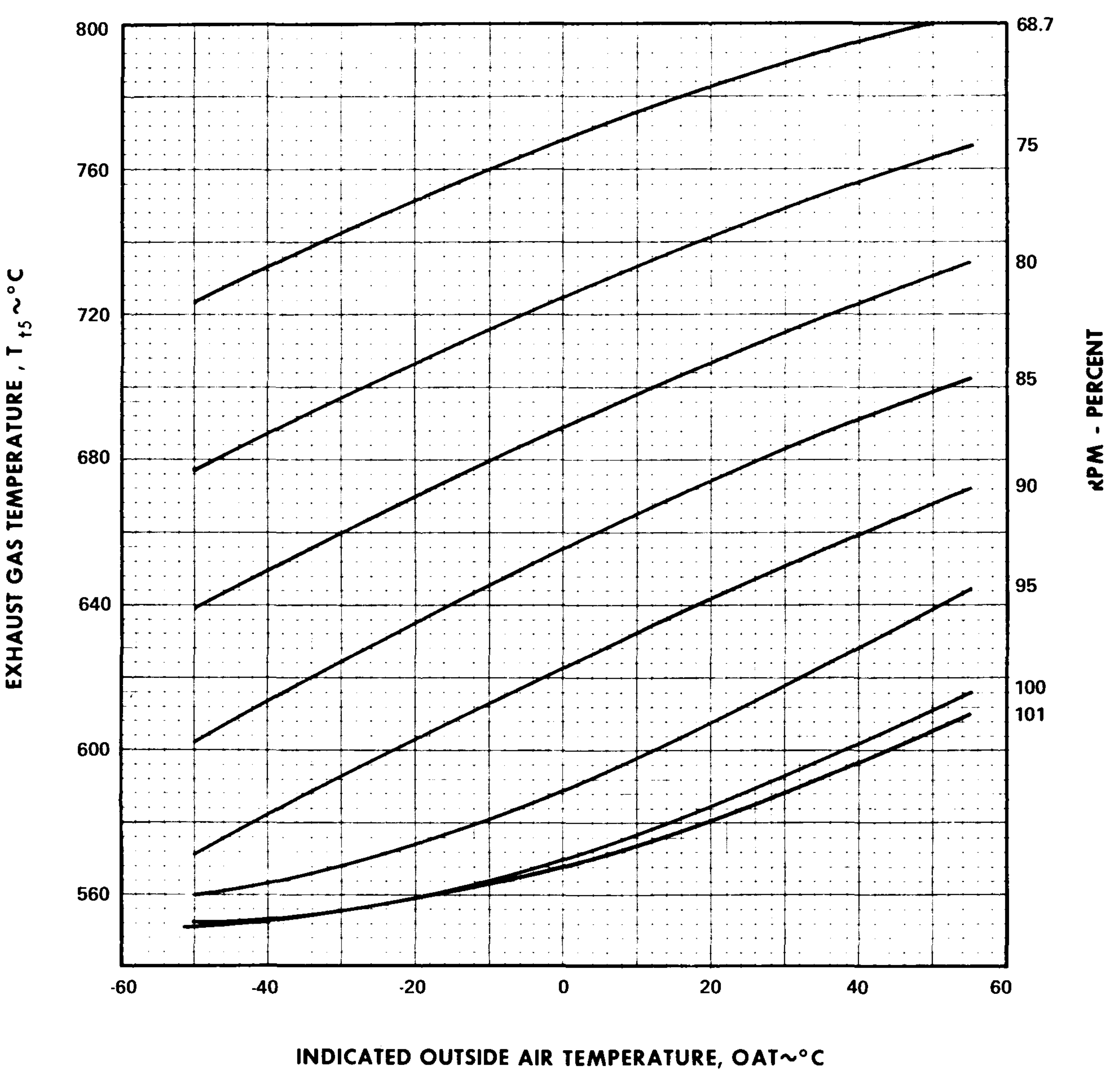
Small fluctuations in oil pressure are normal.

EGT LIMITS VS RPM AND OAT — MAXIMUM ALLOWABLE

DATA BASED ON: NR C-1099B
DATA AS OF: 15 JULY 68

ENGINES: T-76G-10/-12
FUEL: MIL-T-5624 (JP-4)

MAXIMUM ALLOWABLE EXHAUST GAS TEMPERATURE VARIATION STEADY STATE OPERATION - 30 MIN DURATION



NOTES:

1. To Determine Transient Temperature Limit, add 12°C to all Temperatures along each RPM Line.

2. See Figure 5-4 for Altitude and Airspeed Corrections.

VA-1-59C

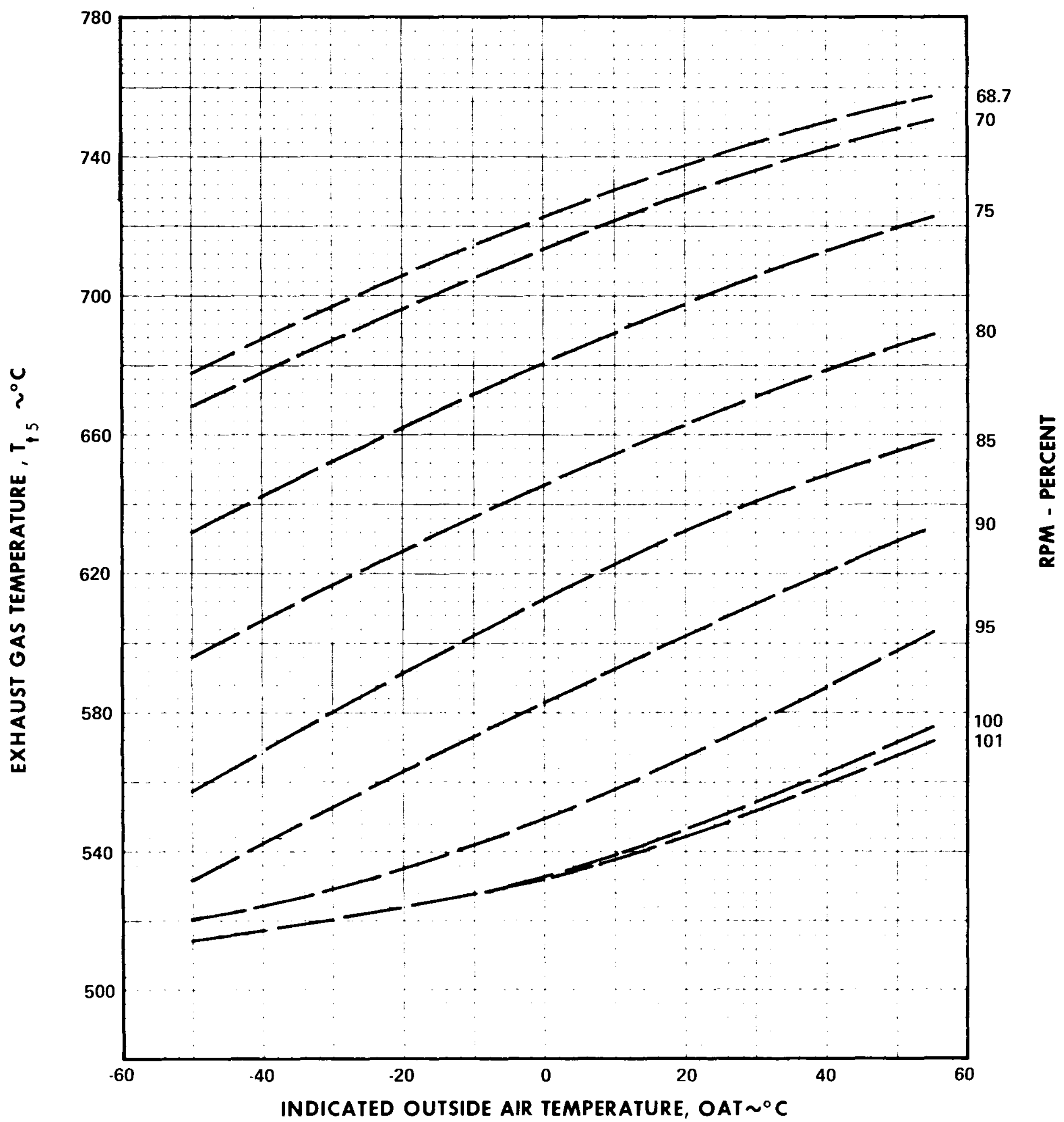
Figure 5-2

EGT LIMITS VS RPM AND OAT — MAXIMUM CONTINUOUS

DATA BASED ON: NR C-1099A
DATA AS OF: 12 FEBRUARY 68

ENGINES: T-76G-10/-12
FUEL: MIL-T-5624 (JP-4)

MAXIMUM CONTINUOUS EXHAUST GAS TEMPERATURE VARIATION STEADY STATE OPERATION



NOTES:

1. To Determine Transient Temperature Limit, add 12° C to all Temperatures along each RPM Line.

2. See Figure 5-4 for Altitude and Airspeed Corrections.

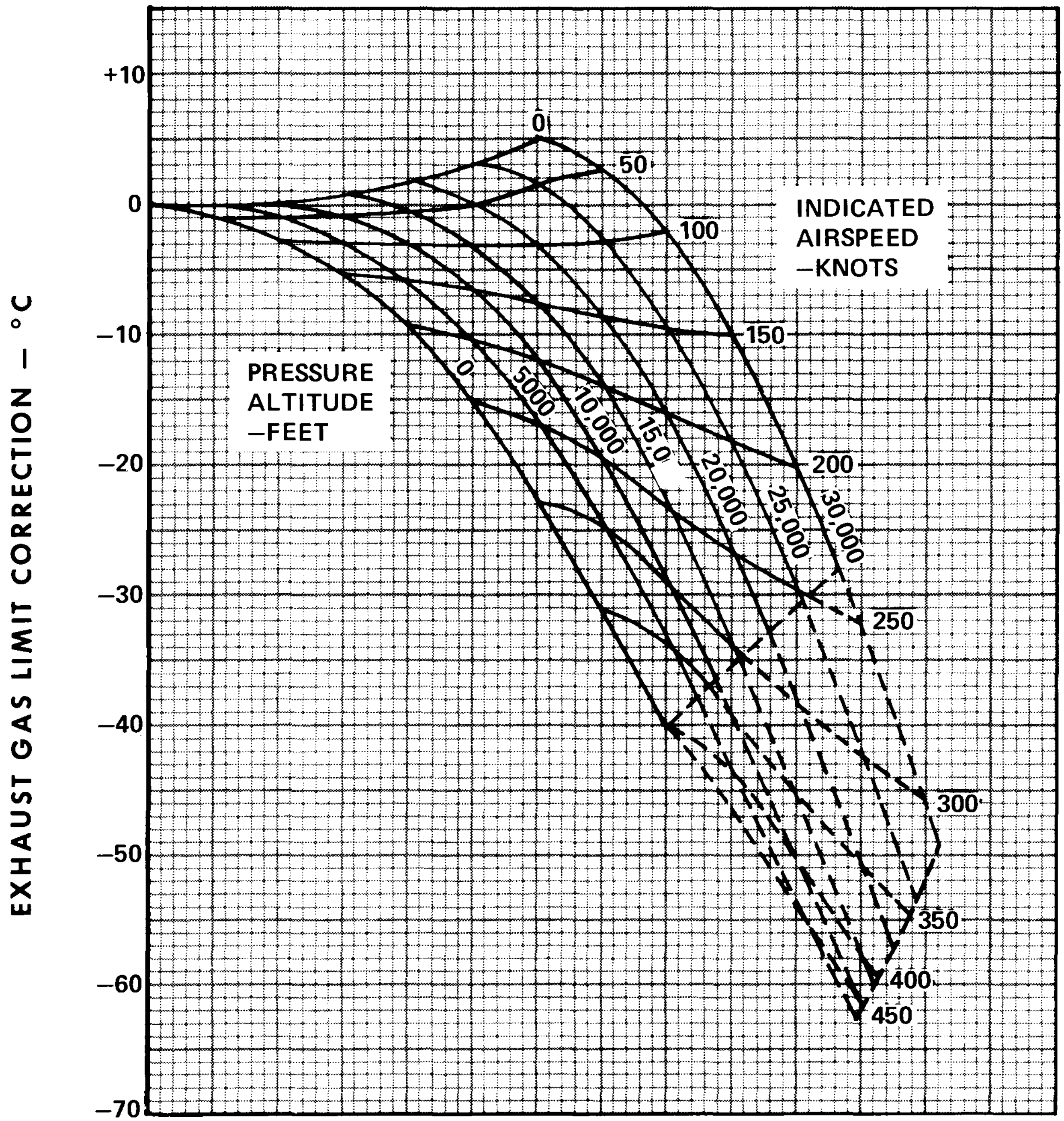
VA-1-113A

Figure 5-3

EGT LIMIT CORRECTION

EGT SYSTEMS

ENGINES: T-76G-10/-12
FUEL: MIL-T-5624 (JP-4)

