A1-F18AC-NFM-000

NATOPS FLIGHT MANUAL
NAVY MODEL
F/A-18A/B/C/D
161353 AND UP
AIRCRAFT

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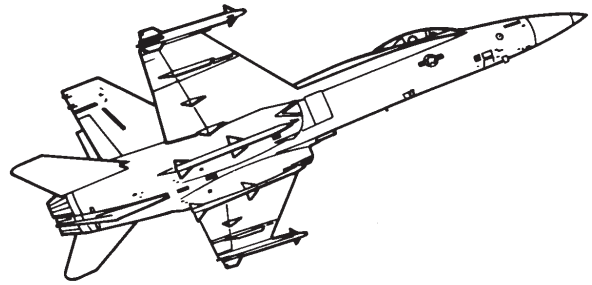


ISSUED BY AUTHORITY OF THE CHIEF OF NAVAL OPERATIONS AND
UNDER THE DIRECTION OF THE COMMANDER
NAVAL AIR SYSTEMS COMMAND.

05 June 2018

Engine Shutdown

1	Brake gauge	3,000 psi
2	Nosewheel steering	DISENGAGE
3	FLAP switch	FULL
4	Throttle	OFF (alternate sides)
	Before engine shutdown, engine should be operated on ground at idle for 5 m	
5	L(R) DDI, HI/MPCD, HUD.	OFF
6	Throttle	OFF
	When amber FLAPS light illuminates	
9	BATT switch	OFF

INDEX

Interior Check

Left Console

1	OBOGS control switch	OFF
a.	~~*OXY FLOW knob*~~	~~*OFF (DCS HYPOXIA WARNING)*~~
2	COMM 1/IFF AMT SEL switches	AUTO/BOTH
3	COMM panel	SET
a.	*Relay, G XMT switches*	*OFF*
b.	*ILS*	*Set Frequency/UFC*
c.	*Master, mode 4, and crypto switches*	*NORM/OFF/NORM*
4	VOL panel	SET AS DESIRED
5	GEN TIE CONTROL switch	NORM/GUARDED
6	FCS GAIN switch	NORM/GUARDED
7	PROBE switch	RETRACT
8	EXT TANKS switches	NORM
9	DUMP switch	OFF
10	INTR WING switch	NORM
11	EXT LT panel	SET
12	Throttles	OFF
13	PARK BRK handle	SET
14	LDG/TAXI LIGHT switch	OFF
15	ANTI-SKID switch	ON (Field) / OFF (Carrier)
16	FLAP switch	FULL
17	SELECT JETT knob	SAFE
18	LDG GEAR handle	DN
18	Landing gear handle mechanical stop	FULLY ENGAGED
19	CANOPY JETT handle	FORWARD

Instrument Panel

1	MASTER ARM switch	SAFE
2	FIRE and APU FIRE warning lights	NOT PRESSED IN
3	L(R) DDI, HI/MPCD, and HUD knobs	OFF
4	Altitude source	SELECT

Post Flight

After Landing

Do not taxi with the right engine shut down.
With right engine shut down, only the accumulators provide hyd. power for NWS & brakes.

