McDonnell Douglas DC-10-10/30 Procedures

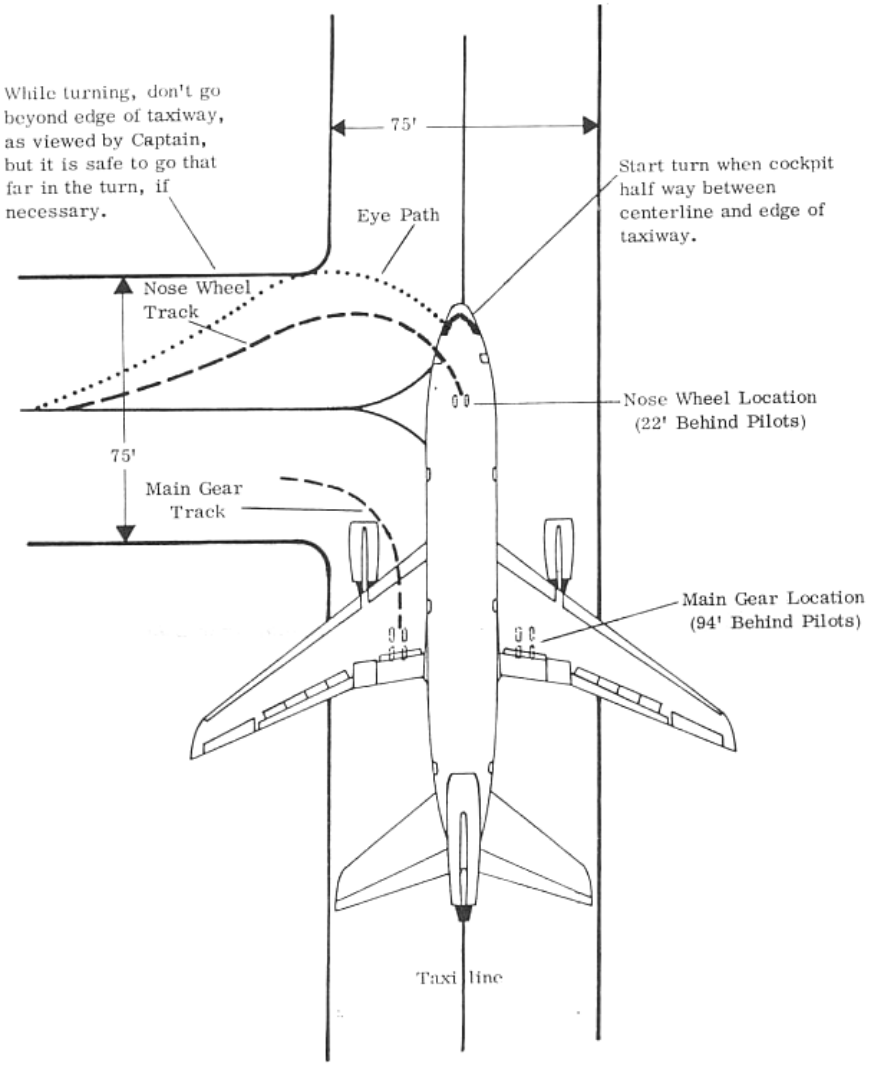
Compiled by Matt Zagoren

TAXIING

The DC-10's response to throttle movement is slow, particularly at high gross weights. When adding power to start moving (40% N1 is normal limit), wait for the airplane to respond before adding more power. As an example, approximately 40% N1 on all three engines will be required for movement at 410,000 lbs on a level ramp with cold tires and no turns. This thrust will produce approximately 135 mph winds at 50 feet aft of the airplane, and 90 mph at 100 feet aft. Using asymmetrical power and/or pivoting on the inside gear to make tight turns is prohibited.

Check taxi speed by looking out the side window occasionally for cross reference. The use of reverse thrust to control taxi speed is not authorized. The DC-10 wing engines are vulnerable to foreign object damage.

