

Boeing 737-200 / -300 / -400 Procedures

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BEFORE TAXI

Engine Starting, -200

Normal starting procedure is to start No. 2, then No. 1 engine from APU air utilizing the APU electrical supply.

Hold engine start switch in GRD position. When N2 reaches 20% and there is an N1 indication, move start lever to IDLE and check fuel flow and EGT rise. Normal starting fuel flow is 800 - 1000 lbs. At 35%-40% N2, release the start switch.

Standard day, sea level, stabilized idle indications are:

	JT8D-9	JT8D-15A
EPR	1.06	1.06
N1 RPM	33%	33%
EGT	300° - 400°	300° - 400°
N2 RPM	56%	56%
Fuel Flow	1000 lbs/hr	1200 lbs/nr
Oil Pressure	40 - 50 psi	40 - 50 psi

The requirement to abort an engine start is recognized by one or more of the following conditions:

- No N1 rotation by 20% N2.
- No oil pressure increase in 30 seconds.
- Fuel flow greater than 1,100 PPH at initial start.
- No increase in EGT within 20 seconds after the engine start lever is raised to IDLE.
- No increase in, or very slow increases in N1 or N2 after EGT indication.
- EGT rapidly approaching or exceeding the start limit.

Engine Starting, -300

Normal starting procedure is to start No. 2, then No. 1 engine from APU air utilizing the APU electrical supply.

When cleared to start, position the ignition select switch to IGN L or IGN R (alternating starts and flights) and select the engine start switch to GRD. Observe the start valve open light illuminate and begin timing for 50 seconds. When the engine has rotated for 50 seconds and a minimum N2 RPM of 20% and a positive N1 rotation is observed, move start lever to IDLE and check for fuel flow and EGT rise. Initial normal start fuel flow is approximately 400 lbs/hr.

Note: The 50-second motoring time, prior to introducing fuel, restores more uniform compressor and turbine clearances, thereby improving engine start parameters.

At 46% N2, the start switch moves to OFF.

Allow the first engine to stabilize before engaging second starter. A decreasing EGT following the peak EGT, along with stabilized N1, N2 and fuel flow are the best indication of a stabilized engine.

Standard day, sea level, stabilized indications for CFM-56-3B1:

N1 RPM	21.5%
N2 RPM	60.3%
EGT	475° C
Fuel Flow	720 lbs/hr

The requirement to abort an engine start is recognized by one or more of the following conditions:

- No N1 rotation before the engine start lever is raised to IDLE.
- No oil pressure indication by the time the engine is stabilized at IDLE.
- No increase in EGT within 10 seconds after the engine start lever is raised to IDLE.
- No increase in, or very slow increases in N1 or N2 after EGT indication.
- EGT rapidly approaching or exceeding the start limit.

AFTER ENGINE START

The engine anti-ice must be ON during all ground and flight operations when icing conditions exist or are anticipated, except during climb and cruise when temperature is below -40° C SAT.

Normal takeoffs are made with Engine Bleed Switches ON. The aircraft gross weight must be at least 2,500 lbs (-200), 1000 lbs (-300/-400) (runway limit) or 2,700 lbs (climb limit) less than the maximum allowable gross weight for existing conditions. If these weight margins are not available, turn off bleeds and use APU. If use APU, correct thrust by adding .03 EPR (-200) or 1% N1 (-300/-400)

TAXI

Do not taxi away from the gate with an engine shut down. However, once away from the gate and congested areas:

- -200 - The No. 1 engine may be shutdown during taxiing when an outbound delay is anticipated.
- -300/-400 - Single-engine taxi is not permitted

Position the flap lever to the takeoff position after the aircraft is clear of the ramp area.

Full deflection of the rudder pedals produces approximately 7° of nose wheel turn. For the -200, idle reverse thrust may be used during taxi to reduce brake usage, except on snow, ice, or slush covered taxi surfaces. For the -300/-400, idle reverse is not to be used during taxi.

The minimum width of pavement for a 180° turn is:

- -200 - 60 feet
- -300 - 64.6 feet
- -400 - 73.0 feet

Set two outer bugs on V1 and Vr. Set the airspeed inner bug on V2.

SPEEDS

Normal Speeds, -200

- Climb below 10,000 feet: 250 knots (ATC)
- Climb above 10,000 feet: Performance Management System (PMS) ECON climb speed. If PMS is INOP, climb at 280 knots or .70 Mach.
- Cruise below 10,000 feet: 250 knots (ATC)
- Cruise above 10,000 feet: PMS ECON cruise speed. If PMS is INOP, cruise at 320 knots/.72 Mach.
- Descent from cruise altitude to 10,000 feet: Cruise Mach to crossover point, then 310 knots.
- Descent below 10,000 feet: 250 knots

Normal Speeds, -300/-400

- Climb below 10,000 feet: 250 knots (ATC)
- Climb above 10,000 feet: FMCS (Flight Management Computer System) ECON climb speed. If FMCS is INOP, climb at 280 knots or .74 Mach.
- Cruise below 10,000 feet: 250 knots (ATC)
- Cruise above 10,000 feet: FMCS ECON cruise speed. If FMCS is INOP, cruise at 300 knots/.74 Mach.
- Descent from cruise altitude to 10,000 feet: .74 Mach/250 kts (economy) or .70M/280/250 (turbulent).
- Descent below 10,000 feet: 250 knots