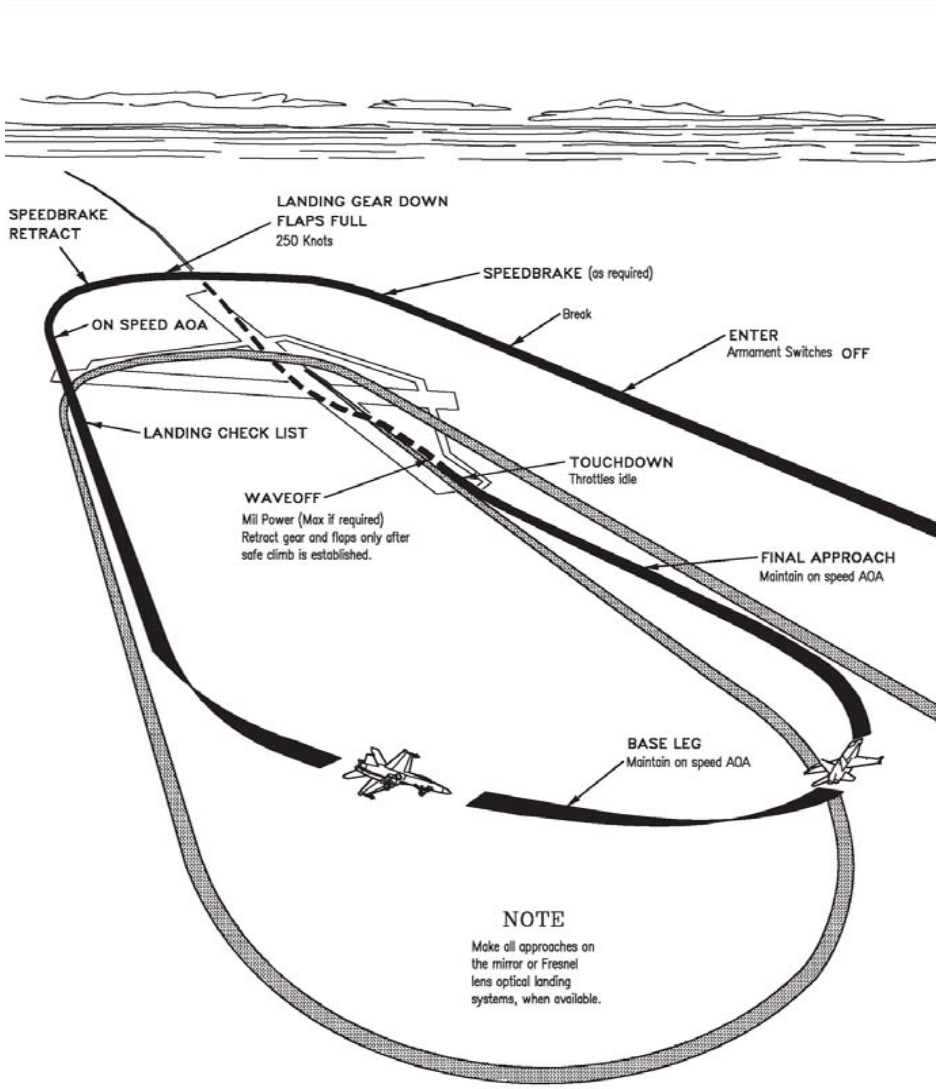
When clear of active runway

1	Ejection seat	SAFE
2	Landing gear handle mechanical stop	FULLY ENGAGED
3	FLAP switch	AUTO
4	T/O TRIM button	PUSH (note TRIM advisory)
5	MASK	OFF
~~6~~	~~OXY FLOW knob~~	~~OFF (DCS HYPOXIA WARNING)~~
7	Canopy	Full up or Full down

Before Engine Shutdown

1	PARK BRK handle	SET
2	*BIT display*	*RECORD DEGD*
3	*BLIN codes*	*RECORD*
4	*Radar Maintenance codes*	*NOTE IF PRESENT*
5	INS	PERFORM POST FLIGHTS UPDATE
6	INS knob	OFF (10 seconds before engine shutdown)
7	Standby attitude reference indicator	CAGE/LOCK
8	Sensors, radar avionics & VTRS	OFF
9	COMM 1, 2	OFF
10	EXT and INT LT knobs	OFF
11	CRYPTO switch	AS REQUIRED
12	Canopy	OPEN
13	QDC	DISCONNECT AND STOWED

LANDING (Continued)



Interior Check (Continued)

5	ATT switch	AUTO
6	COMM 1 and 2 knobs	OFF
7	ADF switch	OFF
8	ECM mode knob	OFF
9	Dispenser switch	OFF
10	AUX REL switch	NORM
11	Standby attitude reference indicator	CAGE/LOCK
12	IR COOL switch	OFF
13	SPIN switch	GUARD DOWN/OFF