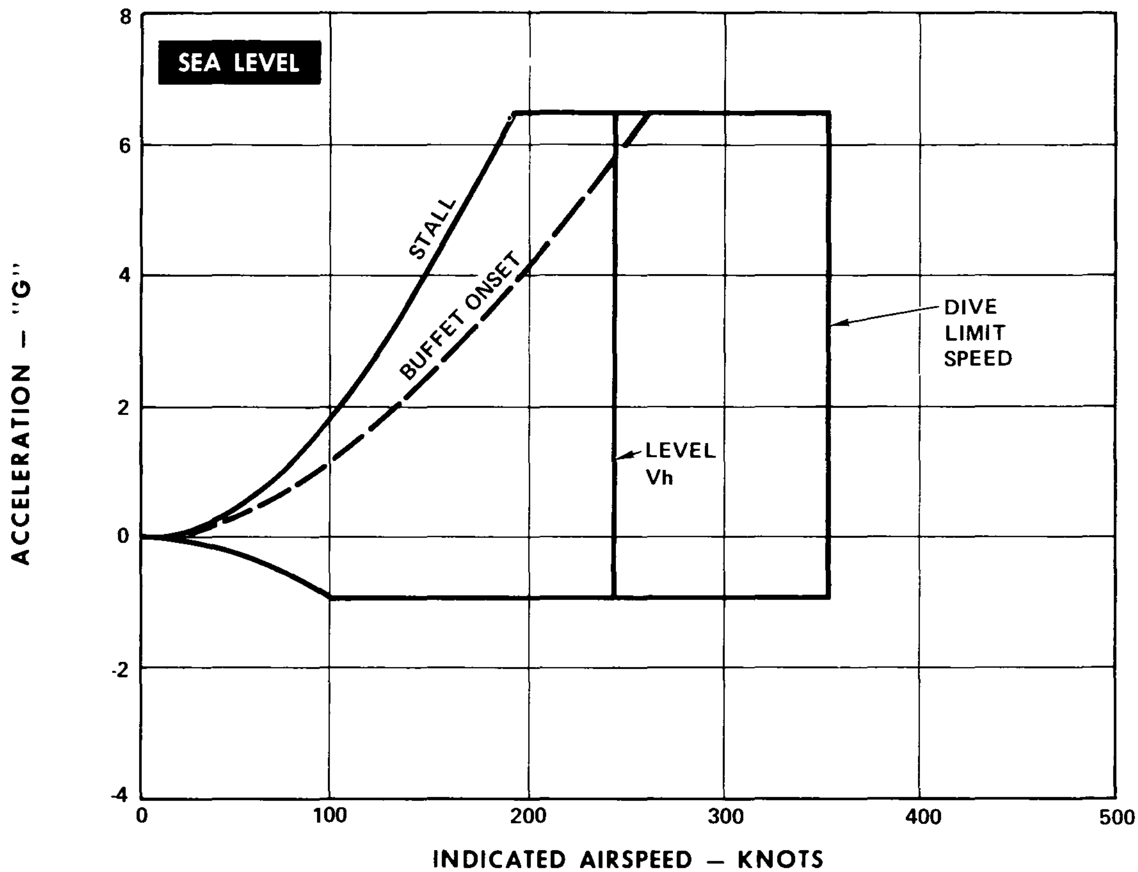


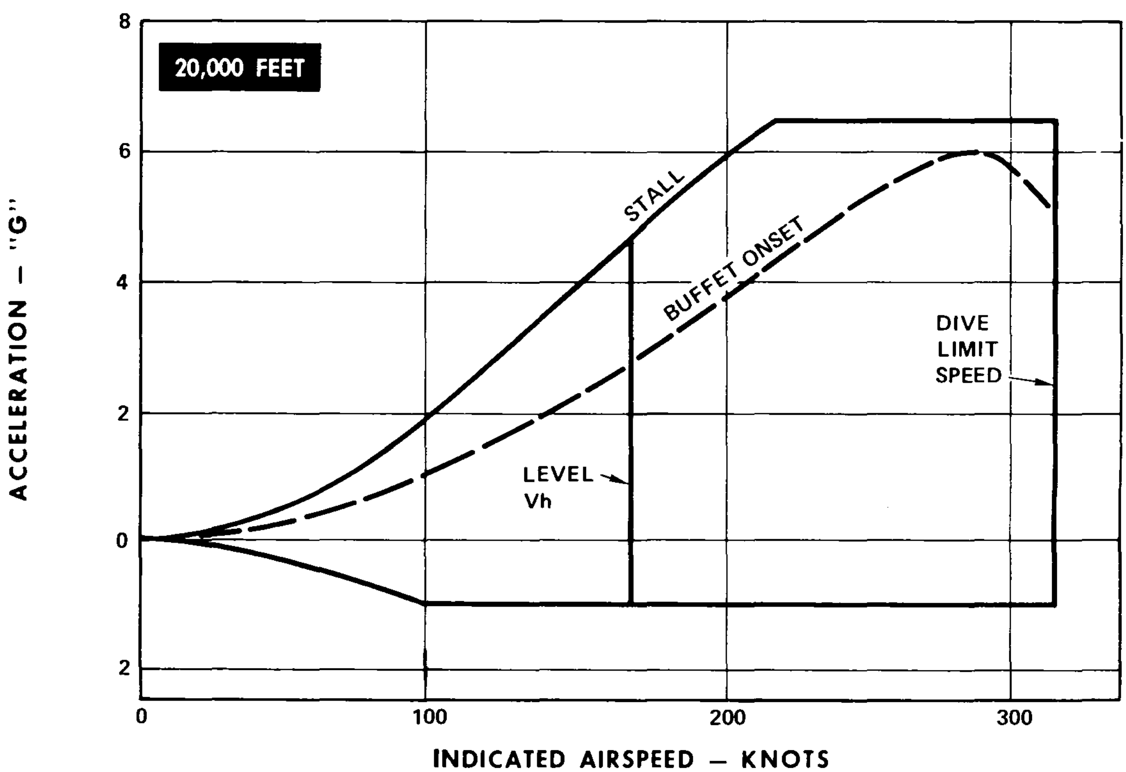
DATA BASED ON: NR C-1049
DATA AS OF: AUG 1967

VA-1-60B

Figure 5-4

V-N DIAGRAM





VA-1-61B

Figure 5-5

REVERSE THRUST LIMITS

Use of reverse thrust is prohibited in flight. The condition levers must be in the T.O./LAND position for all landings. After landing, when below 70 (100*) KIAS, partial reverse thrust may be used. If FULL REVERSE is required, proceed smoothly but rapidly to the FULL REVERSE condition (99% to 100% rpm) before modulating reverse thrust.

CAUTION

If rpm decreases to 94% during reverse thrust operation, power levers shall be immediately advanced to GROUND START to prevent further rpm decay and engine overtemperature.

HYDRAULIC OPERATION LIMITS

A 3-minute cooling period is required after 5 minutes of continuous nose wheel steering, or three continuous flap cycles, or three continuous landing gear cycles.

AIRSPEED LIMITS

MAXIMUM ALLOWABLE AIRSPEED

For operating flight limits, see figure 5-5. Maximum allowable airspeed is 350 KIAS.

LANDING GEAR LIMIT SPEED

Maximum speed for operation with the landing gear extended, extending, or retracting is 155 KIAS.

FLAP LIMIT SPEEDS

Maximum speed for flap extension to 20 degrees is 155 KIAS. Maximum speed for full flaps to 40 degrees is 130 KIAS.

LIMIT SPEED–CARGO DOOR REMOVED

For flights with the cargo door removed, airspeed is limited to 300 KIAS.

MINIMUM SPEEDS–NORMAL OPERATIONS

Take-off

Minimum speed for take-off with 20 degrees flaps is 85 KIAS and with 0 degrees flaps, 95 KIAS. These speeds are based on gross weights up to 9500 pounds. For other gross weights and operations, refer to Appendix I.

Landing

For other gross weights and operations, refer to Appendix I.

Note

- Crosswind component limit is 20 knots for take-off and landing during normal operations.
- Crosswind component limit is 10 knots for reduced spoiler operations.

"G" LIMITS

For "g" limits, see figure 5-6 or figure 5-8 as applicable.

Note

Flight at zero or negative "g" is limited to 10 seconds.

PROHIBITED MANEUVERS

The following maneuvers are *prohibited:*

- Take-off using full flaps.
- Intentional spins.

*Aircraft having T.O. 1L-10A-612 incorporated

"G" LIMITS

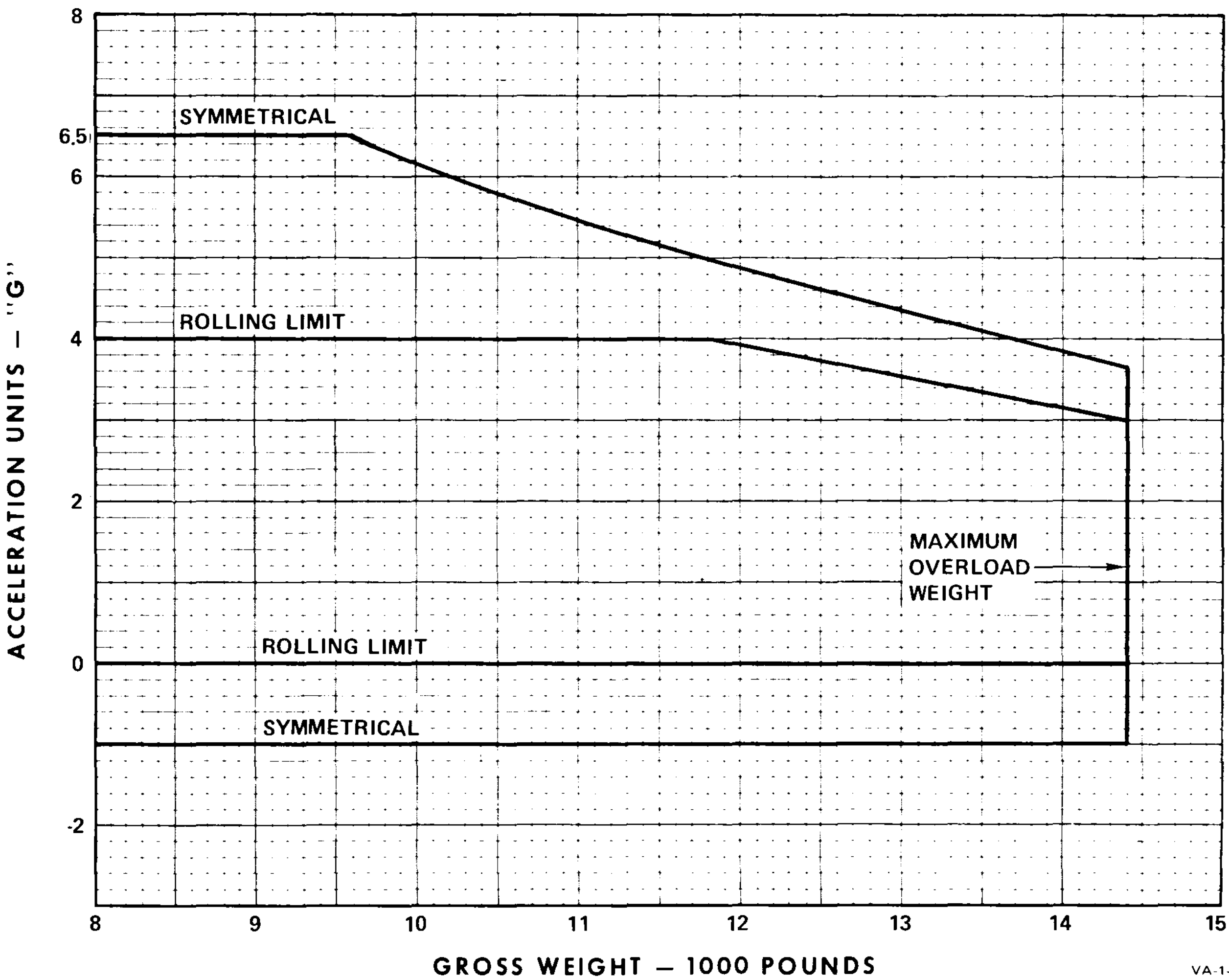


Figure 5-6

3. Abrupt aileron rolls above 250 KIAS.

4. Flight at zero or negative "g" in excess of 10 seconds.

5. Landings on prepared smooth surfaces at sink rates in excess of 850 feet per minute, and on prepared sod fields at a sink rate in excess of 600 feet per minute for gross weights under 10,000 pounds. For sink rates at other gross weights, see figure 5-7.

6. In-flight use of reverse thrust.

FLIGHT LIMITS WITH TWO IDENTICAL ENGINES

Flight with either two T76-G-10 (left) or two T76-G-12 (right) engines is permitted within the following limits:

Minimum airspeed, 20-degree flaps (take-off, landing, or in flight)	95 KIAS
Minimum airspeed, 0-degree flaps (take-off, landing, or in flight)	105 KIAS
Maximum airspeed	250 KIAS
Maximum flap setting	20 degrees
Crosswind component	10 knots
Acceleration limits	+0.5 to +2.5 "g's"
Maximum gross weight	11,000 pounds

Carriage of external stores is prohibited.
Normal or accelerated stalls are prohibited.

These limits are prescribed solely with the intent to permit ferrying the aircraft to another area where the correct engine configuration may be installed. Prolonged flight operations within these limits and sudden, deliberate maneuvers are not permitted.

EXTERNAL STORE LIMITS

For information on authorized external stores, together with speed and "g" limits for carrying, firing, or releasing stores, see figure 5-8.

CENTER-OF-GRAVITY LIMITS

The center of gravity limits are 21.8% and 28.5% MAC. For factors controlling center-of-gravity and loading limits, refer to the Weight and Balance Data Manual (T.O. 1-1B-40) and the Basic Weight Checklist and Loading Data Manual (T.O. 1L-10A-5).

WEIGHT LIMITS

Weight limits under various conditions are as follows:

1. Maximum permissible take-off gross weight—14,400 pounds.

GROSS WEIGHT VS SINK RATE FOR LANDING

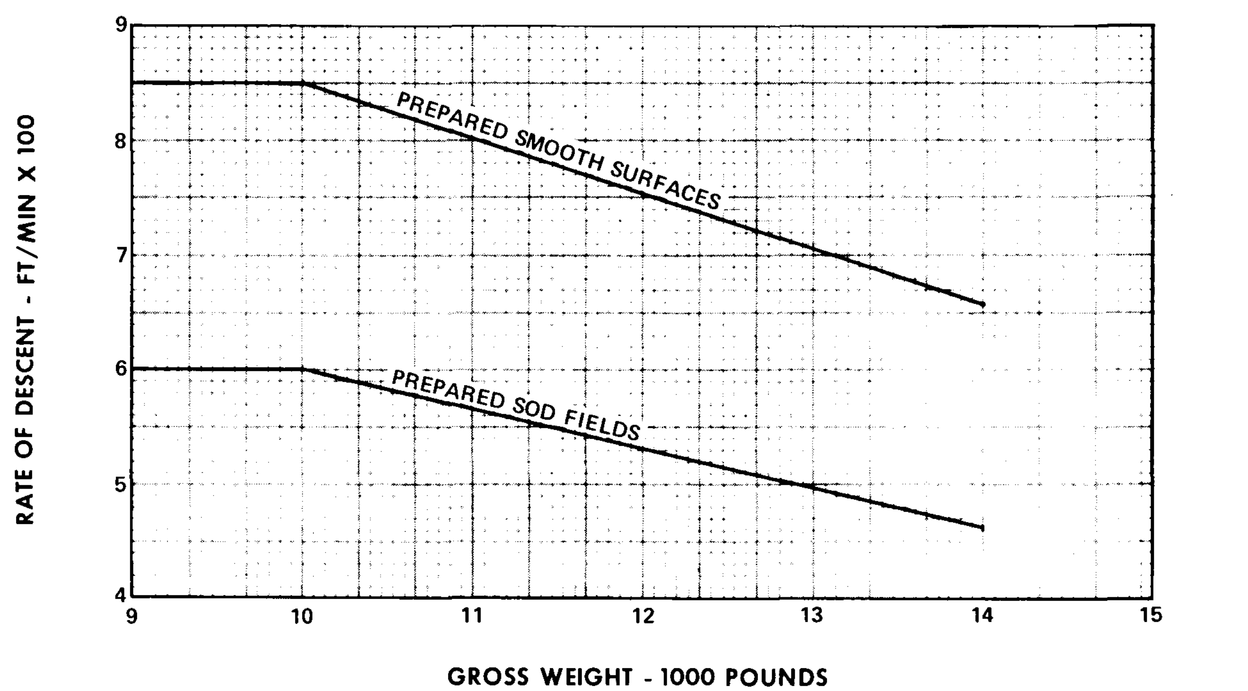
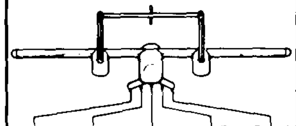