TAKEOFF

- Set 1.4 EPR (-200) or 70% N1 (-300/-400) or higher (throttles vertical) prior to brake release or as the airplane is aligned with the runway, then smoothly and rapidly advance throttles to obtain takeoff EPR (-200) or takeoff N1 (-300) prior to 60 knots.
- Keep nose wheel firmly on runway by holding slight forward pressure on the control column. As airspeed reaches V1 (within 15 knots), the control column is moved aft of neutral. At Vr, rotate the airplane smoothly.
- Rotate initially towards 15° nose-up deck angle, until V2 + 15 to V2 + 25 knots is achieved. Maximum deck angle is normally limited to 20 for takeoffs where the flight director is not utilized. When the flight director is utilized, the command pitch may be flown. Rotation should be approximately 2-3 degrees per second. Be aware of airplane attitude.
- After positive rate of climb is established, retract gear and maintain takeoff flap setting.
- Climb at V2 +15 to V2 + 25 knots until reaching 1,000 feet AFE.
- Upon reaching 1,000 feet AFE, reduce pitch attitude to approximately one-half that required to maintain V2 + 15 to V2 + 25 knots. Accelerate and retract flaps on schedule (see below).

- For the -200, as the flaps are retracted from 1° to 0°, the power may be reduced to 1.7 EPR for noise abatement and continued climb to 3,000 feet AGL. At 3,000 feet AGL, set climb thrust.
- For the -300/-400, select level change and set 0° flap maneuver speed (minimum) in the speed window. As the flaps are retracted from 1° to 0°, set climb thrust (N1).
- Maintain 0° flap chart maneuver speed (minimum) to 3,000 AGL.
- At 3,000 feet adjust pitch attitude as required to accelerate while maintaining an approximate rate of climb of 1,000 fpm during acceleration to 250 knots.

737-200 Normal Takeoff

TAKEOFFS

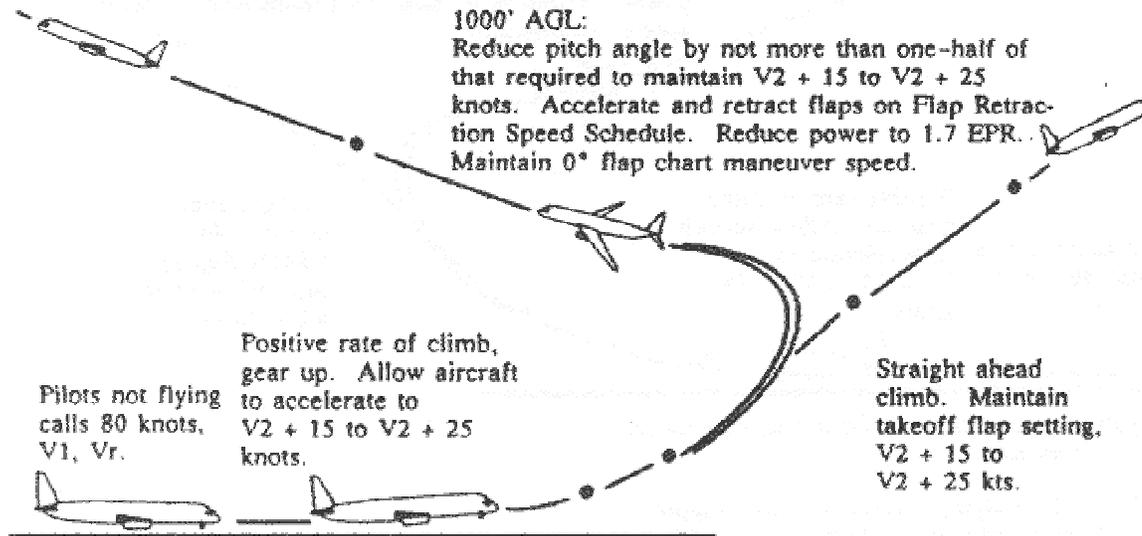
100 NORMAL TAKEOFF (NOISE ABATEMENT)(NO AUTO THROTTLE OR PMS) FLAPS 1°, 2°, 5°, 10° AND 15°

FLAP RETRACTION SPEED SCHEDULE			
	Flap Setting for Takeoff		
	15°/10°	5°/2°	1°
Select flap 5° at	V ₂ + 15		
Select flap 1° at	Chart Maneuver Speed	V ₂ + 15	
Select flap 0° at	Chart Maneuver Speed		
Final Segment Climb	Chart Maneuver Speed		

NOTE: Flap retraction speeds (minimum maneuver speeds) may be led by 10 knots when accelerating. Limit bank angle to 15 until reaching MANEUVER speeds.

As the flaps are retracted from 1° to 0°, the power may be reduced to 1.7 EPR for noise abatement and continued climb to 3,000 feet AGL.

At 3,000 feet AGL, apply climb thrust and accelerate to 250 knots.



Apply power smoothly. Obtain takeoff thrust prior to 60 knots.

V₁/V_r. Pilot flying rotates smoothly (approx. 2°-3°/sec.). Maximum deck angle is 20° if flight director is not utilized. When flight director is utilized, the commanded pitch may be flown.