Right Console

1	Circuit breakers (4)	IN
2	HOOK handle	UP
3	WING FOLD handle	SAME AS WING POSITION
4	AV COOL switch	NORM
5	Radar Altimeter	OFF
6	GEN switches	NORM
7	BATT	OFF
8	ECS panel	SET
	a. MODE switch	*AUTO*
	b. CABIN TEMP knob	*10 O'CLOCK*
	c. CABIN PRESS switch	*NORM*
	d. BLEED AIR knob	*NORM and DOWN*
	e. ENG ANTI ICE switch	*OFF*
	f. PITOT ANTI ICE switch	*AUTO*
9	DEFOG handle	MID RANGE
10	WINDSHIELD switch	OFF
11	INTR LT panel	AS DESIRED
12	Sensors	OFF
13	KY-58 panel	SET

Engine Start (Bat & APU)

1	Battery status	CHECK
	a. Battery switch	*ORIDE*
	b. E BATT voltage	*CHECK*
	After a minimum if 5 seconds in ORIDE, check for minimum voltage of 23.5 volts.	
	c. Battery switch	*ON*
	d. U BATT voltage	*CHECK*
	After min. of 5 seconds in ORIDE, check for min. voltage of 23.5v. *Cold weather Temps down to -18°, a min. of 20.5v on the UBATT is acceptable*	

With external electrical power

1	EXT PWR switch	RESET
2	GND PWR switches 1, 2, & 3	B ON (hold for 3 seconds)
3	L(R) DDI, HI/MPCD, & HUD knobs	AS DESIRED
4	COMM 1, 2, and ADF	AS DESIRED
5	Warning and caution lights	TEST
6	Inertial navigation system	ENTER WAYPOINTS DESIRED

ALL starts

1	BATT switch	ON (if not previously ON)
2	FIRE warning test	PERFORM
	a. FIRE test switch	*TEST A*
	(hold until all lights and aural warnings indicate test has been successfully passed)	
	b. FIRE test switch	*NORM*
	(pause 7 seconds or cycle BATT switch)	
	c. FIRE test switch	*TEST B*
	(hold until all lights and aural warnings indicate test has been successfully passed)	

If APU start

3	APU ACC caution light	OFF
	a. APU switch	*ON (READY light within 30 seconds)*

If external air start

3	BLEED AIR knob	OFF

LANDING (Continued)

Asymmetric Stores Landing

Landing with asymmetric external stores up to 12,000 footpounds of lateral asymmetry requires no special considerations. Above 12,000 foot-pounds of lateral asymmetry, AOA must be kept below 12° to prevent uncommanded sideslip.

The inboard station is 7.3 feet from the aircraft centerline and the outboard station is 11.2 feet from the aircraft centerline. A lateral asymmetry of 12,000 foot-pounds occurs with 1,636 pounds of asymmetry on an inboard station or 1,070 pounds of asymmetry on an outboard station.

Due to landing gear structural limitations, the weight of an asymmetric tip missile and/or internal wing fuel asymmetry must be used in calculating total aircraft asymmetry. Asymmetry due to internal wing fuel imbalance is calculated by multiplying the difference of fuel weight between left hand and right hand wing by 8.0 feet. Fuel weight differences of less than 100 pounds are considered negligible. Wingtip missile asymmetries can be calculated by multiplying missile weight by 19.5 feet (the distance of the wingtip station from aircraft centerline.)

If lateral asymmetry exceeds 12,000 foot-pounds, do not exceed 12° AOA. Recommend fly straight-in approach at optimum approach speed. Do not apply cross controls and make only smooth, coordinated rudder and lateral stick inputs. In a crosswind, fly a crabbed approach to touchdown.

Waveoff

Do not delay the decision to take a waveoff to the point that control of the landing or rollout is in jeopardy.
Takeoff distances at MIL or MAX power are short provided the aircraft has not decelerated to slow speed.
Advance the throttles to MIL or MAX as required to either stop the sink rate or takeoff and maintain angle of attack.
Raise the landing gear and flaps only after a safe climb has been established.