Figure 5-7

EXTERNAL STORES LIMITATIONS

NOTE: STORES ARE SUSPENDED FROM AERO 65A RACK UNLESS OTHERWISE SPECIFIED

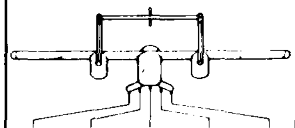


LINE NUMBER	WEAPON OR STORE	STATION LOADING 1	2	3	4	5	MAXIMUM AIRSPEED (KIAS) CARRIAGE	LAUNCH/FIRE	RELEASE	JETTISON	ACCELERATION "g" CARRIAGE	LAUNCH/FIRE	RELEASE	JETTISON LEVEL FLIGHT	MAX DIVE ANGLE (Degrees)	RELEASE INTERVAL (MODE)	REMARKS
	MACHINE GUNS																
1	M60C	MOUNTED IN SPONSONS					Basic Acft Limits	350	–	–	Basic Acft Limits	+0.5 to +4.0	–	–	–	–	
	EXTERNAL FUEL TANKS																
2	150 GAL, AERO 1C			X			350	–	–	150	0.0 to +5.5	–	–	+1.0 (Full or Empty)	–	–	Requires Aero 1A Adapter with Aero 65A Rack
	THE 150 GAL. FUEL TANK IS COMPATIBLE WITH ALL AUTHORIZED STORES ON STATIONS 1 AND 5, AND FOLLOWING STORES ON STATIONS 2 AND 4: MK81 CONICAL (+ OR x) FIN, CBU-14A/A, LAU-32B/A, AF/B37K-1 MK82 CONICAL (+ OR x) FIN, CBU-22A/A, LAU-59/A, SUU-11A/A MK82 SNAKEYE (+ OR x) FIN, CBU-25A/A, BLU-10/B, SUU-11B/A																
3	230 GAL			X			350	–	–	150	*	–	–	+1.0 (Full or Empty)	–	–	Requires Aero 1A Adapter with Aero 65A Rack
	THE 230 GAL. FUEL TANK IS COMPATIBLE WITH ALL AUTHORIZED STORES ON STATIONS 1 AND 5, AND FOLLOWING STORES ON STATIONS 2 AND 4: MK81 CONICAL (x) FIN, CBU-14A/A, LAU-32B/A MK82 CONICAL (x) FIN, CBU-22A/A, LAU-59/A MK82 SNAKEYE (x) FIN, CBU-25A/A * CARRIAGE ACCELERATION FULL OR PARTIALLY FILLED TANK MANEUVER LIMITS: SYMMETRICAL: 0.0 TO +5.5g UNSYMMETRICAL: 0.0 TO +4.5g																
	GUN POD																
4	SUU-11A/A, SUU-11B/A	X	X	X	X	X	350	325	–	150	+0.5 to +6.0	+0.5 to +6.0	–	+1.0	70		

Figure 5-8 (Sheet 1 of 4)

EXTERNAL STORES LIMITATIONS

NOTE: STORES ARE SUSPENDED FROM AERO 65A RACK UNLESS OTHERWISE SPECIFIED



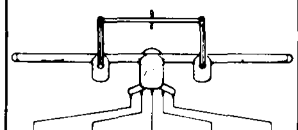
LINE NUMBER	WEAPON OR STORE	STATION LOADING 1	2	3	4	5	MAXIMUM AIRSPEED (KIAS) CARRIAGE	LAUNCH/FIRE	RELEASE	JETTISON	ACCELERATION "g" CARRIAGE	LAUNCH/FIRE	RELEASE	JETTISON LEVEL FLIGHT	MAX DIVE ANGLE (Degrees)	RELEASE INTERVAL (MODE)	REMARKS
	GENERAL PURPOSE BOMBS																
5	MK81 (CONICAL FIN)	X	X	X	X	X	350	–	290	–	Basic Acft Limits	–	+0.8 to +4.0	–	45	Single or Dual (Outboard to Inboard)	
6	MK82 (CONICAL FIN)	X	X	X	X	X	350	–	325	–	0.0 to +6.0	–	+1.0 to +1.5	–	45	Single	
7	MK82 (SNAKEYE, RETARDED/UNRETARDED)	X	X	X	X	X	350	–	325	–	0.0 to +6.0	–	+1.0 to +1.5	–	45	Single	
8	M117 (CONICAL FIN)			X			350	–	325	–	0.0 to +6.0	–	+1.0 to +1.5	–	45	Single	
9	M117 (RETARDED/ UNRETARDED)			X			350	–	325	–	0.0 to +6.0	–	+1.0 to +1.5	–	45	Single	
9A	AN-M47-A4	X	X	X	X	X	350	–	275		0.0 to +5.5 Symmetrical 0.0 to +4.0 Unsymmetrical		+0.7 to +1.5	+1.0	30	Single or Pairs	
	FIRE BOMBS																
10	BLU-1C/B (UNFINNED) BLU-27/B (UNFINNED) BLU–27A/B (UNFINNED) BLU–27B/B (UNFINNED)	X				X	350	–	300	–	0.0 to +5.0	–	+0.5 to +1.5	–	30	Single or Pairs	Requires Smooth Hard Surface Run-way for Adequate Ground Clearance
11	BLU-23/B (UNFINNED) BLU-32/B (UNFINNED) BLU–32A/B (UNFINNED) BLU–32B/B (UNFINNED)	X	X		X	X	350	–	300	–	0.0 to +5.5	–	+0.5 to +1.5	–	45 20	Single Pairs	 Stations 1 & 5 Only
12	BLU-10/B (UNFINNED)	X	X		X	X	350	–	325	–	0.0 to +5.5	–	+0.5 to +1.5	–	45	Single or Pairs	Stations 1 & 5, 2 & 4, 1 & 4, or 2 & 5

VA-1-127B

Figure 5-8 (Sheet 2 of 4)

EXTERNAL STORES LIMITATIONS

NOTE: STORES ARE SUSPENDED FROM AERO 65A RACK UNLESS OTHERWISE SPECIFIED

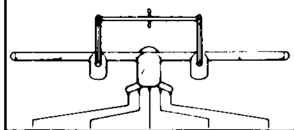


LINE NUMBER	WEAPON OR STORE	STATION LOADING 1	2	3	4	5	MAXIMUM AIRSPEED (KIAS) CARRIAGE	LAUNCH/FIRE	RELEASE	JETTISON	ACCELERATION "g" CARRIAGE	LAUNCH/FIRE	RELEASE	JETTISON LEVEL FLIGHT	MAX DIVE ANGLE (Degrees)	RELEASE INTERVAL (MODE)	REMARKS
	PRACTICE BOMBS																
13	MK106 WITH B37K-1 RACK	X	X		X	X	350	–	300	150	0.0 to +5.5	–	+0.5 to +1.5	+1.0	60	Single, Pairs, or Salvo	
14	BDU-33/B WITH B37K-1 RACK BDU-33A/B WITH B37K-1 RACK BDU-33B/B WITH B37K-1 RACK	X	X		X	X	350	–	310	150	-1.0 to +6.5	–	+0.5 to +1.5	+1.0	60	Single, Pairs, or Salvo	
	CLUSTER BOMBS																
15	CBU-14A/A, CBU-22A/A, CBU-25A/A, CBU-25B/A	X	X		X	X	350	–	280	See Below	0.0 to +5.5	–	+0.5 to +1.5	+1.0	20	Single, Pairs, or Salvo	
	(FULL DISPENSER)									200							
	(EMPTY DISPENSER)									150							
16	CBU-24B/B	X				X	350	–	300	150	0.0 to +5.0	–	+0.5 to +1.5	+1.0	45	Single or Pairs	X Fin Only
16A	CBU-55/B (FAE)	X		X		X	350	–	300	300 LEVEL	0.0 to +5.5	–	+0.5 to +1.5	+1.0	60	Single or Pairs	Loaded Sta 1 and 5 with 150-gal Tank on Sta 3, Sta 2, and Sta 4 Must Be Empty
	ROCKET LAUNCHERS (5.0 IN. FFAR)																
17	LAU-10/A (4 RKTS)	X	X		X	X	350	325	–	150	0.0 to +5.0	+0.8 to +4.0	–	+1.0	45	Single— or Ripple—	No Limit Single Station

Figure 5-8 (Sheet 3 of 4)

EXTERNAL STORES LIMITATIONS

NOTE: STORES ARE SUSPENDED FROM AERO 65A RACK UNLESS OTHERWISE SPECIFIED



LINE NUMBER	WEAPON OR STORE	STATION LOADING 1	2	3	4	5	MAXIMUM AIRSPEED (KIAS) CARRIAGE	LAUNCH/FIRE	RELEASE	JETTISON	ACCELERATION "g" CARRIAGE	LAUNCH/FIRE	RELEASE	JETTISON LEVEL FLIGHT	MAX DIVE ANGLE (Degrees)	RELEASE INTERVAL (MODE)	REMARKS
	ROCKET LAUNCHERS (2.75 IN. FFAR)																
18	LAU-3A/A (19 RKTS)	X	X		X	X	350	325	–	150	0.0 to +5.0	+0.8 to +4.0	–	+1.0	45	Single — or Ripple —	No Limit Single Station Only
19	LAU-32B/A (7 RKTS) LAU-59/A (7 RKTS) LAU-68A/A (7 RKTS) LAU-68B/A (7 RKTS)	X	X		X	X	350	325	–	150	0.0 to +5.7	+0.8 to +4.0	–	+1.0	45	Single — or Ripple —	No Limit Single Station Only
20	FLARE WITH B37K-1 RACK MK24	X	X	X	X	X	350 *	–	300	150	0.0 to +5.5	–	+0.5 to +1.5	+1.0	10	Single, Pairs, or Salvo	Max of 4 Flares Each Station
	LUU-2/B MJU-3/B	X	X	X	X	X	350 *	–	300	150	0.0 to +5.5		+ 0.5 to +1.5	+1.0	0	Single, Pairs, or Salvo	
21	MARKER LUU-1/B OR LUU-5/B WITH B37K-1 RACK	X	X		X	X	350 *	–	300	150	0.0 to +5.5	–	+0.5 to +1.5	+1.0	10	Single, Pairs, or Salvo	Max of 4 Markers Each Station
	MK6 MOD 3 WITH B37K-1 RACK	X	X		X	X	350 *	–	300	150	0.0 to +5.5	–	+0.5 to +1.5	+1.0	60	Single, Pairs, or Salvo	
22	PARACHUTE FLARE DISPENSER SUU-25B/A LUU-1/B MK-24 LUU-2/B MJU-3/B LUU-5/B	X	X		X	X	350	–	300	150	0.0 to +5.5	–	+0.5 to +1.5	+1.0	10	Single, Pairs, or Salvo	

* FOR THE B37K-1 RACK WITH FLARES OR MARKERS LOADED ON ADJACENT AIRCRAFT STATIONS WITH LARGE DROPPABLE STORES, SUCH AS FIRE BOMBS OR THE CBU-24 (SUU-30B/B DISPENSER), OBSERVE EITHER OF THE FOLLOWING:

(1) THE AFT OUTBOARD RACK STATIONS SHOULD NOT BE LOADED, OR
(2) FLARES OR MARKERS CARRIED ON THE AFT OUTBOARD RACK STATIONS SHOULD BE DROPPED BEFORE THE ADJACENT STORE IS DROPPED.

VA-1-136C

Figure 5-8 (Sheet 4 of 4)

FLIGHT CHARACTERISTICS

SECTION VI – FLIGHT CHARACTERISTICS

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INTRODUCTION

The aircraft is highly maneuverable, responsive, and stable. Control forces are light at normal cruising speeds and trim characteristics allow precise control for "hands-off" flight. The elevator and aileron-spoiler systems are very effective, with maximum "g" and available roll rate being more than adequate for most conditions. The rudders are extremely effective at all airspeeds, as nearly the entire span of both vertical stabilizers is within the propeller air stream.

STALLS

Both power-on and power-off stalls are mild and controllability remains positive throughout 1-g stalls. Natural prestall warning consists of mild airframe vertical buffet onset 3 to 5 knots before stall, accompanied by stick force lightening, random pitch oscillations, and increasing rate of sink. The stall warning (rudder pedal shaker) system provides warning approximately 5 knots above stall in most configurations. At high power settings, high pitch angles are generated. At stall, the aircraft usually pitches down and large yaw excursions may occur. Control may be regained at any point by relaxing control stick back pressure.

ACCELERATED STALLS

Accelerated stall warning is experienced in the form of buffet with severity and warning margin depending upon initial speed, "g" load, gross weight, and how rapidly "g" is applied. At stall, the aircraft usually pitches down and rolls into the engine developing lower torque. Control may be regained immediately by relaxing stick back pressure.

Note

> For stall speeds, see figure 6-1. For detailed stall speed data, refer to Appendix I.

SPIN AVOIDANCE

A spin requires the simultaneous achievement of stalled angle of attack and yaw. If either of these conditions is absent, the aircraft will not enter a spin. For erect stalls, angle of attack information is displayed on the angle-of-attack indicator and indirectly through the rudder pedal shaker. Maintaining angle of attack below 25 units AOA or below that required to activate the rudder pedal shaker is an effective means of avoiding a stall. Maintaining zero sideslip is effected by keeping the ball of the turn-and-bank indicator centered. Intentional spins are prohibited because of a tendency for the propellers to lose oil pressure due to unusual "g" loadings, and move toward the feather position, which will produce engine rpm decay and overtemperature conditions.