DC-10 Recommended Technique for Turns While Taxiing



DC-10 TAXI

Turns of more than 90°, using 75 foot wide taxiways, should not be attempted since the geometry of the landing gear makes it almost impossible to prevent running the main gear off the taxiway.

A 180° turn requires a minimum 150 foot wide dry runway, full nose wheel steering and minimum speed. The use of asymmetrical thrust and/or light differential braking causes excessive tire wear and reduces gear fatigue life and should be used only when absolutely necessary.

Don't attempt a rolling takeoff on wet or icy runways with high forward thrust since the nose wheel steering may not be effective enough to line the airplane up on the runway.

Several factors affect airplane tire temperatures. The most significant are continuous taxi and takeoff distance (maximum 35,000 feet), under-inflation, gross weight and speed. Taxi speeds are not to exceed 20-30 knots to prevent rapid buildup of tire temperatures.

TAKEOFFS
Recommended airspeed bug settings are at V1, V2 and slat retract speeds. The airspeed command bug is normally set at the first intended steady airspeed, normally clean maneuver speed or just under 250 knots.

Takeoff Flap Position
You should not arbitrarily assume that flaps 10 is "normal" for takeoff. The Captain must weigh all the factors and decide which flap position is most suitable for the particular takeoff and departure. Flaps 5 (8 for -30) can offer improved performance in the event of windshear, turbulence, or engine failure during or after takeoff, as well as potential fuel saving and noise reduction. Flaps 18 (15 for -30) can offer improved short field capability; however, climb performance is limited.

When acceptable from an operational standpoint, gross weight and runway conditions permitting, the use of Flaps 5 for takeoff is encouraged.