Wet Runway Landing

The aircraft exhibits satisfactory handling characteristics during landing rollouts on wet runways. However, experience indicates that landing in crosswind conditions may increase the pilot tendency to directionally overcontrol the aircraft during the landing rollout.

Wet runways can induce hydroplaning throughout the landing rollout. As a result, the aircraft may respond sluggishly to NWS commands and encourage the pilot to use excessively large control inputs. Rudder pedal commands should be kept small, especially if hydroplaning is suspected.
Minimum total hydroplaning speed of the main landing gear tires inflated to 250 psi is 140 knots groundspeed and, for nose gear tires inflated to 150 psi, is 110 knots. However, some hydroplaning can occur at much lower speed, depending upon runway conditions.

For wet (standing water) runway landings, reduce gross weight to minimum practical. Concentrate on landing ON SPEED or slightly slow with power coming off at touchdown.
Maintain a constant attitude and sink rate to touchdown. Ensure the throttles are in ground idle.

When comfortable with directional control, use maximum anti-skid braking to minimize landing distance.
Go around if a directional control problem occurs and make an arrested landing. Delaying the decision to abort the landing and go around can put the pilot in a situation in which he cannot remain on the runway during the takeoff attempt.

ALL starts

4	ENG CRANK switch	R
5	Right throttle	IDLE (15% rpm minimum) *Maximum EGT during start is 815° C.*
6	GPWS Voice Alerts	CHECK (“ROLL LEFT, ROLL LEFT”)
7	L(R) DDI, HI/MPCD, HUD, and UFC avionics, and radar altimeter.	ON
8	HMD switch (if applicable)	ON
9	IFEI	CHECK

If APU or Crossbleed start

10	BLEED AIR knob	CYCLE THRU OFF TO NORM

The bleed air shutoff valves close during fire warning test and the BLEED AIR knob must be cycled thru OFF to NORM with ac power on to reset the valves.

11	Warning and caution lights	TEST

For a crossbleed start, ensure APU switch is OFF and a minimum of 80% rpm and 1,900 pph fuel flow.

12	ENG CRANK switch	L
13	Left throttle	IDLE (15% rpm minimum)
14	ENG CRANK switch	CHECK OFF

If external air start

15	BLEED AIR knob	RETURN TO NORM

ALL starts

16	IFEI	CHECK

Before Taxi

1	Waypoint zero and magnetic variation	CHECK
2	INS knob	CV/GND (parking brake set) or IFA (functioning GPS)
3	RADAR knob	OPR
4	WING FOLD	SPREAD AND LOCK
5	FCS RESET button	PUSH

If the wings are folded, verify aileron Xs are present.

If no reset

a.	*T/O trim button*	*PUSH (note TRIM advisory)*
b.	*FCS exerciser mode*	*INITIATE*

Lift FCS BIT consent switch and push FCS RESET button simultaneously.

If still no reset

c.	*FCS circuit breakers*	*PULL 4 CHANNELS*
d.	*Wait 10 seconds.*	
e.	*FCS circuit breakers*	*RESET*
f.	*FCS RESET button*	*PUSH*

6	FLAP switch	AUTO
7	FCS RESET button and paddle switch	ACTUATE SIMULTANEOUSLY
8	FLAP switch	HALF
9	FCS INITIATED BIT	PERFORM
a.	*AOA warning tone*	*VERIFY ANNUNCIATION AT FCS IBIT COMPLETION*
10	Trim	CHECK

Check pitch, roll, & yaw trim for proper movement, then set for takeoff.

11	T/O TRIM button	PRESS UNTIL TRIM ADVISORY DISPLAYED
12	FLAP switch	AUTO

LANDING (Continued)

Braking Technique

Under normal circumstances, the best results are attained by applying moderate to heavy braking with one smooth application of increasing braking pressure as airspeed decelerates towards taxi speed.