SPINS

Spin characteristics of the OV-10A aircraft were determined by intensive wind tunnel tests, contractor flight tests, and Navy flight tests. These tests indicate that the aircraft is not prone to unintentional spins in symmetric power or pretrimmed asymmetric power configurations. However, the aircraft will spin easily from untrimmed asymmetric power configurations and will readily spin in any configuration provided pro-spin controls are applied and held. Recoveries are positive and rapid in all configurations. Positive application of the

STALL SPEEDS

INDICATED AIRSPEED – KNOTS

POWER OFF

FLAPS	GROSS WEIGHT –POUNDS	ANGLE OF BANK–0° LOAD FACTOR–1.0 GEAR UP	ANGLE OF BANK–0° LOAD FACTOR–1.0 GEAR DOWN	ANGLE OF BANK–30° LOAD FACTOR–1.2 GEAR UP	ANGLE OF BANK–30° LOAD FACTOR–1.2 GEAR DOWN	ANGLE OF BANK–60° LOAD FACTOR–2.0 GEAR UP	ANGLE OF BANK–60° LOAD FACTOR–2.0 GEAR DOWN
0°	8,000	75	81	81	87	106	115
	10,000	84	91	90	98	119	129
	12,000	92	100	99	107	130	141
	14,000	99	109	106	117	140	154
20°	8,000	60	64	65	69	85	90
	10,000	72	76	77	82	102	107
	12,000	85	88	91	95	120	125
	14,000	95	98	102	105	134	139
40°	8,000	56	56	60	60	79	79
	10,000	68	68	73	73	96	96
	12,000	79	79	85	85	112	112
	14,000	90	90	97	97	127	127

POWER ON

FLAPS	GROSS WEIGHT –POUNDS	ANGLE OF BANK–0° LOAD FACTOR–1.0 GEAR UP	ANGLE OF BANK–0° LOAD FACTOR–1.0 GEAR DOWN	ANGLE OF BANK–30° LOAD FACTOR–1.2 GEAR UP	ANGLE OF BANK–30° LOAD FACTOR–1.2 GEAR DOWN	ANGLE OF BANK–60° LOAD FACTOR–2.0 GEAR UP	ANGLE OF BANK–60° LOAD FACTOR–2.0 GEAR DOWN
0°	8,000	59	59	64	64	84	84
	10,000	70	70	75	75	99	99
	12,000	81	81	87	87	115	115
	14,000	89	89	96	96	126	126
20°	8,000	50	50	54	54	71	71
	10,000	60	60	65	65	85	85
	12,000	70	70	75	75	99	99
	14,000	78	78	84	84	110	110
40°	8,000	44	44	47	47	62	62
	10,000	54	54	58	58	76	76
	12,000	63	63	68	68	89	89
	14,000	72	72	78	78	102	102

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Figure 6-1

recommended recovery controls will produce the most consistent recovery characteristics. Simply releasing controls will effect recovery in most cases, but is not recommended because a developed spin mode does exist (asymmetric power-oscillatory mode) from which recovery cannot be effected using this method. Further, positive control action will preclude nonrecovery due to an inadvertent application of full nose-up trim during the spin.

ERECT SPINS

Symmetric Power

Symmetric power is defined as any combination of condition lever and/or power lever position that results in an indicated torque difference between engines of 200 pound-feet or less. Elevator effectiveness is reduced at idle power settings and forward center-of-gravity positions. The aircraft is less prone to stall and spin under these conditions and attempted spin entry usually results in a diving spiral. However, normal center-of-gravity positions (25 to 27 percent MAC) and power settings between 800- and 1200-pound-foot torque are conditions from which spins are easily achieved.

There is a definite departure from controlled flight in a 1.0-g spin entry. The entry is characterized by little or no post-stall gyration with the nose of the aircraft falling sharply through to 90 degrees (straight down) in one-half turn and then pitching up to 60 degrees (down) during the next one-half turn. Succeeding turns are characterized by steep nose-down attitudes, fast rotation rates about the roll axis, and considerable airframe buffet. The spin will normally become steady-state within one- and one-half to two- and one-half turns. Lateral control opposite to spin direction (cross controls) applied concurrently with departure from controlled flight will often prevent the development of a spin by opposing the build-up of both yaw and roll. Aileron applied opposite to spin direction, once the spin has developed, has the effect of slowing the turn rate and flattening the pitch angle slightly. Aileron applied with the spin will increase turn rate to approximately 200 degrees per second. Turn rates of this magnitude are best described as "extremely fast," and multi-turn spins can cause disorientation and dizziness. External stores can produce high yaw and turn rates (sometimes exceeding those obtainable in the clean configuration); however, overall spin and recovery characteristics are not appreciably altered with external stores. There is no tendency toward a flat spin mode. Spins entered from accelerated flight conditions are characterized by a sudden departure from controlled flight and a one- and one-half to two- and one-half turn snap roll. The nose falls through to a near vertical attitude and the ensuing spin closely resembles the spin resulting from a 1.0-g entry.

Spins entered from vertical, climbing flight are characterized by tail-sliding (if zero airspeed is obtained) or rolling pitch-over. Aerodynamic feedback in the control system is experienced during tail slide, but the pilot's counteracting force requirements are light. A typical erect spin results after one-half to one incipient-type turn. Altitude loss during the preceding spins varies between 300 and 700 feet per turn. Spins in the power approach configuration, with either 20- or 40-degree flap deflection, are much the same as the spins previously described.

The steep nose-down attitude that follows the first one-half turn will result in recovery airspeed approaching flap and landing gear limit. Spins in excess of one turn will likely result in limit speeds being exceeded during recovery.

Altitude loss during recovery from landing gear and flaps down spins is approximately 2000 feet.

Asymmetric Power

Spins entered with a large asymmetric power condition result in large pitch oscillations and high turn rates. Spins with one engine at MIL and the other engine at IDLE power can become violent. Developed spins can occur under these conditions without application of pro-spin rudder. Departure from controlled flight is characterized by sudden yaw and roll into the inoperative engine. If pro-spin rudder is applied concurrently with this departure, the ensuing roll rate exceeds the turn rate to the extent that an apparent outside snap roll occurs with the nose passing vertically down, then returning to level or above by the completion of one turn. This gyration resembles an oblique cartwheel. A sudden slowing of roll and pitch rate occurs in the second or third turn. This usually appears to the pilot as a momentary slowing and flattening of the spin. Very deep stall penetrations (70 degrees AOA or greater) can occur during the most violent of these spins. Yaw, roll and pitch excursions are of such rate and amplitude that high "g" forces are exerted on the pilot's body and control placement requires considerable force. However, all asymmetric power spins do not develop to such violent proportions. Forward center-of-gravity positions, reduced asymmetric power, and internal fuel consumption (to reduce lateral moment of inertia) have a moderating effect upon the spin. It is important for the pilots to realize the magnitude the gyrations can assume so that if a pilot should encounter such a spin, it can be recognized as a known aerodynamic characteristic and one from which recovery can be positively effected. Spins of this type can be easily avoided by flying in balanced flight when maneuvering with an inoperative engine and/or by quickly recovering from asymmetric power stalls.

ERECT SPIN RECOVERY

Spin recovery technique for all configurations is rudder opposite to spin direction, neutral aileron, and neutral to slightly forward stick.

Note

> Neutral stick requires forward stick pressure due to the high "up" float forces on the elevator during the spin.

True spin direction is always indicated by the turn needle; therefore, the turn needle should be used as the primary instrument for determining spin direction. This is especially true if accurate outside visual cues are not available. Normally, control forces required for spin recovery are moderate. However, pilots must be aware that asymmetric power spins can sometimes produce deep stall penetrations which require strong forward stick pressure to ensure proper recovery control placement. The required forward stick force may reach 115 pounds and it is recommended that the pilot use both hands to position the stick in these cases.

CAUTION

> Failure to establish proper longitudinal control placement (neutral to slightly forward stick) during asymmetric power spins may significantly delay or entirely preclude spin recovery.

Recovery in all configurations is positive with proper flight control placement. Asymmetric power spins usually required one and one-half turns for recovery, while symmetric power spins usually require only one-half turn to recover. The nose-down attitude will be steep and altitude loss from initiation of recovery controls to wings-level flight is approximately 2500 feet. Air speed buildup during dive recovery is rapid and significant "g" force is quickly available for pullout. Progressive stalls/spins will normally not be encountered. The aircraft will recover from all spins, with correct flight control placement, regardless of power control lever position (including asymmetric). However, power increases turn rate and altitude loss during the recovery dive. Power opposite to spin direction has very little effect once the spin has developed and is of no value as a spin recovery technique. For standardization and simplification, it is recommended that the power control levers be placed in FLIGHT IDLE during recovery.

Erect Recovery Procedure

1. Power levers—FLIGHT IDLE ("Gate").
2. Rudder—FULL AGAINST SPIN.
3. Elevator—NEUTRAL TO SLIGHTLY FORWARD.
4. Aileron—NEUTRAL.
5. When rotation ceases, neutralize rudder, allow buildup to safe airspeed, and effect pullout from ensuing dive.

INVERTED SPINS

Intentional inverted spins should not be performed since the risk of overtemping both engines will be high. The aircraft will spin with lateral stick opposite rudder direction. Occasionally, it may spin with neutral aileron, but will not spin with lateral stick in the direction of rudder application. Inverted spins from vertical or −1.0-g flight condition are characterized by the nose falling gently through to approximately 60 degrees nose-down attitude as the aircraft rotates in the direction of applied rudder. The inverted spin is classic with steady, moderate turn rates (100 degrees per second), moderately steep nose-down attitudes (60 to 70 degrees) and a steady −1.0 "g".

INVERTED RECOVERY

Recovery procedure consists of opposite rudder (push the rudder in the direction it wants to go) and neutral stick. Recovery in a split "S" will require 800 to 1000 feet to regain wings-level flight. If an inverted spin is entered accidentally and for some reason is allowed to fully develop, it is recommended that both propellers be feathered immediately to prevent engine overtemperature. This action also places the aircraft in a known value of symmetrical thrust and allows straight forward neutral controls recovery. Engines are restarted normally following recovery.

This procedure of feathering engines to obtain known thrust values in unusual attitudes (spins) is unorthodox, but not unsafe, provided the pilot is mentally ready to perform the proper restart procedures immediately upon recovery. The aircraft glides very well with a glide ratio equal to that of both engines providing 400- to 450-pound thrust symmetrically. The characteristics of the power plant system can cause high unsymmetrical drag/thrust relationships between engines. Retardation to flight idle will usually cure the situation, but if the propeller governor senses a low oil pressure, the propeller may move toward the feather position. With the engine still ignited, high drag will result on that side. Thus, the propeller should be feathered to protect the engine. Feathering both propellers, recovering, and restarting, should be considered if altitude permits.

Inverted Recovery Procedure

1. Condition levers—FEATHER & FUEL SHUT-OFF.
2. Rudder—FULL AGAINST THE SPIN.
3. Stick—NEUTRAL.
4. When rotation ceases, neutralize rudder and recover from ensuing vertical dive.
5. Execute AIR START procedures.

FLIGHT CONTROL CHARACTERISTICS

ELEVATOR SYSTEM

On the ground, the elevator system, including the control stick, rests in the position determined by pitch trim setting. To move the spring tabs at zero speed, the stick must be pulled or pushed far enough to drive the elevator to the surface travel limit. Stick force then increases and further stick movement moves the spring tabs. With flight speed dynamic pressure loading the elevator system, the spring tab/elevator sequence is reversed, making the stick operate the tabs initially, and operating the elevator directly when tab spring force is overcome. The pitch trim system provides positive, stable elevator trim, permitting long-period stability for "hands-off" attitude control. The pitch trim system provides approximately 20 pounds stick force, nose up or nose down.

Stick force per "g" increases slightly as speed increases beyond 250 knots, approximately 4 pounds per "g" at 250 knots to 9 pounds per "g" at 360 knots. The stick force per "g" is lowest (4 pounds per "g" at 250 knots) at aft centers of gravity and increases at forward centers of gravity (7 pounds per "g" at 250 knots).

AILERON-SPOILER SYSTEM

On the ground, the aileron-spoiler system presents an unfamiliar, "disconnected" feel. Normally expected centering action of the control stick is totally absent, the force gradient with lateral movement of the stick is very light, and no positive "neutral" point is apparent. In order to move the aileron spring tabs at zero speed, the stick must be deflected until the aileron travel limit is reached (approximately half stick). A slight increase in force gradient is then felt and further stick movement moves the spring tabs. With flight dynamic pressure (actually, speeds in excess of about 20 knots) loading the lateral system, the tab/aileron sequence is reversed, making the stick operate the tabs initially and driving the ailerons when tab spring force is overcome. Operation of the spoilers is readily visible from the cockpit. Proper operation of the lateral control system is evident if the spoilers are seen to operate (rotate upward) on the side toward which the stick is deflected. The lateral trim system has a stick force relief capacity of 5 pounds left or right.

CAUTION

At speeds above 350 knots, unusual gyrations may be experienced if abrupt control movements are performed in the spoiler-shift range.

RUDDER SYSTEM

The dual rudder system operates in a conventional manner. Adequate directional control may be maintained on the ground with rudder alone, since the propeller wash covers nearly the entire span of both vertical stabilizers. The yaw trim system provides pedal force relief capacity of 85 pounds left or right.

LEVEL FLIGHT CHARACTERISTICS

SLOW FLIGHT

At maximum endurance airspeeds (100 to 110 KIAS), the aircraft remains responsive and maneuverable. In this range, positive "g" loading of approximately 1.8 is available before buffet onset, providing very short turn radii for low-speed reconnaissance or station keeping. With flaps set at 20 degrees, these characteristics are available at speeds as low as 80 to 85 knots, depending on gross weight and ambient conditions.

HIGH-SPEED FLIGHT

At maximum obtainable level flight speeds, control forces remain light, and high-rate pitch and roll response is available. On entry into turbulent air, a low-frequency vertical oscillation may be noted, primarily evident in the forward cockpit. This effect is due to natural flexing of the wing between the booms and the fuselage.

MANEUVERING CHARACTERISTICS

ROLLS

Roll rate capability is more than adequate throughout the speed envelope. At 200 knots with maximum external load, full stick deflection provides approximately 55 degrees of bank within 1 second. At high speeds, steady-state roll rates, in excess of 160 degrees per second, have been observed. Abruptly executed rolling maneuvers at speeds below 150 KIAS generate a moderate amount of adverse yaw (away from the direction of roll). At speeds above 160 KIAS, yaw generated as a function of roll reverses to become favorable (in the direction of roll). Full lateral stick rolls at high speeds (250 KIAS or higher) produce lateral acceleration as high as 0.5 "g," with attendant roll rates nearing 170 degrees per second. Abrupt rolling maneuvers (reversals in this speed range cause fairly large sideslip angles to be generated on recovery. As a function of the adverse and favorable yaw exhibited, high-rate rolling maneuvers at high speeds also produce "g" transients of up to + or – 2.0 "g's," depending upon speed and rate of roll.