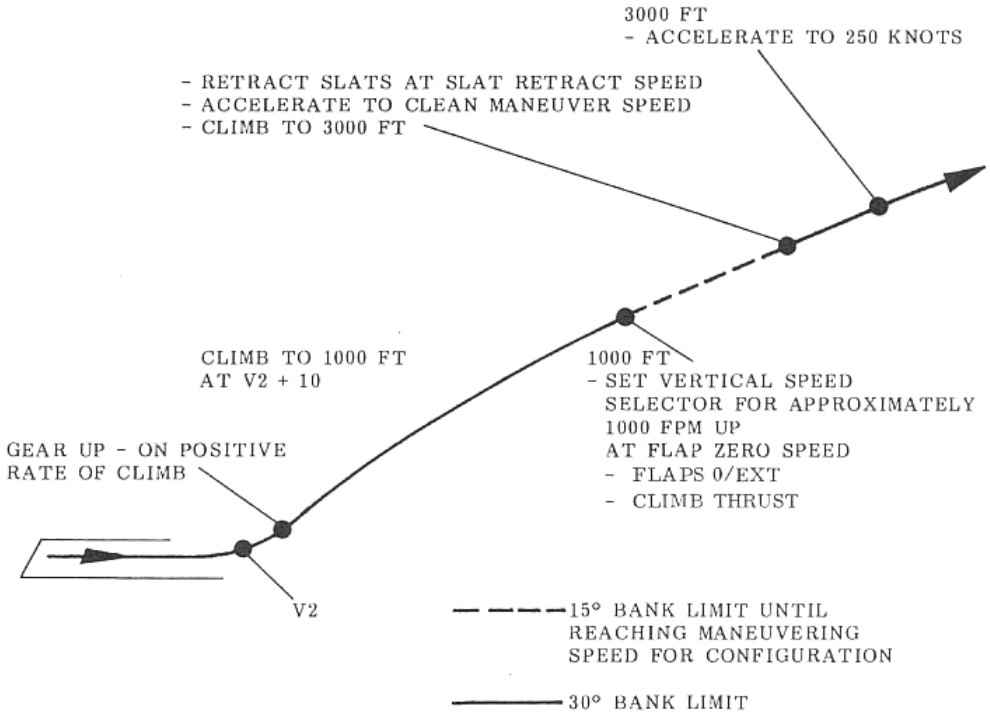
Normal Takeoff

- At the start of the takeoff roll (standing start or rolling), the throttles should be advanced slowly to assure even engine spoolup. Maintain directional control through the use of rudder steering.
- At Vr, rotate the airplane to approximately 15° ANU at about 3°/second, and then maintain V2 + 10 by adjusting pitch attitude. Early, rapid, or overrotation may cause the stick shaker to actuate and/or the fuselage to contact the runway.
- At 1000 feet AGL, set the vertical speed selector to the desired rate of climb (approx 1000 fpm). Retract flaps to 0 and set climb thrust.
- Accelerating to clean maneuver speed, retract the slats on schedule.
- Limit bank angle to 15 degrees until reaching clean maneuver speed and then climb to 3000 feet at this speed.
- Upon reaching 3000 feet AGL, accelerate to 250 knots.

DC-10 Normal Takeoff

FLAP/SLAT RETRACTION SCHEDULE	
AT	SELECT FLAPS/SLATS
FLAP ZERO SPEED SLAT RETRACT SPEED	0/EXT UP/RET
MANEUVERING SPEEDS (30° BANK LIMIT)	
SLAT RETRACT SPEED CLEAN MANEUVER SPEED	0/EXT CLEAN

THIS PROFILE MAY BE ABANDONED IF NECESSARY TO MEET TRAFFIC, SID OR OBSTACLE CLEARANCE REQUIREMENTS OR IF TURBULENCE OR WIND SHEAR IS ANTICIPATED OR ENCOUNTERED.



NORMAL TAKEOFF

Engine Failure on Takeoff

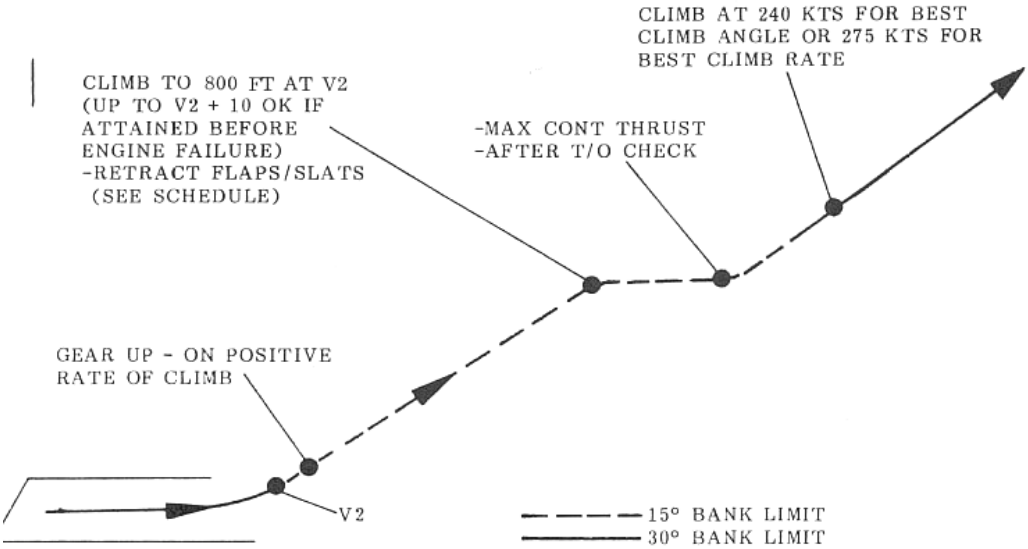
When an engine failure occurs, the climbout profile is normally straight ahead to 800 feet AGL prior to cleanup. If special engine failure procedures or operational factors dictate, a 15 degree bank may be used at V2 speed.