Anti-skid is effective down to approximately 40 KGS. Below 40 KGS, heavy brake pedal pressure should be relaxed to prevent tire skid.
Below 35 KGS, steady but firm brake pedal pressure should be applied. Steady, light brake applications should be avoided, as they increase brake heating, and do not significantly contribute to deceleration, and ultimately reduce braking effectiveness.
If desired, selecting aft stick (up to full) below 100 KCAS will increase TEU stabilator deflection and aid in deceleration. Full aft stick increases down force on the main landing gear, as well as significantly increasing drag due to large stabilator size.

Maximum braking performance is attained by applying full brake pedal pressure (approximately 125
lb) immediately after touchdown.
Anti-skid must be on to attain maximum braking performance and to reduce the risk of a blown tire. Longitudinal pulsing may be felt as the anti-skid cycles.
Approaching 40 KCAS, full brake pedal pressure should be relaxed to prevent tire skid.

Crosswind Landing

The optimum technique for crosswind landing is to fly a crabbed approach, taking out half the crab just before touchdown.
For landing in a crosswind greater than 15 knots on a dry runway, the touchdown should be slightly cushioned in order to reduce landing gear trunion loads.
The wing-down top-rudder technique is ineffective in crosswinds greater than 20 knots, creates excessive pilot workload, and should not be used.
Touchdown in a full crab or with all the crab taken out may cause large directional oscillations which can lead to excessive pilot inputs and subsequent PIO.
Taking out half the crab provides the correct amount of pedal force and resultant NWS command to start the aircraft tracking down the runway.

Subsequent runway centerline tracking requires only small rudder inputs to initiate directional corrections.Although lateral stick is not generally required during the landing roll, judicious inputs may be made to counter the upwind wing rocking up.
Landing rollouts in crosswinds up to 30 knots have been accomplished with hands off the control stick with little or no objectionable roll (less than 5°) induced by crosswind or asymmetric stores.

Touchdown

Maintain approach attitude and thrust setting to touchdown using the lens or make a firm touchdown at least 500 feet past the runway threshold.
At touchdown, place the throttles to IDLE.
The aircraft tends to align itself with the runway. Small rudder corrections (NWS) may be required to keep the aircraft tracking straight.
Using a flared minimum descent rate landing, the WOW switch may not actuate immediately. In this case, the throttles cannot be reduced to ground idle and may be inadvertently left in the flight idle position, thereby reducing the deceleration rate and extending the length of the landing rollout.

Track down the runway centerline using rudder pedals to steer the aircraft.
Aerodynamic braking is not recommended. Getting the nosewheel on the ground and use of aft stick (programmed in by light braking and slowly pulling the stick aft after touchdown so only the minimum required distance to command full aft stabilator deflection by 100 knots) provides faster deceleration from the stabilators and more directional control with use of the NWS.

Nosewheel steering

The nosewheel steering (NWS) is the most effective means of directionally controlling the aircraft during landing rollout. Aerodynamic control surface inputs become ineffective below an airspeed of 75-85 knots.
Differential braking requires special attention and technique to control the aircraft below this speed.

NWS is activated automatically in the low mode (16° limit) by weight on the nose and at least one main gear. NWS inputs are commanded through force sensors behind the minimum displacement rudder pedals allowing for precise directional control.
The NWS does not receive commands through the rolling surface to rudder interconnect (RSRI).

Landing Rollout

Track down the runway centerline using rudder pedals to steer the aircraft directionally.
Aerodynamic braking is not recommended.
Use wheel braking only after the aircraft main wheels are firmly on the runway