DIVES

Steep power-on dives from altitudes above approximately 12,000 feet allow speeds near design limit (0.7 Mach) to be attained. Stick forces required for dive recovery are low, and care should be taken not to exceed desired "g" on pullout.

FLIGHT WITH EXTERNAL STORES

The effect of external stores, other than that of drag, is relatively slight. External loads result in decreased climb and cruise performances but adverse rolling inertia or yaw characteristics are not exhibited. At high airspeeds with external stores, moderate airframe buffet may be encountered.

FLIGHT CHARACTERISTICS WITH TWO IDENTICAL ENGINES

Flight characteristics with either two T76-G-10 (left) or two T76-G-12 (right) engines are essentially the same as the basic aircraft configuration. The following changes should be noted:

1. Strong yaw reaction due to engine torque at high power settings and low airspeeds.
2. With flaps extended, a mild nose left yaw occurs with two right engines (counterclockwise rotating propellers) and a mild nose right yaw with two left engines (clockwise rotating propellers).
3. Slight increase in trim change requirements with speed and power changes.

ALL WEATHER PROCEDURES

SECTION VII — ALL-WEATHER OPERATIONS

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ICE AND RAIN

With visible moisture and freezing temperatures, ice will form on the windshield, wing leading edge, and empennage. Altitude should be changed immediately on the first sign of ice accumulation. The resultant drag and weight increase acts to reduce airspeed and increase power requirements, with consequent reductions in range.

CAUTION

Heavy ice accumulations can cause stalling speed to be greatly increased. Extreme caution must be used when landing under such conditions.

When observed weather data is used, it is often possible to avoid areas of probable icing. However, if you are caught in icing conditions, immediately take the following precautions if possible:

1. Change altitude rapidly by climb or descent in layer clouds (stratus), or vary course to avoid cloud formations.
2. Establish airspeed at 160 KIAS.
3. If ice or frost forms on the windshield or canopy, pull the TEMPERATURE knob as required and push CKPT AIR/DEFR knob full in.

LANDING IN RAIN

The windshield wiper provides improved visibility in most forms of precipitation. At low airspeeds, such as in the landing pattern, visibility may remain impaired in extremely heavy rain or in snow. Braking action on wet runways is generally poor, requiring longer landing rolls. Plan to use reverse thrust or all the available runway when landing during wet runway conditions.

WARNING

Reverse thrust may cause momentary loss of all forward visibility at about 20 knots during deceleration.

TURBULENCE AND THUNDERSTORMS

CAUTION

Flights through thunderstorms or other areas of extreme turbulence must be avoided whenever possible. Maximum use of weather forecast facilities and air or ground radar to aid in avoiding thunderstorms and turbulence is essential.

If a thunderstorm or turbulence cannot be avoided, the following procedures should be followed:

1. Attitude.

   The key to proper flight technique through turbulence is attitude. Both pitch and bank should be controlled by reference to the attitude indicator (ADI). *Do not change trim* after the proper attitude has been established. Extreme gusts will cause large attitude changes. Use smooth and moderate elevator and aileron inputs to re-establish the desired attitude. To avoid overstressing the aircraft, *do not make large or abrupt attitude changes.*

2. Airspeed.

   Adjust power to establish a speed of 160 KIAS. Trim the aircraft for level flight at this speed. Severe turbulence will cause large and rapid variations in indicated airspeed. *Do not chase the airspeed.*

COLD-WEATHER PROCEDURES

The majority of cold-weather operating difficulties is encountered on the ground. The following instructions supplement the normal operating instructions when arctic-type weather is encountered. Extreme diligence on the part of both the ground and flight crews is the answer to successful arctic operation.

EXTERIOR INSPECTION

1. Check all protective covers removed.
2. Perform exterior inspection as outlined in Section II.
3. Check that the entire aircraft is free of snow, frost, and ice. Brush off light snow and frost. Remove all ice and encrusted snow.

Note

- Be sure to check all spring tab hinges, spoiler openings, propeller spinners, and flap slot door areas for ice. Ice buildup on elevator and aileron tabs can cause serious control surface unbalance.
- During freezing rain conditions, ice, not visible during visual inspection, may form on propeller blade seals. This will result in oil leakage from the propeller assembly on engine start.

WARNING

Remove all snow and ice from the wings, fuselage, and tail before flight. Depending on the weight and distribution of the snow and ice, take-off distances and climb-out performance can be adversely affected. The roughness, pattern, and location of the snow and ice can affect stall speeds and handling characteristics to a dangerous degree. In-flight structural damage may also result, because of the vibrations induced by unbalanced loads of accumulated ice and snow.

CAUTION

Do not chip or scrape ice from aircraft surfaces, as this may cause damage.

4. Check to see that engines are free of internal ice. If equipment is available, the engines may be preheated as necessary.
5. Check to ensure all dirt and ice removed from shock struts, actuating cylinder pistons, and all limit switches. Clean struts and pistons with a rag soaked in hydraulic fluid to avoid damaging packings and seals.
6. Inspect the area behind the aircraft to ensure that loose snow and ice will not be blown into personnel, other aircraft or equipment during engine start.
7. If equipment is available, the cockpit area, propeller hub, and tail boom electronic compartments should be preheated.

ENTERING AIRCRAFT

Use caution on the retractable steps. The metal steps may become extremely slippery as snow, ice, or water is deposited by personnel entering the aircraft.

ALTERNATE FUEL USE

When alternate fuels are used, specific attention must be given to compliance with alternate fuel instructions covered in Section II.

Note

Ground and air starts may be more difficult in cold temperatures using JP-5 fuel.

STARTING ENGINES

At temperatures below 0°F (−18°C), external d-c starting power should be used. Battery power may not be adequate to provide the rpm required for normal starting after prolonged exposure to below-zero temperatures.

CAUTION

If the aircraft has been "cold-soaking" overnight at these very low temperatures, engine starts should not be attempted until the engines are thoroughly preheated. This procedure will lessen slow-starting effects. Under extreme cold conditions, it is also recommended that propellers be unfeathered manually before engines are started to prevent possible overload of the unfeathering pumps.

GROUND CHECKS

1. Normally, engine warm-up is unnecessary and as soon as the engines stabilize at idle rpm with normal oil pressure and the propellers are unlocked, the power levers may be advanced to MILITARY. However, if the engine has been "cold-soaked" at temperatures below 0°F (−18°C), a 2-minute warm-up at FLIGHT IDLE is recommended.

Note

Difficulty may be encountered in unlocking propellers unless the engines are preheated. If unlocking cannot be obtained, allow time for engine temperatures to increase and reattempt unlocking.

2. Before taxi, conduct a thorough check of full-travel operation of all flight control surfaces and the flaps with the crew chief. Ensure proper operation of tabs and spoilers with flaps extended and retracted.

3. Check all electronic equipment and instruments for proper operation, allowing at least 3 minutes for warm-up before checking.

Note

If runways and taxiways are slippery, perform pretake-off aircraft and engine checks before chocks are removed.

TAXIING

Avoid taxiing through water or slush. Water or slush splashed into the wheel wells will freeze, causing possible gear retraction malfunctions. If taxiing behind another aircraft, maintain a greater interval than normal to avoid ice and slush from being blown onto the aircraft.

TAKE-OFF

Monitor engine torque closely during take-off acceleration, as torque increase with ram effect in cold weather could result in exceeding engine torque limits.

AFTER TAKE-OFF

After take-off from wet snow or slush-covered surfaces, leave the landing gear down for a short period, or operate the gear and flaps through several complete cycles to prevent freezing in the retracted position. Use care to avoid exceeding gear and flap limit speeds during these cycles.

LANDING

The basic, normal landing techniques apply to landing on slippery surfaces, except that the effects of cross-wind are multiplied.

Note

Except as necessary to control direction on unprepared surfaces, the use of nose wheel steering is NOT recommended for landing roll-out. More precise directional control is available using differential propeller thrust and rudder.

CAUTION

Under conditions of intense rain, sleet, or snow, or when a depth of loose, dry snow, or standing water is present, modulate reverse thrust to preclude momentary complete visual obstruction.

BEFORE LEAVING

1. Ensure fuel servicing as soon as possible.
2. If the aircraft is to be idle for more than 4 hours at temperatures below –20°F (–29°C), remove batteries to a warm area.
3. Check that all protective covers are installed and that the aircraft is chocked and tied down as required.

HOT-WEATHER AND DESERT PROCEDURES

Hot-weather and desert procedures differ from normal procedures when high temperatures, coupled with blowing wind and dust, are encountered. Extreme caution must be exercised by both the ground and flight crews to prevent damage to systems during desert operations. Proper protection and inspection of the aircraft while on the ground and observance of the precautions covered in this section will ensure the most successful operation.

EXTERIOR INSPECTION

1. Remove all protective covers and dust plugs.
2. Inspect tires and struts for proper inflation.
3. Clean dust and sand from struts, hydraulic pistons, and switches, and wipe down struts with hydraulic fluid if available.
4. Always place the aircraft in a position to avoid sandblasting equipment and personnel during engine starts and ground checks.
5. Check the intake ducts and remove any accumulation of dust and sand.

WARNING

Use gloves during exterior inspection to prevent serious burns from contact with extremely hot aircraft surfaces.

BEFORE STARTING ENGINES

1. Check instruments and electrical equipment for excessive moisture from high humidity and use ground heat, as necessary, to dry them.
2. Check cockpit for excessive accumulations of dust or sand.

BEFORE TAKE-OFF

1. Expect the engines to accelerate to idle more slowly than on a normal or cold day.
2. Minimize the duration of engine ground operation. The engine temperature may be reduced by advancing the condition levers slightly forward of the NORMAL FLIGHT position.
3. Keep sufficient distance between aircraft during taxiing to prevent sand and dust from being blown into the engines.

TAKE-OFF

Delay rotation, if the take-off roll is not critical, until reaching take-off speed, to provide positive control and a higher initial rate of climb. Monitor engine temperatures to avoid exceeding limits.

WARNING

Take-off planning is of prime importance when operating from a marginal-length surface with high ambient temperatures. Refer to appropriate charts in Appendix I.

APPROACH AND LANDING

Maintain recommended approach and landing speeds shown in Appendix I. Allow for longer landing rolls resulting from slightly increased ground speeds with high outside air temperatures.

CAUTION

Hot-weather operation requires the pilot to be cautious of gusts and wind shifts near the ground.

BEFORE LEAVING

1. Make sure that protective covers are installed on the pitot-static tube, angle-of-attack probe, and engine intakes and exhaust pipes.

2. If the aircraft is parked in the sun, leave the cargo bay door slightly ajar and one cockpit door open to allow air circulation if wind-blown sand is not a problem.

3. Ensure the aircraft is tied down if the possibility of a windstorm exists.

PERFORMANCE

APPENDIX I — PERFORMANCE DATA

PART 1 — BASIC DATA

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AIRCRAFT CONFIGURATION DRAG INDEX SYSTEM

Climb, range, and endurance data are presented in a drag index format to provide maximum flexibility, while requiring minimum interpolation. With this system, clean aircraft drag is assigned a value of 10 and a store drag number is assigned to each external store. By adding the individual drag numbers, a configuration drag number (called Drag Index) is obtained. This Drag Index is used with aircraft gross weight in performance data computation. The Drag Index obtained can be rounded off for convenience without losing excessive accuracy. The only interpolation then required is that used to determine data point placement between drag index reflector curves provided on the charts.

AIRCRAFT CONFIGURATION TABLE (FIGURE A1-1)

The Aircraft Configuration Table (figure A1-1) is used to determine aircraft drag index and gross weight for performance data computations. The drag number columns include data for the effects of store interference drag, or the effect of a given store by addition of stores on one side (adjacent), or on both sides (multiple adjacent).

AIRCRAFT OPERATING WEIGHT

The operating weight of the clean aircraft is approximately 8260 pounds. Derivation of this weight and data on specific aircraft equipment are provided for planning use as required.

● Weight Empty	7190 pounds
Unusable fuel	52
Engine oil	34
Armor plate	307
Observer's equipment	60
Parachutes	42
Survival kits	60
Oxygen system	63
Cargo conversion package	91
First aid kit	3
● Basic Weight	7902 pounds
Pilot	180
Observer	180
● Operating Weight	8262 pounds

Note

For gross weights of useful load items and external stores, see figure A1-1. For detailed weight data, refer to the Weight and Balance Technical Manual (T.O. 1-1B-40).

EXAMPLE PROBLEMS

Drag Index Example

AIRCRAFT CONFIGURATION: Sponsons and centerline pylon plus one Aero 1C external fuel tank and two LAU-3A/A rocket pods.

Clean aircraft drag number	10
Sponsons drag number	21.0
Centerline pylon drag number	4.5
External fuel tank drag number	14.0
Two LAU-3A/A rocket pods drag number (Single store, nonadjacent)	18.0
Drag Index (Total)	67.5

Note

- In this case, 67.5 may be rounded to 70 for use in performance computation.
- If the rockets are fired and the empty pods released, Drag Index is reduced by 18.0, resulting in a return route Drag Index of 50 (67.5 minus 18, or 49.5).

Gross Weight Example

AIRCRAFT CONFIGURATION: As previously stated, with full ammunition load, and two crew members:

● Operating Weight—Clean Aircraft	8,262 pounds
Fuel—usable, internal	1,550
Sponsons (two)	272
Guns (four)	150
Ammunition	130
Centerline pylon	52
230-gallon external tank (full)	1,698
LAU-3A/A rocket pods (two)	854
● Take-off Gross Weight	12,968 pounds

FUEL WEIGHT VS. TEMPERATURE (FIGURE A1-2)

Pertinent performance data are based on the use of JP-4 fuel at a specific weight of 6.5 pounds per gallon (Standard Day). Variations in fuel weight for nonstandard temperatures and/or the use of alternate or emergency fuels can be determined by using figure A1-2.

Note

Fuel which has been stored in aircraft tanks for more than approximately 4 hours can be assumed to be at the same temperature as ambient air.

STANDARD DATA

AIRSPEED CONVERSION (FIGURE A1-3)

The Airspeed Conversion chart (figure A1-3) is used to determine calibrated airspeed (CAS), true airspeed (TAS), and Mach number. Indicated airspeed (IAS) must first be converted to CAS before entering the chart to determine TAS.