737-300/-400 Normal Takeoff

TAKEOFFS

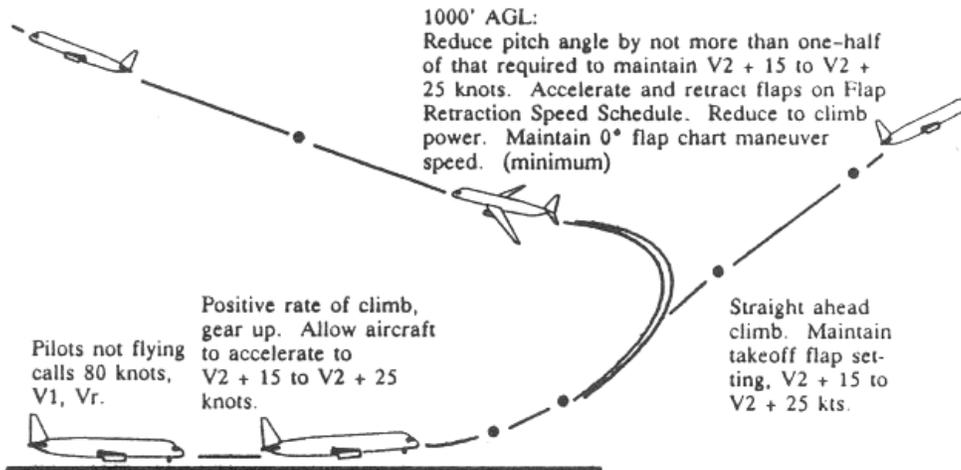
 NORMAL TAKEOFF (FLAPS 1°, 2°, 5°, 10° AND 15°)

 NORMAL TAKEOFF (FLAPS 5° AND 15°)

FLAP RETRACTION SPEED SCHEDULE			
	Flap Setting for Takeoff		
	15°/10°	5°/2°	1°
Select flap 5° at	V2 + 15		
Select flap 1° at	Chart Maneuver Speed	V2 + 15	
Select flap 0° at	Chart Maneuver Speed		
Final Segment Climb	Chart Maneuver Speed		

NOTE: Flap retraction speeds (maneuver speeds) may be led by 10 knots when accelerating. Limit bank angle to 15° until reaching maneuver speeds.

At 3,000 feet AGL accelerate to 250 knots.



Apply power smoothly. Obtain takeoff thrust prior to 60 knots.

V1/Vr. Pilot flying rotates smoothly (approx. 2°-3°/sec.). Maximum deck angle is 20° if flight director is not utilized. When flight director is utilized, the commanded pitch may be flown.

737-200 PMS A/T Takeoff

TAKEOFFS

200 TYPICAL PMS A/T (NOISE ABATEMENT)
FLAPS 1°, 2°, 5°, 10° AND 15°

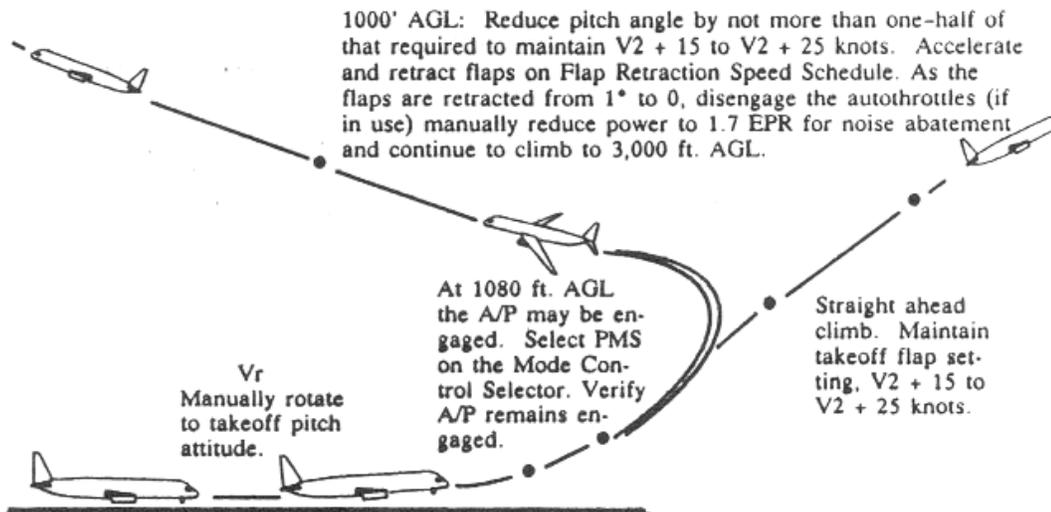
FLAP RETRACTION SPEED SCHEDULE			
	Flap Setting for Takeoff		
	15°/10°	5°/2°	1°
Select flap 5° at	V ₂ + 15		
Select flap 1° at	Chart Maneuver Speed	V ₂ + 15	
Select flap 0° at	Chart Maneuver Speed		
Final Segment Climb	Chart Maneuver Speed		

NOTE: Flap retraction speeds (maneuver speeds) may be led by 10 knots when accelerating. Limit bank angle to 15° until reaching MANEUVER speeds.