13	Controls	CHECK
	a. Full aft: 24 NU stabilator	
	Full fwd: 3 NU	
	R/L Aileron: CHECK 20 units differential stabilator.	
	CHECK differential trailing edge flaps.	
	b. FLAP switch	*AUTO*
	c. Rudder pedals	*CYCLE 30° left and right*
14	Trim	SET FOR TAKEOFF
15	PROBE, speedbrake, LAUNCH BAR switches, HOOK handle & pitot heat	CYCLE 30° left and right
16	Air scoop	CHECK
	a. AV COOL switch	*EMERG*
	FCS ram air scoop deploys (thumbs up from plane captain).	
	b. Plane captain manually restows scoop.	
17	APU	VERIFY OFF
18	FUEL	BIT/SET BINGO
19	Altimeter	SET
20	GPWS/TAWS	BOXED
21	Mission data	ENTER WAYPOINTS DESIRED
22	BIT	NOTE DEGD/FAIL
23	Weapons/sensors	AS REQUIRED
24	STORES page	VERIFY STORE INVENTORY & STATION STATUS
25	HMD	ALIGN
	Canopy must be down and locked to align HMD	
	a. SUPT/HMD/ALIGN page	*SELECT*
	b. Superimpose the HMD alignment cross on the HUD/BRU alignment cross	
	c. Cage/Uncage button	*PRESS and HOLD until ALIGNING turns ti ALIGN OK*

If ALIGN FAIL

d. Repeat steps b and c

If ALIGN OK & HMD alignment crosses are not coincident with HUD/BRU alignment cross

d. Perform FINE ALIGN

(1) With FA DXDY displayed, use TDC to align azimuth and elevation HMD alignment crosses with the HUD/BRU alignment cross.

(2)	*Cage/Uncage button*	*PRESS and RELEASE*

(3) With FA DROLL displayed, use TDC to align the roll axis HMD alignment crosses with the HUD/BRU alignment cross

(4)	*Cage/Uncage button*	*PRESS and RELEASE*

If satisfied with alignment

e.	*ALIGN*	*UNBOX*
26	Standby attitude reference indicator	UNCAGE
27	ATT switch	STBY

Verify INS attitude data is replaced by standby attitude data on HUD.
Check agreement of standby and INS data.
Verify Xs appear in CH 1/3 of the PROC row on the FCS page.

28	ATT switch	AUTO
29	OBOGS systems	CHECK
a.	*OBOGS control switch*	*ON*
b.	*OXY FLOW knob*	*ON/MASK ON*
c.	*OBOGS flow*	*CHECK*
d.	*OBOGS monitor electronic BIT pushbutton.*	*PRESS and RELEASE*

e. Verify OBOGS DEGD caution set and removed within 15 seconds.

f.	*OXY FLOW knob*	*OFF/MASK OFF*

30 ID - Enter 3 digit Julian date and event number via UFC

31 Canopy either full up or full down during taxi

Approach

Enter the pattern as prescribed by local course rules.
At the break, reduce thrust and extend the speedbrake (if required).
As the airspeed decreases through 250 knots, lower the landing gear and place the FLAP switch to FULL and ensure that speedbrake is retracted.
Decelerate to on-speed, and compare airspeed and angle of attack.
Complete the landing checklist.

Roll into the base leg and establish a rate of descent, maintaining on-speed AOA.
On-speed without external stores and 2,000 pounds of internal fuel is about 125 knots.
Add about 2.5 knots for each 1,000 pounds increase in fuel and stores.
Rate of descent can be established using the velocity vector on the HUD to set the glide-slope.
Avoid overcontrolling the throttles as thrust response is immediate.
Compensate for crosswind by crabbing the aircraft into the wind on final approach.

1	LAND checklist	COMPLETE

LANDING

Descent/Penetration

Before descent, preheat the windshield by increasing defog air flow (DEFOG-HIGH) and, if necessary windshield anti-ice/rain air flow (WINDSHIELD ANTI-ICE/RAIN).

Since rapid descents cannot always be anticipated, the maximum comfortable cockpit interior temperature should be maintained to aid in defrosting the windshield.

Normal instrument penetration is 250 knots and 4,000 to 6,000 feet per minute descent.