Airspeed Conversion Example Problem

Determine true airspeed:

- Altitude—10,000 feet
- CAS—130 knots
- Temperature—20°C

1. True Mach number = 0.235
2. Standard Day TAS = 146 knots
3. Corrected TAS = 164 knots

SPEED-ALTITUDE CORRECTION (FIGURE A1-4)

The Speed-Altitude Correction chart (figure A1-4) is used to determine indicated airspeed (IAS) when desired calibrated airspeed (CAS) is known, and to obtain corrections for converting indicated altitude to true pressure altitude. Airspeed corrections are generally small enough to be considered negligible. Altimeter corrections for low-altitude, high-speed flight are sufficient to warrant preplanning for low-level missions.

STANDARD ATMOSPHERE TABLE (FIGURE A1-5)

The Standard Atmosphere Table (figure A1-5) provides various atmospheric parameters under ICAO Standard Day conditions from sea level through 39,000 feet.

DENSITY ALTITUDE CHART (FIGURE A1-6)

The Density Altitude Chart (figure A1-6) shows $\frac{1}{\sqrt{\sigma}}$ and density altitude when the pressure altitude and ambient temperature are known. This chart is used to find density altitude and $\frac{1}{\sqrt{\sigma}}$ on other than Standard Day conditions. To use the chart, enter at the known temperature, move vertically to the known pressure altitude, and read the density altitude directly to the left of this point, or $\frac{1}{\sqrt{\sigma}}$ directly to the right. True airspeed (TAS) may then be obtained from equivalent airspeed (EAS) by multiplying the given EAS by the $\frac{1}{\sqrt{\sigma}}$ value.

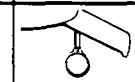
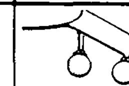
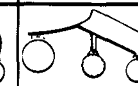
Example:

1. Outside air temperature = 25°C
2. Pressure altitude = 3500 feet
3. $\frac{1}{\sqrt{\sigma}}$ = 1.083
4. Density altitude = 5400 feet

AIRCRAFT CONFIGURATION TABLE

CLEAN AIRCRAFT DRAG INDEX = 10.0

NOTE USE HIGHEST DRAG INDEX IN CASE OF MIXED STORES,

ITEM	STATION 1	2	3	4	5	WEIGHT-LBS FULL	EMPTY	DRAG NUMBER SINGLE	ADJACENT	MULTIPLE
GENERAL										
AIRCRAFT OPERATING WEIGHT						8262				
SPONSONS (TWO) WITH RACKS AND M60C GUNS (FOUR)						422		21.0	-	-
CENTERLINE PYLON			X			52		4.5	-	-
AMMUNITION 2000 ROUNDS						130		-	-	-
* 150 GALLON (AERO 1C) EXTERNAL TANK			X			1110	135	.14.0	20.0	24.0
† 230 GALLON EXTERNAL TANK			X			1698	210	17.0	24.0	29.0
7.62 MM GUN PODS										
SUU-11A/A	X	X	X	X	X	325	245	7.0	.8.0	9.5
SUU-11B/A	X	X	X	X	X	325	245	7.0	8.0	9.5
UNFINNED FIRE BOMBS										
BLU-1C/B	X				X	700		6.5	-	11.0
BLU-27/B	X				X	870	-	10.0	-	25.0
BLU-23/B	X	X		X	X	490	-	8.0	13.0	19.0
BLU-32/B	X	X		X	X	540	-	8.0	13.0	19.0
BLU-10/B	X	X		X	X	250	-	9.0	14.0	21.0
GENERAL PURPOSE BOMBS										
MK81 (CONICAL FIN)	X	X	X	X	X	260	-	4.0	5.0	6.0
MK82 (CONICAL FIN)	X	X	X	X	X	531	-	5.0	6.0	7.0
MK82 (SNAKEYE, RETARDED/ UNRETARDED)	X	X	X	X	X	572	-	9.0	10.0	11.0
M117 (CONICAL FIN)			X			823	-	10.5	-	17.0
M117 (RETARDED/UNRETARDED)			X			857	-	19.0	-	27.0

* COMPATIBLE WITH ALL AUTHORIZED STORES ON STATIONS 1 AND 5 AND FOLLOWING STORES ON STATIONS 2 AND 4:
MK81 CONICAL (+ OR x) FIN, CBU-14A/A, LAU-32B/A, AF/B37K-1
MK82 CONICAL (+ OR x) FIN, CBU-22A/A, LAU-59/A, SUU-11A/A
MK82 SNAKEYE (+ OR x) FIN, CBU-25A/A, BLU-10/B, SUU-11B/A

† COMPATIBLE WITH ALL AUTHORIZED STORES ON STATIONS 1 AND 5 ALL FOLLOWING STORES ON STATIONS 2 AND 4:
MK81 CONICAL (x) FIN, CBU-14A/A, LAU-32B/A
MK82 CONICAL (x) FIN, CBU-22A/A, LAU-59/A
MK82 SNAKEYE (x) FIN, CBU-25A/A

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Figure A1-1 (Sheet 1 of 3)

ITEM	STATION 1	2	3	4	5	WEIGHT-LBS FULL	EMPTY	DRAG NUMBER SINGLE	ADJACENT	MULTIPLE
PRACTICE BOMBS										
* AF/B37K-1 RACK							80	14.0	17.0	20.0
*WITH FOUR BDU-33/B, BDU-33A/B BDU-33B/B	X	X		X	X	176	80	20.0	27.0	35.0
*WITH FOUR MK 106	X	X		X	X	100	80	24.0	32.0	42.0
CLUSTER BOMBS										
CBU-14A/A	X	X		X	X	250	50	18.0	20.0	31.0
CBU-22A/A	X	X		X	X	226	50	18.0	20.0	31.0
CBU-24B/B	X				X	830	50	18.0	20.0	31.0
CBU-25A/A	X	X		X	X	264	50	18.0	20.0	31.0
CBU-25B/A	X	X		X	X	264	50	18.0	20.0	31.0
CBU-55/B (FAE)	X		X		X	519	-	13.0	20.0	27.0
FLARE/MARKER										
AF/B37K-1 RACK							80	14.0	17.0	20.0
WITH FOUR MK6 MOD 3	X	X		X	X	145	80	40.0	50.0	62.5
WITH FOUR MK24 MODS/	X	X	X	X	X	200	80	30.0	40.0	52.5
WITH FOUR LUU-1/B, OR LUU-5/B	X	X		X	X	200	80	30.0	40.0	52.5
WITH FOUR LUU-2/B, OR MJU-3/B	X	X	X	X	X	200	80	30.0	40.0	52.5
SUU-25B/A FLARE DISPENSER WITH EIGHT MK24 MODS/	X	X		X	X	360	157	16.0	25.0	34.0
WITH EIGHT LUU-1/B, OR LUU-5/B	X	X		X	X	360	157	16.0	25.0	34.0
WITH EIGHT LUU-2/B, OR MJU-3/B	X	X		X	X	360	157	16.0	25.0	34.0
2.75 INCH FFAR ROCKET LAUNCHERS										
LAU-3A/A (CONES ON)	X	X		X	X	427	-	9.0	15.0	20.0
W/OUT CONES (FULL)						414	-	29.0	35.0	40.0
W/OUT CONES (EMPTY)						-	79	12.0	18.0	23.0
LAU-32B/A (CONES ON)	X	X		X	X	165	-	4.0	5.0	6
W/OUT CONES (FULL)						152	-	15.0	16.0	17.0
W/OUT CONES (EMPTY)						-	42	5.0	6.0	7.0
LAU-59/A (CONES ON)	X	X		X	X	174	-	4.0	5.0	6.0
W/OUT CONES (FULL)						161	-	15.0	16.0	17.0
W/OUT CONES (EMPTY)						-	52	5.0	6.0	7.0
LAU-68A/A (CONES ON)	X	X		X	X	217	-	4.0	5.0	6.0
W/OUT CONES (FULL)						204	-	15.0	16.0	17.0
W/OUT CONES (EMPTY)							67	5.0	6.0	7.0
LAU-68 B/A (CONES ON)	X	X		X	X	217	-	4.0	5.0	6.0
W/OUT CONES (FULL)						204	-	15.0	16.0	17.0
W/OUT CONES (EMPTY)							67	5.0	6.0	7.0

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Figure A1-1 (Sheet 2 of 3)

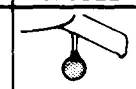
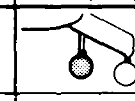
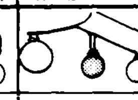
ITEM	STATION 1	STATION 2	STATION 3	STATION 4	STATION 5	WEIGHT-LBS FULL	WEIGHT-LBS EMPTY	DRAG NUMBER SINGLE	DRAG NUMBER ADJACENT	DRAG NUMBER MULTIPLE
5.0 INCH FFAR ROCKET LAUNCHER										
LAU-10/A (CONES ON)	X	X		X	X	533	-	7.0	11.0	15.0
W/OUT CONES (FULL)						500	-	26.0	30.0	34.0
W/OUT CONES (EMPTY)						-	105	9.0	13.0	17.0

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Figure A1-1 (Sheet 3 of 3)