DC-10 Engine Failure During Takeoff

FLAP/SLAT RETRACTION SCHEDULE	
AT	SELECT FLAPS/SLATS
FLAP ZERO SPEED	0/EXT
SLAT RETRACT SPEED	UP/RET
MANEUVERING SPEEDS (30° BANK LIMIT)	
SLAT RETRACT SPEED	0/EXT
CLEAN MANEUVER SPEED	CLEAN

NOTE

EXCEPTIONS TO THIS PROCEDURE ARE IN THE HANDBOOK. UNLESS THE HANDBOOK SHOWS A SPECIAL ENGINE FAILURE ON TAKEOFF PROCEDURE FOR THE RUNWAY IN USE, TERRAIN CLEARANCE IS ASSURED ONLY BY CLIMBING TO 1500' AGL WHILE TRACKING THE EXTENDED RUNWAY CENTERLINE.



ENGINE FAILURE DURING TAKEOFF

INFLIGHT PROCEDURES

Altitude Select

The ALT indicator should be set the departure clearance altitude and altitude armed before takeoff. Cleared altitudes should be set and the altitude armed throughout the flight. Included are the crossing altitudes on SID's and STAR's and level-off altitudes on approach procedures. During approach descent when no longer required for ATC clearance or crossing altitudes, set the ALT indicator to the FAF crossing altitude (nearest 100 feet) and arm for capture. After passing the FAF, set the ALT indicator as desired.

Holding

When conserving fuel is of prime importance and whenever practicable, hold in the clean configuration at minimum drag speed. If necessary, obtain ATC approval to exceed the published holding speed limits.

To maintain holding speed, it will be necessary to increase thrust slightly during the turns, and decrease slightly during the straight-away leg.

Normal Descent
Descent from altitude is similar to the techniques used by other jet transports, but requires some additional planning to minimize large thrust changes with their associated bleed shifts. The transition from 280 KIAS descent to 250 KIAS at 10,000 feet MSL can be started at about 11,000 feet MSL with throttles idle and descent rate reduced to 800-1000 fpm. The slowdown will require approximately 7 miles. Level flight deceleration from 280 to 250 KIAS will be at the rate of about 10 knots per mile with throttles at idle.

APPROACHES

General
Consider the approach as starting when leaving FL180 or as soon after as practicable. It is mandatory that CAT II approaches be coupled. In all cases where an ILS is utilized and weather is expected to be near minimums, it is strongly recommended that the approach coupler be engaged and remain so to the lowest altitude to which it is certified.

On an approach in minimum weather, it is desirable that airspeed and profile be stabilized earlier in the approach than is otherwise necessary. Under more favorable weather conditions, and in the interest of fuel conservation and noise abatement, the initial part of the approach may be flown with less than landing flaps extended. Select landing flaps and reduce to appropriate speed so as to be stabilized no later than 500 feet above field elevation.

Visual Approaches
The DC-10, when following a descent profile of 2½° to 3° at approach speed and configuration, is flying with about a 4° nose up body angle. The pilot's eye will pass through a given point in space some 35 feet higher than will the main landing gear.

The main gear touchdown should be planned to be no less than 1000 feet down the runway. To accomplish this, and to assure adequate wheel clearance over the threshold, a visual descent profile should be flown so as to approximate a 3° descent profile (700 fpm), with a pilot aim point 1500 feet down the runway. Plan to cross the threshold at a radio altimeter height of about 50 feet.

The normal two-bar VASI must not be used below 500 feet AGL for establishing the glide-slope in the DC-10. An on-glide slope indication using this system establishes a visual aim point which is only about 1000 feet down the runway from the threshold. If you follow a 2½° VASI and are on the lower edge of the on-glide slope indication, the main gear can touchdown short of the runway.

Three-bar VASIs establish a 3° glide slope and a visual aim point of about 1600 feet from the threshold.

ILS Approaches
Glide slope altitude at the Outer Marker should be checked against the approach plate. At DH, the airplane should be in position to land with a minimum of maneuvering. At 100 feet, the cockpit must be within the runway edges and headed so as to remain there.