Before starting descent, perform the following:

1	ENG ANTI ICE switch	AS DESIRED
2	PITOT ANTI ICE switch	AUTO
3	DEFOG handle	HIGH
4	WINDSHIELD switch	AS DESIRED
5	Altimeter setting	CHECK
6	Radar Altimeter	SET AND CHECK
7	HUD - SELECT NAV MASTER MODE, COMPARE WITH STBY INSTR. & STBY COMPASS	
8	Navaids	CROSSCHECK
9	ARA-63 (ILS)	ON AND CHANNEL SET
10	IFF	AS DESIRED
11	Weapons/sensors	AS REQUIRED

TAXI

1	Normal Brakes	CHECK
2	Nosewheel steering	CHECK

TAKEOFF

Before Takeoff

1	Canopy	CLOSED
2	OXY FLOW knob	ON/MASK ON
3	IFF	ON
4	Inertial navigation system	CHECK
5	PARK BRK handle	FULLY STOWED
6	MENU checklist	COMPLETE
7	Engines	MIL CHECK (if desired)

F404-GE-402

N2 % RPM	90 to 102
EGT °C	715 to 880
FF pph	6,000 to 12,500
NOZ %	0 to 48
OIL psi (warm oil)	95 to 180
AB	Check if desired

Normal Takeoff

Takeoff trim	12°
Speedbrakes	RETRACTED

Set takeoff trim to 12° and ensure the speedbrake is retracted. The aircraft should be aligned with the centerline of the runway for individual takeoffs. When in position, roll
forward slightly to center the nose wheel and select low gain nosewheel steering. As the takeoff roll is begun, advance throttles to MIL power and check EGT and RPM. If an afterburner takeoff is desired, afterburner is selected by moving both throttles into the afterburner range and advancing smoothly to MAX power. If one afterburner fails to light or blows out during takeoff, the resulting power loss is significant.

Sufficient directional control is available with the rudder and nosewheel steering to continue the takeoff with asymmetric power. The decision to abort or continue the takeoff depends on existing circumstances: external stores configuration, runway remaining, and the characteristics of the afterburner failure since it may indicate problems with the basic engine. Nosewheel steering is used to maintain directional control throughout the takeoff roll. Differential braking alone may not be adequate to maintain directional control on takeoff. Also, the drag of the brakes increases the length of the takeoff roll.

The location of the main landing gear well aft of the CG does not allow the aircraft to be rotated early in the takeoff roll. The normal rotation technique is to position the stick aft of neutral approaching nosewheel lift-off speed. Nosewheel lift-off speed depends on weight and CG, however, hold the aft stick until 6° to 8° nose high attitude (waterline symbol) is reached. Main gear lift-off follows shortly, and a forward adjustment of stick is necessary to maintain the desired attitude. For a minimum run takeoff, use full afterburner power. Approaching nosewheel lift-off speed, apply full aft stick until the aircraft begins to rotate. Adjust the stick to maintain a 10° to 12° nose high attitude (waterline symbol). Once a positive climb rate is established, ensure the gear handle light is out and retract the gear. Accelerate to the appropriate climb speed.

Crosswind Takeoff

The initial portion of the crosswind takeoff technique is the same as the normal takeoff. Aft stick pressure should not be applied until approaching liftoff speed.

Do not assume an immediate wing low attitude in order to counteract for wind drift; the pilot cannot properly judge the wing tip ground clearance on a swept wing aircraft.

After Takeoff

1	LDG GEAR handle	UP
2	FLAP switch	AUTO

Climb

For visibility over the nose, maintain 350 knots to 10,000 feet.

10,000 feet

1	Cockpit altimeter	CHECK
2	Fuel transfer	CHECK
3	RDR altimeter altitude warning system	CHECK/SET

CRUISE

Cruise

Optimum cruise and maximum endurance should be found in the Performance Data, and is attained by flying the correct Mach number for configuration and altitude. Maximum range cruise is approximated by establishing 4.2°, but no faster than Mach 0.85. Maximum endurance is approximated by establishing 5.6° AOA.

Cruise Check

1	Cabin Pressurization/temperature	MONITOR

During cruise, check cabin pressurization/temperature control. Pressurization shall remain at 8,000 feet up to 23,000 - 24,000 feet altitude. Above 23,000 to 24,000 feet altitude, cockpit pressurization shall follow schedule.

AIRCRAFT ALTITUDE	CABIN ALTITUDE
30,000 feet	10,000 to 12,000 feet
40,000 feet	15,000 to 17,000 feet