As the flaps are retracted from 1° to 0°, disengage the autothrottles and manually reduce power to 1.7 EPR for noise abatement. Maintain 0° flap chart maneuver speed (minimum).

NOTE: With PMS coupled, Flight Director will command 210 kts., (220 kts. when GW above 117,000 lbs.)

At 3,000 feet AGL accelerate to 250 knots.



Manually advance thrust to approximately 1.4 EPR. Press A/T switch. Verify PMI annunciates, Engage TAKEOFF. At 80 kts. verify PMI annunciates A/T STBY.

737-300/-400 AFDS/AT Takeoff

TAKEOFFS

300. TYPICAL AFDS/AT TAKEOFF (NOISE ABATEMENT)
FLAPS 1°, 2°, 5°, 10° AND 15°

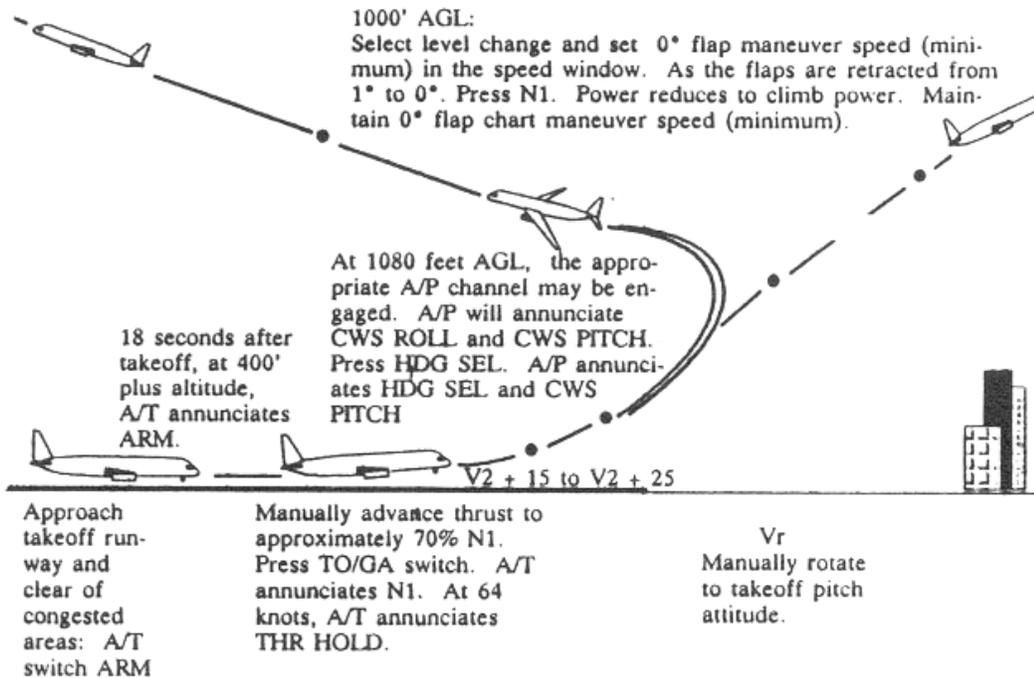
400. FLAPS 5° AND 15°

FLAP RETRACTION SPEED SCHEDULE			
	Flap Setting for Takeoff		
	15°/10°	5°/2°	1°
Select flap 5° at	V2 + 15		
Select flap 1° at	Chart Maneuver Speed	V2 + 15	
Select flap 0° at	Chart Maneuver Speed		
Final Segment Climb	Chart Maneuver Speed		

NOTE: Flap retraction speeds (minimum maneuver speeds) may be led by 10 knots when accelerating. Limit bank angle to 15° until reaching maneuver speeds.

As the flaps are retracted from 1° to 0°, press N1. Power will reduce to climb N1. A/T will annunciate N1.

At 3,000 feet AGL and with F/D on or A/P engaged, press VNAV. A/P and F/D annunciate VNAV SPD.



Flap Speed Schedule

The V-Speed Charts (Flip Chart) on board each aircraft contain a minimum maneuver speed for each flap setting. Flaps may be operated between the minimum maneuver speeds and the maximum placard speed. If the V-Speed Chart is not available, refer to the schedule below.

During acceleration, select flap positions at the following initiation speeds according to Brake Release Gross Weights (BRGW):

		INITIATION SPEED, KNOTS		
INITIAL FLAP POSITION	SELECT FLAP POSITION	BRGW AT & BELOW 117,000 LB	BRGW ABOVE 117,000 LB TO 138,500 LB	BRGW ABOVE 138,500 LB
15	5 1 0	V2 + 15 170 190	V2 + 15 180 200	V2 + 15 190 210
5	1 0	V2 + 15 190	V2 + 15 200	V2 + 15 210
1 737-400 FLAP 1 TAKEOFF NOT CERTIFIED	0	190	200	210
FINAL SEGMENT CLIMB SPEED		210	220	230

Note: Flap retraction speeds (minimum maneuver speeds) may be led by 10 knots when accelerating. Limit bank angle to 15° until reaching maneuver speeds.

CRUISE

Normal Fuel Management

Use center tank fuel to depletion followed by main tank fuel.