FUEL WEIGHT vs. TEMPERATURE

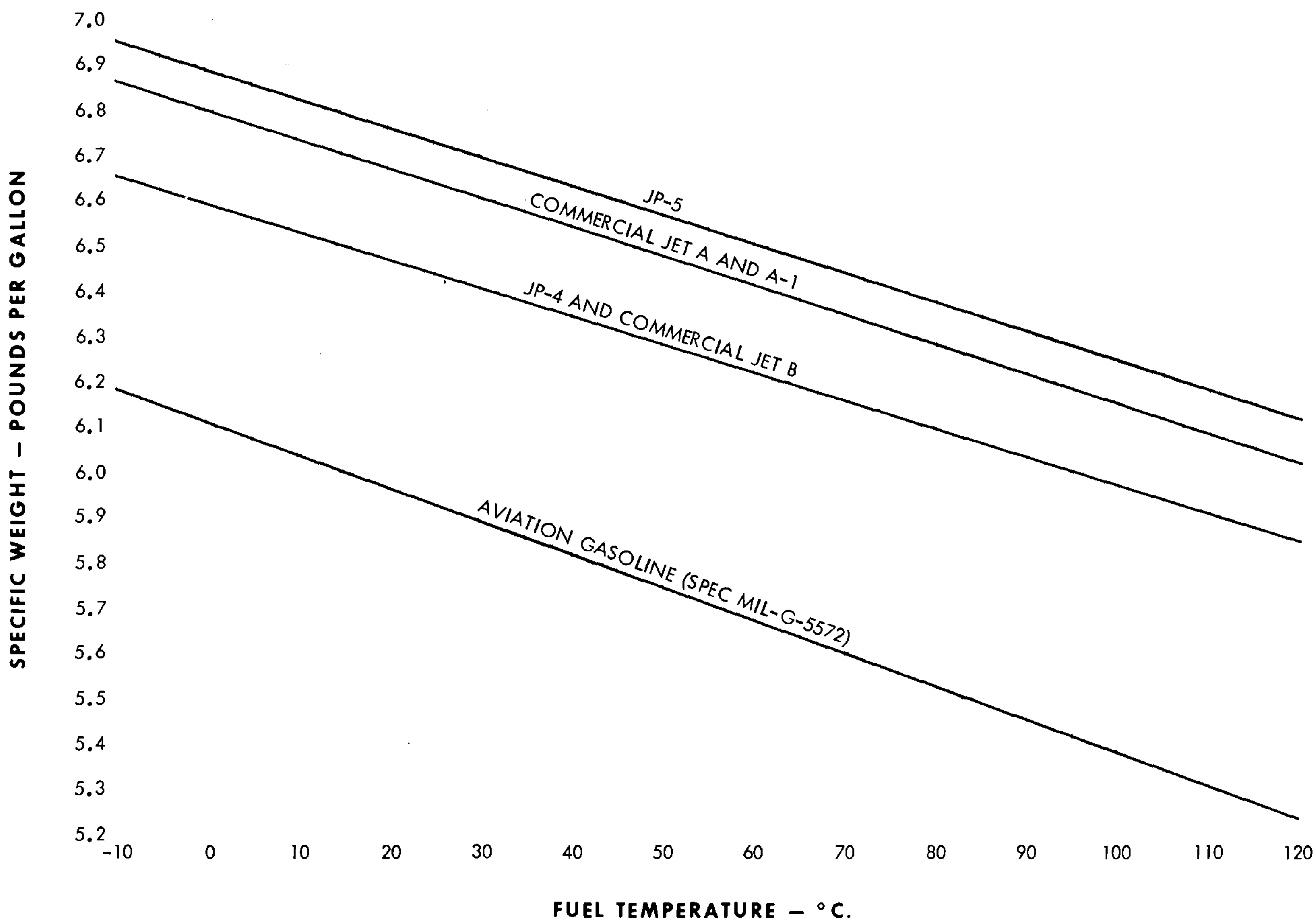

Figure A1-2

AIRSPEED CONVERSION

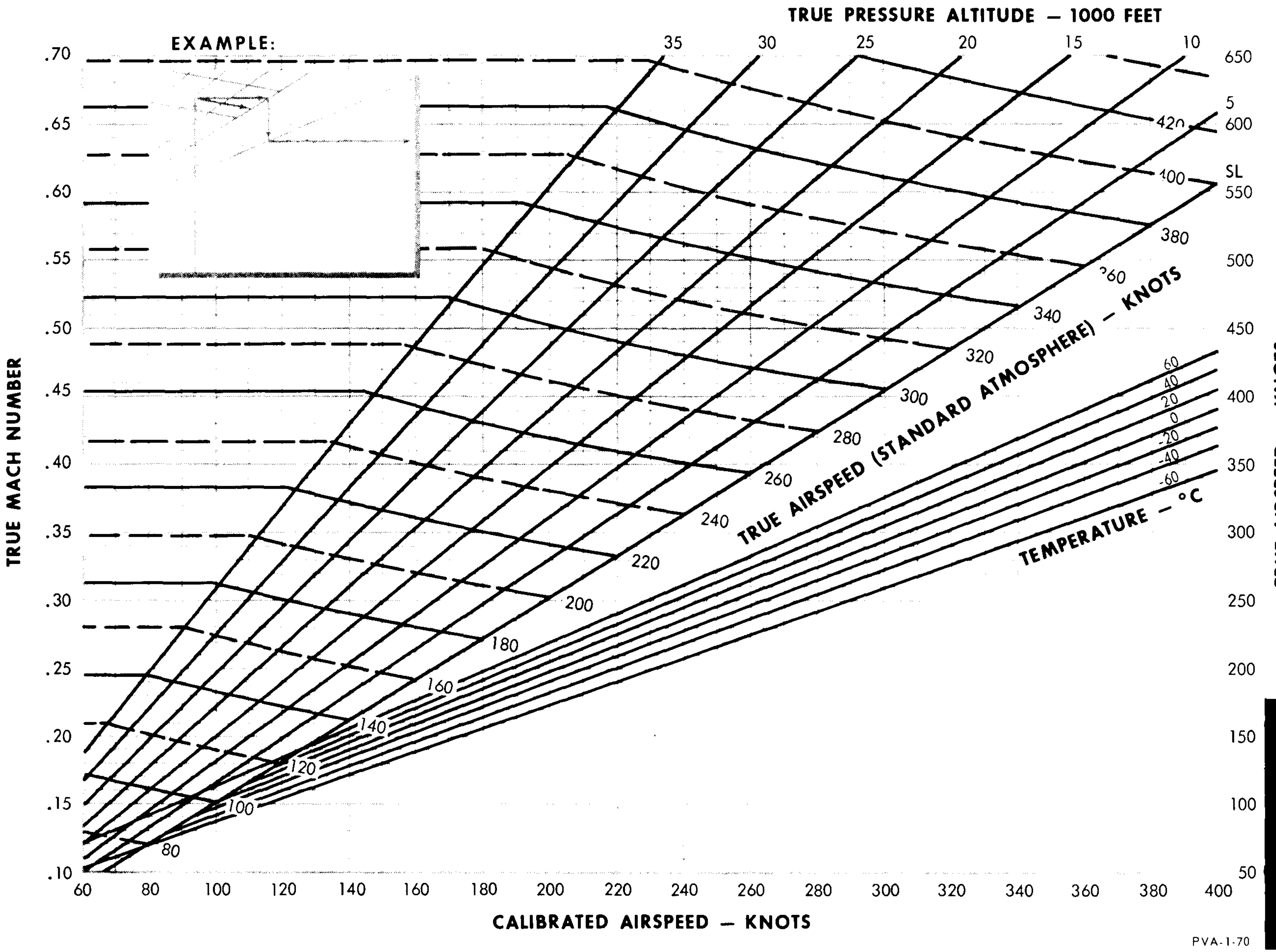

Figure A1-3

CAS-TAS-MACH

AIRSPEED CORRECTION

BASED ON: **FLIGHT TEST**
DATA AS OF: 1 SEPTEMBER 1968

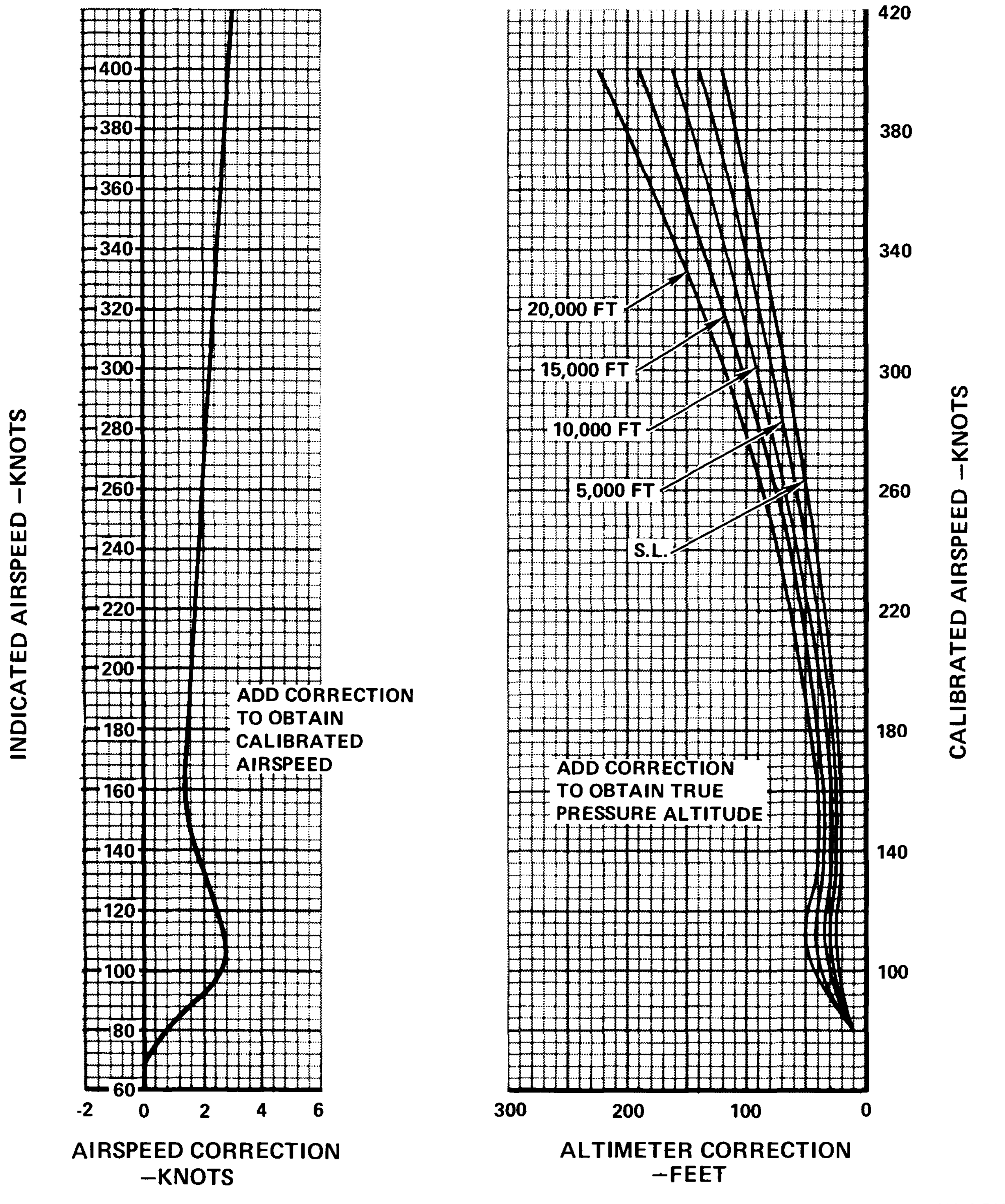

Figure A1-4

STANDARD ATMOSPHERE TABLE

STANDARD S L CONDITIONS:

TEMPERATURE 15°C (59°F)
PRESSURE 29-921 IN. Hg 2116.216 LB/SQ FT
DENSITY .0023769 SLUGS/CU FT
SPEED OF SOUND 1116.89 FT/SEC 661.7 KNOTS

CONVERSION FACTORS:

1 IN. Hg 70.727 LB/SQ FT
1 IN. Hg 0.49116 LB/SQ IN.
1 KNOT 1.151 M.P.H.
1 KNOT 1.688 FT/SEC

ALTITUDE FEET	DENSITY RATIO σ	$\frac{1}{\sqrt{\sigma}}$	TEMPERATURE		SPEED OF SOUND (KNOTS)	PRESSURE	
			DEG. C	DEG. F		IN. OF Hg	RATIO P/PO
0	1.0000	1.000	15.0	59.0	661.7	29.92	1.0000
1000	.9711	1.015	13.0	55.4	659.5	28.86	.9644
2000	.9428	1.030	11.0	51.9	657.2	27.82	.9298
3000	.9151	1.045	9.0	48.3	654.9	26.82	.8963
4000	.8881	1.061	7.1	44.7	652.6	25.84	.8637
5000	.8617	1.077	5.1	41.2	650.3	24.90	.8321
6000	.8359	1.094	3.1	37.6	648.7	23.98	.8014
7000	.8107	1.111	1.1	34.1	645.6	23.09	.7717
8000	.7860	1.128	-0.8	30.5	643.3	22.23	.7429
9000	.7620	1.146	-2.8	26.9	640.9	21.39	.7149
10000	.7385	1.164	-4.8	23.4	638.6	20.58	.6878
11000	.7156	1.182	-6.8	19.8	636.2	19.80	.6616
12000	.6933	1.201	-8.8	16.3	633.9	19.04	.6362
13000	.6715	1.220	-10.8	12.7	631.5	18.30	.6115
14000	.6502	1.240	-12.7	9.1	629.0	17.58	.5877
15000	.6294	1.260	-14.7	5.6	626.6	16.89	.5646
16000	.6092	1.281	-16.7	2.0	624.2	16.23	.5423
17000	.5894	1.303	-18.6	-1.5	621.8	15.58	.5206
18000	.5702	1.324	-20.6	-5.1	619.4	14.95	.4997
19000	.5514	1.347	-22.6	-8.7	617.0	14.35	.4795
20000	.5331	1.370	-24.6	-12.2	614.6	13.76	.4599
21000	.5153	1.393	-26.6	-15.8	612.1	13.20	.4410
22000	.4980	1.417	-28.5	-19.3	609.6	12.65	.4228
23000	.4811	1.442	-30.5	-22.9	607.1	12.12	.4051
24000	.4646	1.467	-32.5	-26.5	604.6	11.61	.3881
25000	.4486	1.493	-34.5	-30.0	602.1	11.12	.3716
26000	.4330	1.520	-36.5	-33.6	599.6	10.64	.3557
27000	.4178	1.547	-38.4	-37.1	597.1	10.18	.3404
28000	.4031	1.575	-40.4	-40.7	594.6	9.742	.3256
29000	.3887	1.604	-42.4	-44.3	592.1	9.315	.3113
30000	.3747	1.634	-44.4	-47.8	589.5	8.904	.2976
31000	.3612	1.664	-46.4	-51.4	586.9	8.507	.2843
32000	.3480	1.695	-48.3	-54.9	584.4	8.125	.2715
33000	.3351	1.727	-50.3	-58.5	581.8	7.757	.2592
34000	.3227	1.760	-52.4	-62.1	579.2	7.402	.2474
35000	.3106	1.794	-54.3	-65.6	576.6	7.061	.2360
36000	.2989	1.829	-56.2	-69.2	574.0	6.733	.2250
37000	.2853	1.872	-56.5	-69.7	573.7	6.418	.2145
38000	.2719	1.918	-56.5	-69.7	573.7	6.118	.2045
39000	.2592	1.964	-56.5	-69.7	573.7	5.832	.1949

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Figure A1-5

DENSITY ALTITUDE CHART

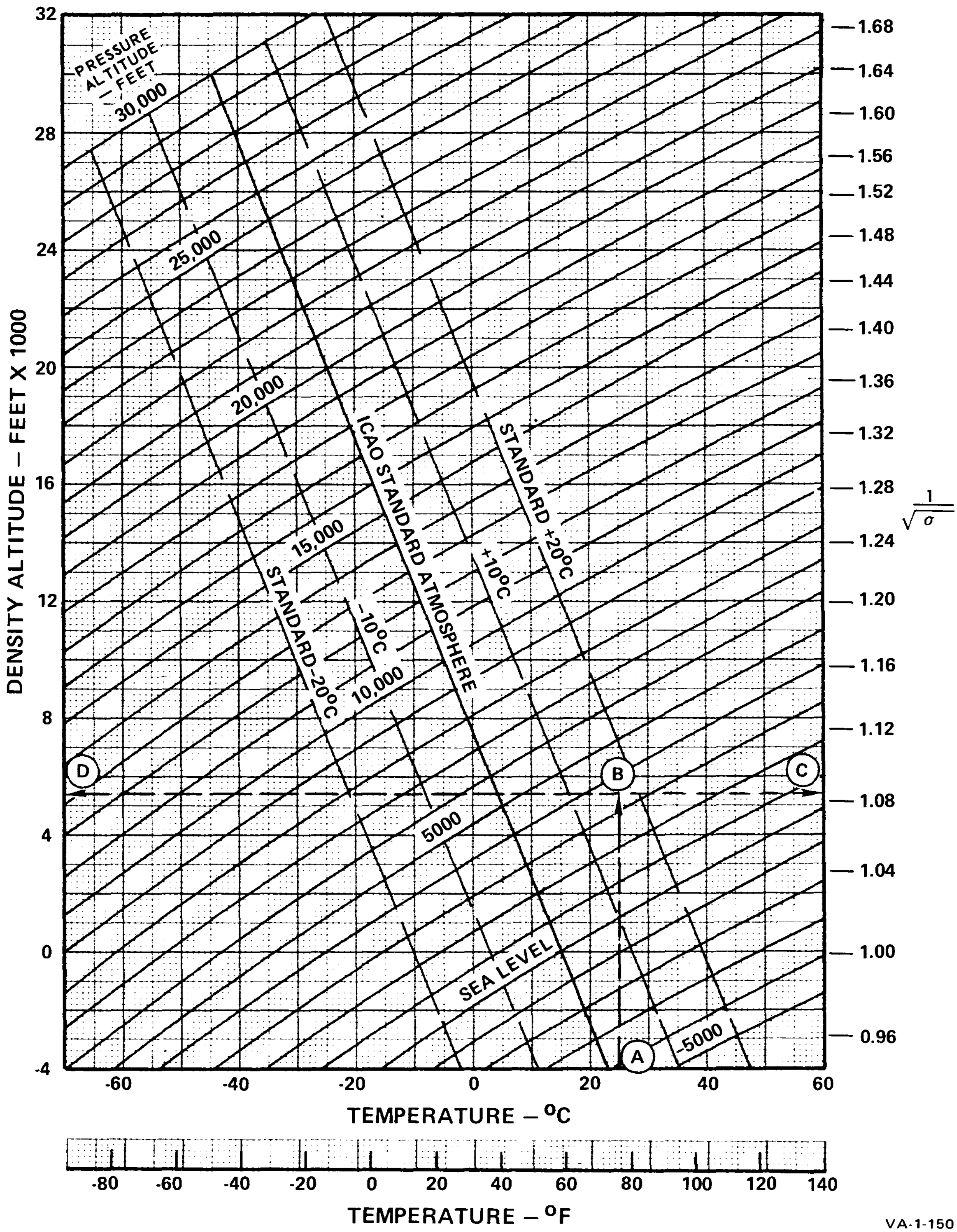


Figure A1-6

PART 2—TAKE-OFF DATA

TABLE OF CONTENTS

TAKE-OFF DATA

WIND COMPONENT (FIGURE A2-1)

The Wind Component chart is used to obtain headwind, tailwind, or crosswind components for winds from 0 to 60 knots at angles up to 90 degrees from aircraft heading. Tailwind components may be determined by entering the chart with wind direction taken from the reciprocal of aircraft heading. See figure A2-1.

Note

Crosswind component limit is 20 knots for take-off and landing.