DESCENT

Use of Speed Brakes

Use of speed brakes below 1,000 feet AGL is not recommended. Speed brakes, flaps and gear may be used if ATC has kept the flight high and in close proximity to the airport.

Anti-Ice

- -200 - When using engine or engine and wing anti-ice, maintain a minimum of 40% N1 (TAT between 0° and 10°C) or 55% N1 (TAT below 0°C), to provide sufficient airflow and temperature for anti-ice. Using 55% N1 will increase descent distance by approximately 25% over idle descent distance.
- -300/-400 - In flight, when engine anti-ice is ON, engine idle RPM is automatically rescheduled to a minimum of high idle RPM. The use of anti-ice and the associated thrust required will increase descent distance required.

BEFORE LANDING

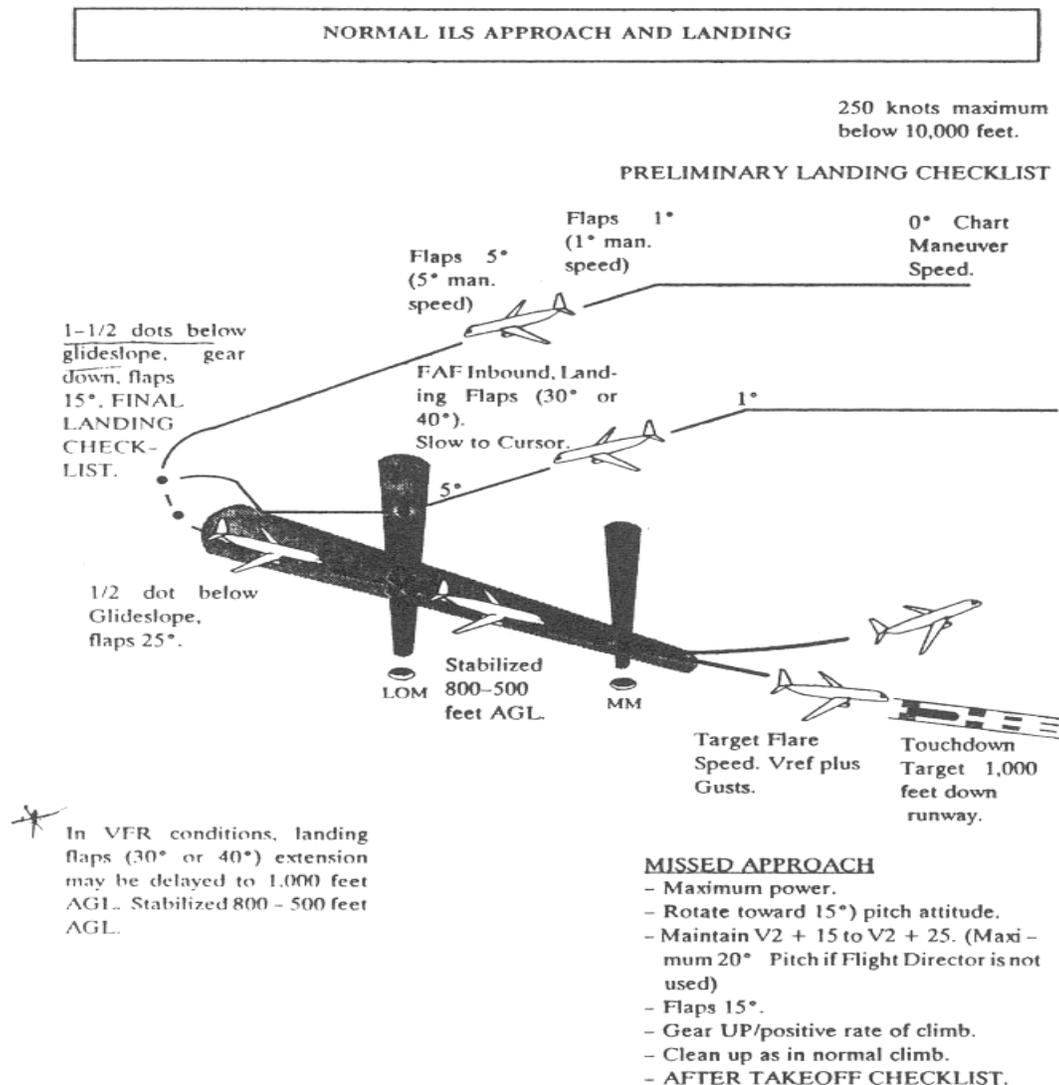
Airspeed Bug Settings

- Set two outer bugs on Vref. Two bugs are used for emphasis.

- Set the airspeed cursor (inner bug) on $V_{ref} + 5$ knots minimum. Position the cursor to $V_{ref} + 1/2$ the reported headwind and all the gust. Maximum cursor setting is $V_{ref} + 20$ knots. In all cases, gust correction should be maintained to touchdown while steady wind correction should be bled off as the aircraft approaches touchdown.
- Set a single outer bug to V_2 for flaps 1° . Setting this bug serves three purposes. The speed is the same for all three possibilities:
 - Two-Engine Go-Around: V_2 for flaps 1° is the minimum speed used for flap retraction from 15° to 5° during a two-engine go-around.
 - Loss Of An Engine On Approach: If an engine fails on approach, set flaps 15° and use the single outer bug as your target speed. Fly this bug plus wind additives.
 - Single-Engine Go-Around: Go-around flap setting with an engine inoperative is 1° . V_2 for flaps 1° is the minimum acceptable speed for go-around with an engine inoperative.

APPROACH

737 Normal ILS Approach and Landing

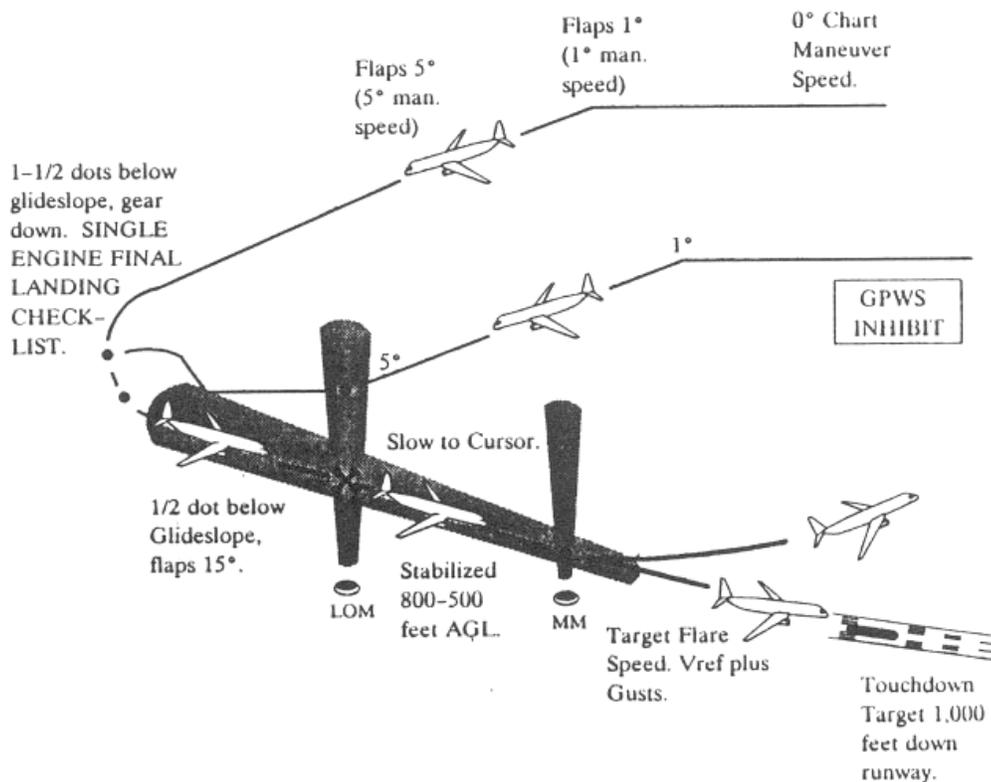


737 One-Engine ILS Approach and Landing

ONE-ENGINE ILS APPROACH AND LANDING

250 knots maximum
below 10,000 feet.

SINGLE ENGINE PRELIMINARY LANDING CHECKLIST



MISSED APPROACH

- Maximum power.
- Rotate towards 15° pitch attitude.
- Maintain V2. (Maximum 20° pitch if Flight Director is not used.)
- Flaps 1°.
- Gear UP/positive rate of climb.
- At 800 feet AGL or obstacle clearance altitude, whichever is higher, reduce pitch and accept a minimum rate of climb while accelerating to Flap Retraction/Speed Schedule.
- Retract flaps on Flap/Speed Schedule.
- AFTER TAKEOFF CHECKLIST