Wind Component Example Problem

- Runway Heading—040 degrees
- Reported Wind—090 degrees, 12 knots

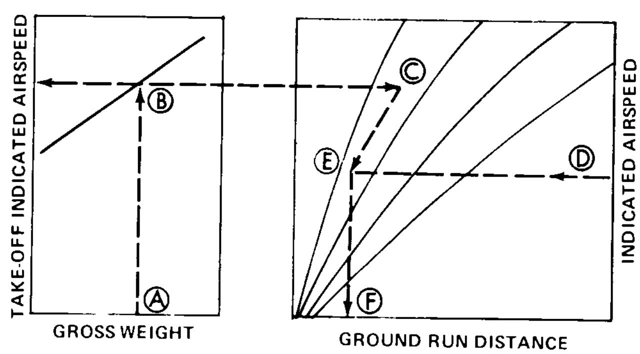
1. Headwind component = 7.5 knots
2. Crosswind component = 9 knots

ACCELERATION CHECK SPEED CHARTS FIGURE A2-2

The acceleration check speed charts are used to obtain a check of the proper acceleration performance of the aircraft on take-off roll for conditions of aircraft gross weight, ambient temperature, pressure altitude, and runway surface.

SAMPLE ACCELERATION CHECK SPEED PROBLEM

FLAPS 20°



Ⓐ AIRPLANE TAKE-OFF GROSS WEIGHT

Ⓑ TAKE-OFF INDICATED AIRSPEED FOR Ⓐ

Ⓒ TAKE-OFF GROUND RUN FOR Ⓐ AND Ⓑ AS DETERMINED FROM NORMAL TAKE-OFF CHARTS FOR TEMPERATURE, ALTITUDE, AND RUNWAY CONDITION.

Ⓓ ARBITRARY SPEED FOR CHECK DURING TAKE-OFF.

Ⓔ FROM Ⓒ ALONG GUIDELINES TO INTERSECT Ⓓ

Ⓕ DISTANCE FROM BRAKE RELEASE POINT WHERE SPEED Ⓓ IS OBTAINED.

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Example Chart 1

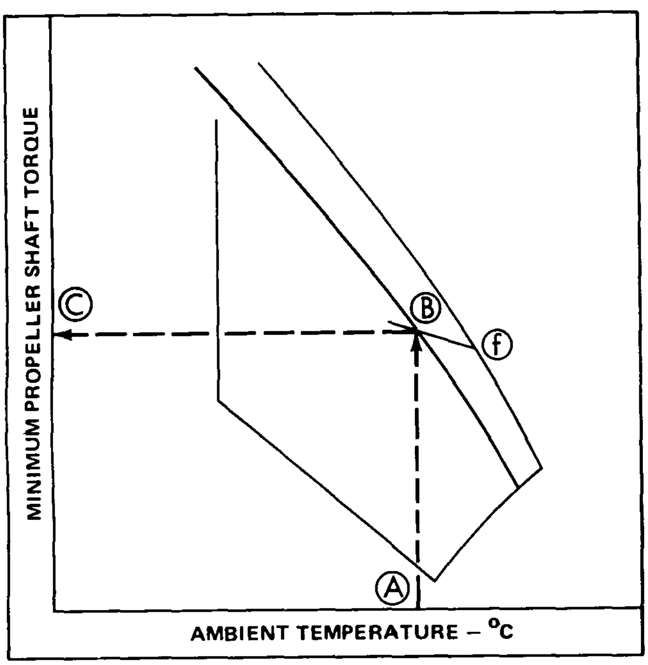
TAKE-OFF DISTANCE FIGURES A2-3 THROUGH A2-7

The take-off distance charts provide a means of determining take-off distance under normal or STOL operating conditions. The charts present expected torque, refusal speeds, take-off speeds, ground run distance for various types of runways, with various wind conditions and total distance over a 50-foot obstacle. These data are based on two-engine operation as a function of aircraft weight. The aircraft cg for chart use represents a mid cg value.

Note

Minimum propeller shaft torque provided on the Take-off Distance charts are based on the TIT system operative. Power correction using figure A2-7 must be applied for EGT systems.

SAMPLE STOL TAKE-OFF



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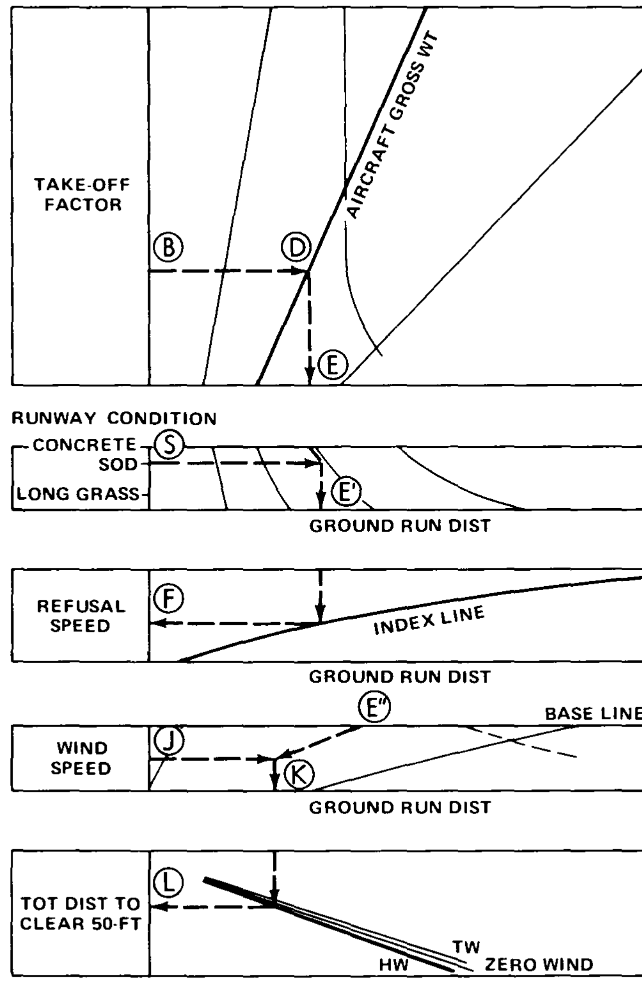
Example Chart 2

Enter Example Chart 2 with runway ambient temperature (A) and proceed up to the line corresponding to the field pressure altitude (B). At that point read the take-off factor (f), record and move horizontally to the expected torque reading (C) based on the engine manufacturer's rated engine at full throttle (MIL) power. From previous engine run-ups if rated torque cannot be obtained, the power correction nomogram must be used to determine corrected take-off distance requirements.

SAMPLE STOL TAKE-OFF



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Example Chart 3

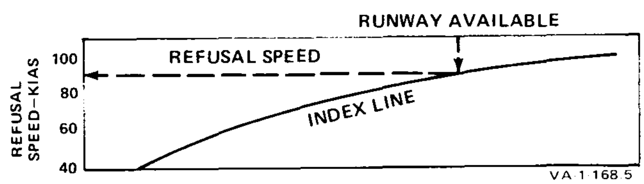
Moving to the upper chart on Example Chart 3, enter (B) with the take-off factor (f), and move horizontally until intersecting the aircraft gross weight line (D).

Note

If the aircraft gross weight is other than the value shown, use linear interpolation.

Then move down to the ground roll distance (E) for a dry, hard, concrete runway in a no-wind condition. If runway condition is other than dry, hard concrete, select the condition at (S), and draw a horizontal line. Then move downward from (E) along the guidelines until the intersection of the horizontal line is reached, then move vertically downward to new no-wind ground roll distance (E′). Otherwise continue using the value (E) and continue downward intersecting the index line in the refusal speed chart and reading the value of refusal speed (F) at the left side of the chart. This chart also can be used to determine the refusal speed, the maximum speed for any runway distance at sea level that the aircraft can accelerate to and stop in the runway length using brakes only for stopping. If the actual available field length is considered longer than the chart value, a new refusal speed may be determined if desired. See Example Chart 4.

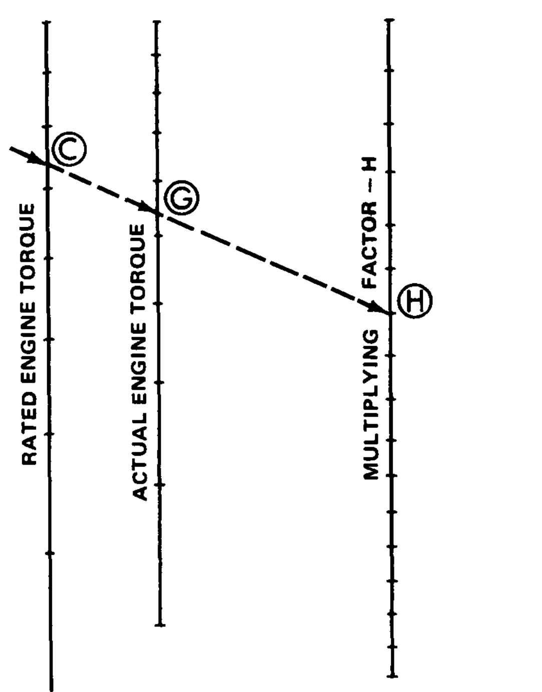
SAMPLE REFUSAL CHART



Example Chart 4

For example, enter chart at the top for length of runway available and drop a vertical line to the

SAMPLE CORRECTION NOMOGRAM



Example Chart 5

index line. Then draw a horizontal line to the left. This will give the refusal speed for that length of runway at sea level of any aircraft configuration.

If the engine torque is below the chart value (B) for the same pressure altitude and temperature conditions, then an additional correction must be made to the ground run and air distance.

Enter the Power Correction Nomogram (Example Chart 5) with the rated and the actual value of the engine torque readings (C) and (G), draw a straight line through these two points and read the multiplying factor at the intersection of the right vertical scale (H). The product of this factor (H) and the ground run (E′) will produce a new corrected ground run (E″).

Reenter Example Chart 3 with the corrected ground distance (E″), or if a power correction is not required, continue using (E′). Enter the value (E″) or (E′) on the baseline of the wind correction chart, then left or right parallel to the guidelines for head or tail wind until the value of the wind speed (J) is intersected. Then move vertically downward to the final corrected ground run distance (K). Continue downward to the index line of the total distance chart for the appropriate wind, then left horizontally for the uncorrected total distance over 50 feet (L).

The air distance must now be corrected for deficient torque readings if required. This is accomplished by subtracting the ground run distance (K) from the total distance (L) and multiplying this value by the multiplying factor (H), then adding the new value to the corrected ground run distance (K) for a final corrected total take-off distance over a 50-foot obstacle.

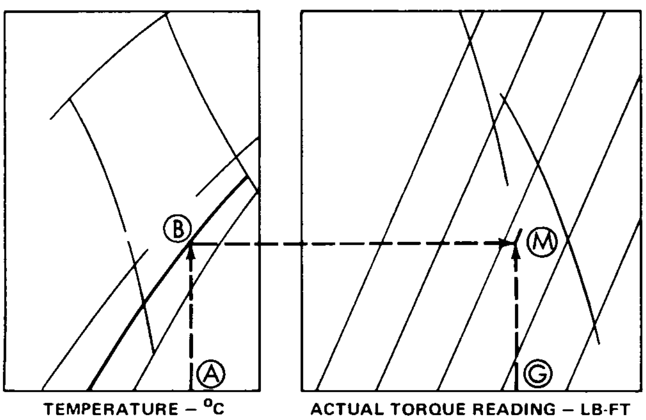
The limiting single-engine condition line is shown as a cross-hatched line sweeping across the aircraft gross weight parameter. The intersection with this line indicates the maximum gross weight at which 100 feet per minute rate of climb can be maintained with the flap and gear up and at the best climb speed (noted in Minimum Single Engine Control Speed Chart, figure A6-3). For values of aircraft gross weight to the right of this line, level flight cannot be maintained in event of engine failure.

Control can be maintained down to the minimum single-engine control speed shown in figure A6-3.

MINIMUM TORQUE VS. GROSS WEIGHT TO MAINTAIN 100 FPM RATE OF CLIMB (FIGURE A2-8)

Aircraft single-engine fly-away capability after reaching lift-off speed, having the landing gear retracted with flaps up or flaps at 20-degree position can be determined from the Minimum Torque vs. Gross Weight to Maintain 100 FPM Rate of Climb chart (figure A2-8).

SAMPLE MINIMUM TORQUE vs. GROSS WEIGHT
TO MAINTAIN 100 FPM RATE-OF-CLIMB



Example Chart 6

If an engine failure occurs during a take-off ground roll, the aircraft should be stopped. Safe stopping distance can be ensured if the refusal speed previously determined is observed. The single-engine fly-away chart (Example Chart 6) is entered at the lower left side with runway temperature (A), then moving vertically up to intersect the field pressure altitude (B). Then move horizontally until a vertical line is intersected from the actual engine torque reading (G) on the right, and the gross weight (M) is then interpolated linearly from the lines of constant gross weight.

If this take-off weight value (M) exceeds the initial value (D), the pilot must be prepared to jettison all external stores in the event of engine failure following take-off in order to maintain level flight. If the value of the aircraft gross weight less external stores still exceeds the chart value (M), then single-engine level flight cannot be maintained and the pilot must be prepared to return the aircraft to the runway at once. If sufficient altitude is not available to return to the runway, ejection procedures should be initiated providing the terrain does not permit a satisfactory landing. Each take-off ground run chart contains a limit line reflecting single-engine fly-away capability.

Take-off Distance Example Problem

Find the ground run, total distance over a 50-foot obstacle, refusal speed, and lift-off speed utilizing maximum performance STOL technique (figure A2-5) for the following conditions:

- Runway Temperature—15°C
- Pressure Altitude—2000 feet
- Flap Setting—20 degrees
- Take-off Gross Weight—11,000 pounds
- Actual Engine Torque Reading—1280 pounds-feet
- Surface—Short grass sod field
- Runway—Level
- Wind—20 knots headwind

1. Read rated engine propeller shaft torque (C) at 1660 pounds-feet and take-off factor (f) as 3.6.
2. For dry concrete runway, take-off distance (E), read 1020 feet, and for sod field of short grass (E′), read 1090 feet.
3. Refusal speed (F) is 53 knots.
4. For rated engine torque (C) of 1660 pounds-feet and actual engine torque reading (G) of 1280 pounds-feet, read power correction factor (H) of 1.30 in figure A2-7.
5. Then corrected ground run (E″) is 1090 feet X 1.3 = 1417 feet.
6. Correct distance for headwind (J) velocity of 20 knots and read total distance (K) as 870 feet.