737 Dual Channel ILS Approach

ILS APPROACH PROCEDURES DUAL CHANNEL ILS/AUTOLAND

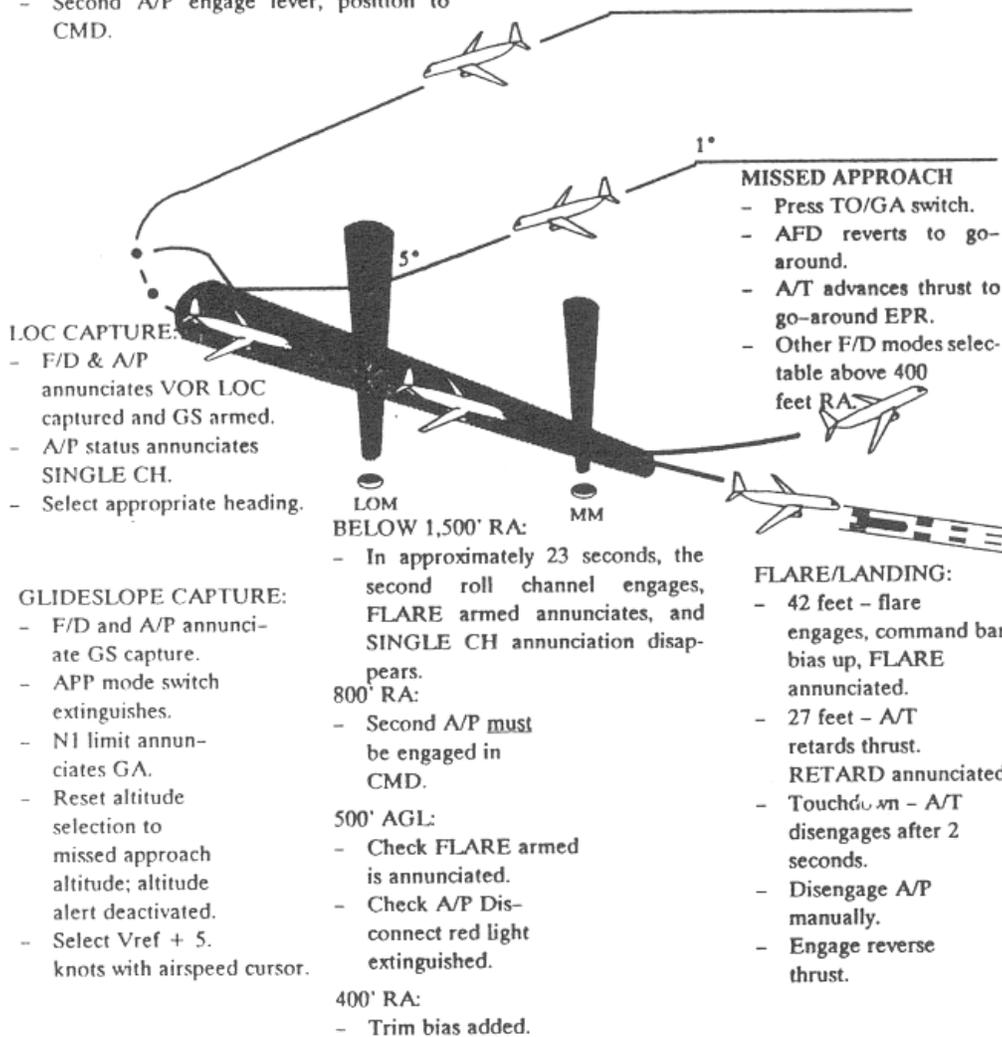
It is necessary to utilize dual channel to accomplish an autoland.

WHEN ESTABLISHED ON LOCALIZER INTERCEPT HEADING:

- Select APP. APP select light on.
- (F/D & A/P) annunciates HDG SEL, VOR LOC armed, and GS armed.
- Second A/P engage lever, position to CMD.

APPROACHING LOCALIZER:

- A/P engage lever to CMD.
- HDG SEL engaged.
- Select pitch modes as desired.
- Autothrottle in compatible mode.
- Both flight directors ON.



NOTE: Use Standard Approach Awareness procedures.

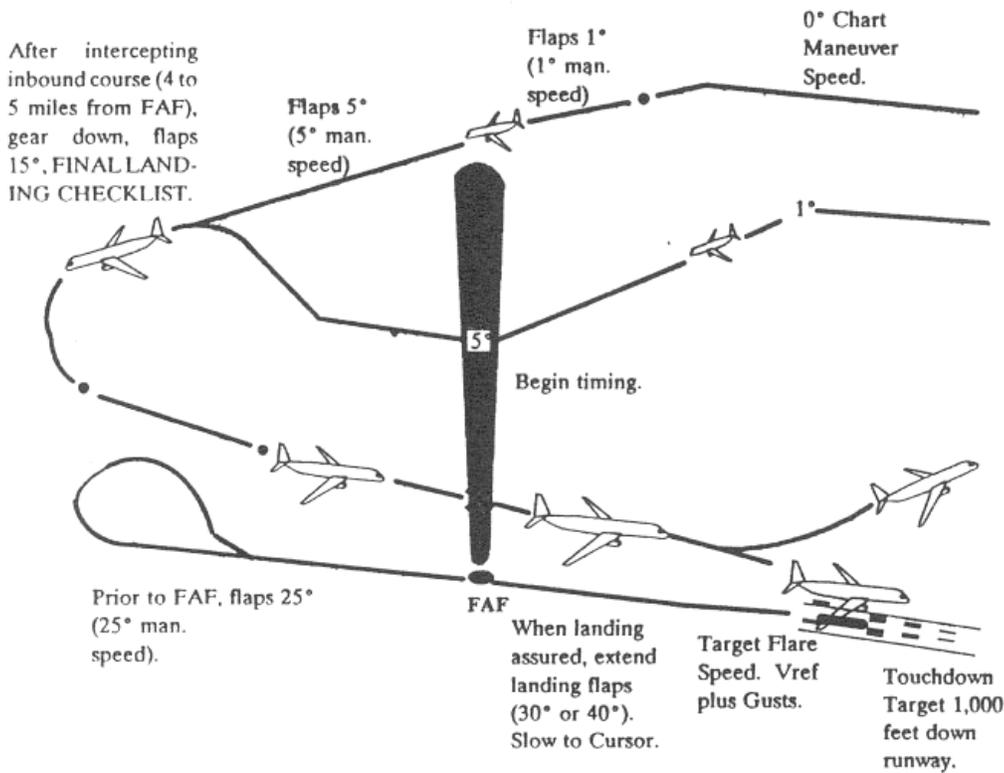
737 Non-Precision Approach

NON-PRECISION APPROACH PROCEDURE

NORMAL VOR/LOC/NDB/LDA/ASR/BK CRS ILS

250 knots maximum
below 10,000 feet.

PRELIMINARY LANDING CHECKLIST



MISSED APPROACH

- Maximum power.
- Rotate toward 15° pitch attitude.
- Maintain $V_2 + 15$ to $V_2 + 25$. (Maximum 20° pitch if Flight Director is not used.)
- Flaps 15°.
- Gear Up/Positive rate of climb.
- Clean up as in normal climb.

AFTER TAKEOFF CHECKLIST

APPROACH / LANDING

Flap Extension

Using flaps as speed brakes is not recommended. The following procedures and maneuvering speeds are used for extending flaps:

- Reduce speed to 0° maneuver speed as depicted on the appropriate gross weight page of the V-speed chart.

- Subsequent flap extensions should be at speeds less than the maximum placarded speeds for the flap selected.
- Maneuvering should be conducted at speeds no higher than placarded speeds, and no lower than maneuvering speeds as shown on the V-speed charts.
- Gear should be extended prior to flaps 15° to preclude gear warning horn sounding.

Normally 30° is the recommended landing flap setting. Flaps 15° is used as a landing flap when operating with one engine and at airports with elevations 3,000 feet and above when ambient temperatures and high landing weights are encountered. Use of this landing flap and corresponding approach speed results in an improved approach go-around capability.

Power Settings

Power must not be reduced to the extent that the engines spool down. It must be remembered that a spooled-down engine can take 8-10 seconds to produce maximum power. Fifty-five (55%) percent of N1 (-200) provides a good indication of a spooled-up engine. A spooled-up condition on the -300/-400 is accomplished automatically by the high idle function when flaps 15 or greater is selected.

Reverse Thrust

After speedbrakes have deployed, lower nose smoothly to the runway and initiate reverse thrust immediately.

- -200 - The maximum allowable go-around EPR may be used. Conditions permitting, limit reverse thrust to 1.5 EPR for passenger comfort. By 60 knots, gradually reduce reverse thrust so as to be at no more than IDLE reverse (1.1 EPR) when reaching taxi speed.
- -300 - The maximum allowable go-around N1 may be used. Conditions permitting, limit reverse thrust to 82% N1 for passenger comfort. By 60 knots, gradually reduce reverse thrust so as to be out of reverse when reaching taxi speed.

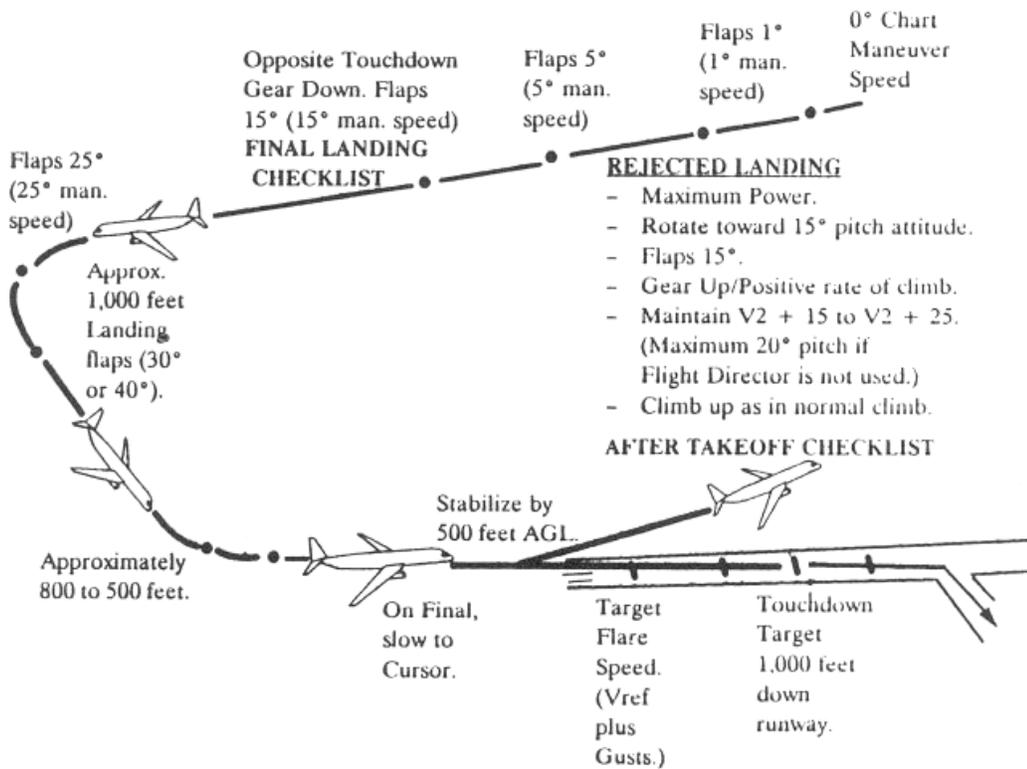
737 VFR Approach and Landing

LANDINGS

NORMAL VFR LANDING

250 knots maximum below 10,000 feet.

PRELIMINARY LANDING CHECKLIST



Reduce thrust slowly over threshold.
 Auto/Manual speedbrakes deploy.
 Lower nose smoothly to the runway. Engage reverse thrust.