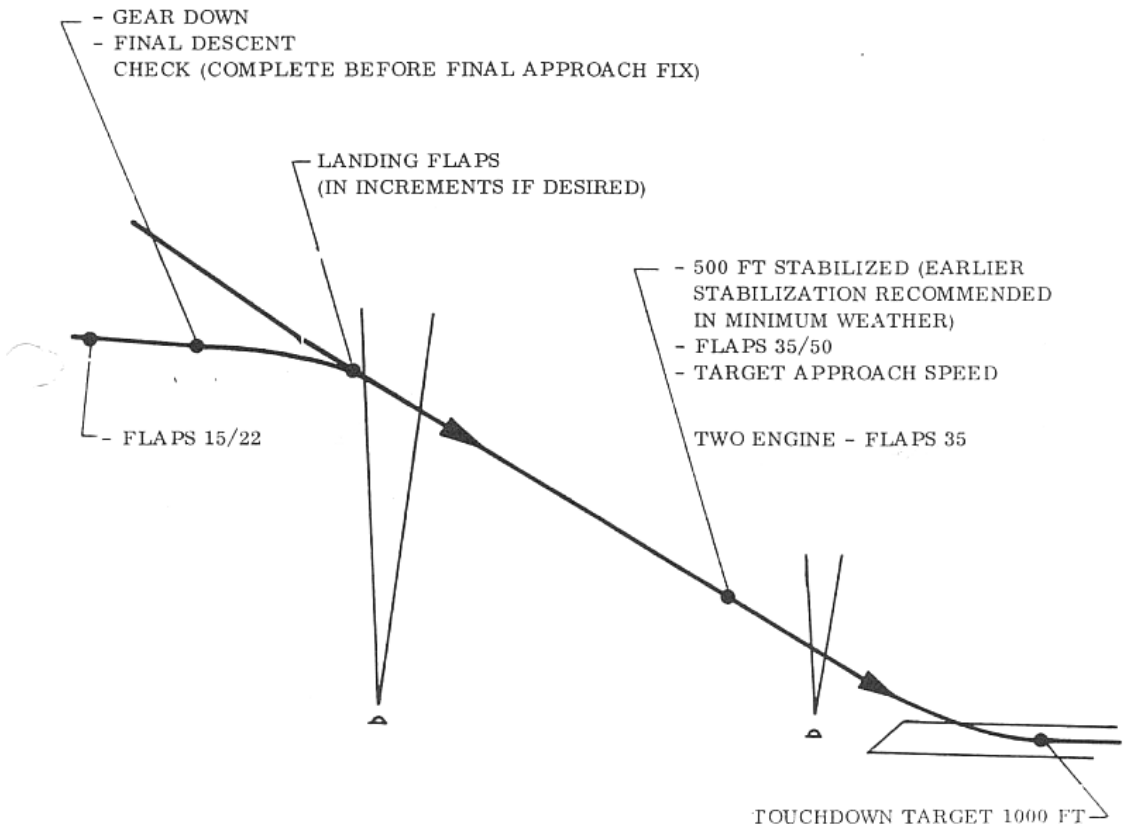
Use of autopilot, coupled to the ILS, is mandatory when making an approach to CAT II DH.

When flying an ILS approach, it is desirable to remain on the glide slope until the airplane is flared for landing. However, since many ILS installations do not provide sufficient main gear clearance when crossing the threshold on glide slope, it is not always possible to remain on the glide slope until flare.

Minimum main gear height over the threshold, when utilizing an ILS glide slope, is 20 feet. The glide slope antenna is located in the nose, and in approach attitude is 28 feet higher than main gear height when crossing a given point. Therefore, in order to cross the threshold at not less than 20 feet, the glide slope height over the threshold must be 48 feet or higher.

Glide slope height over the threshold will be found on most ILS approach charts adjacent to the profile. When glide slope height over the threshold is less than 48 feet or when glide slope angle and/or touchdown distance are minimal, it will be necessary to drift high on the glide slope from 200 feet AGL to touchdown in order to have adequate gear clearance (1½ to 2 dots high at threshold adds approximately 10 feet to the gear clearance).

DC-10 ILS Approach

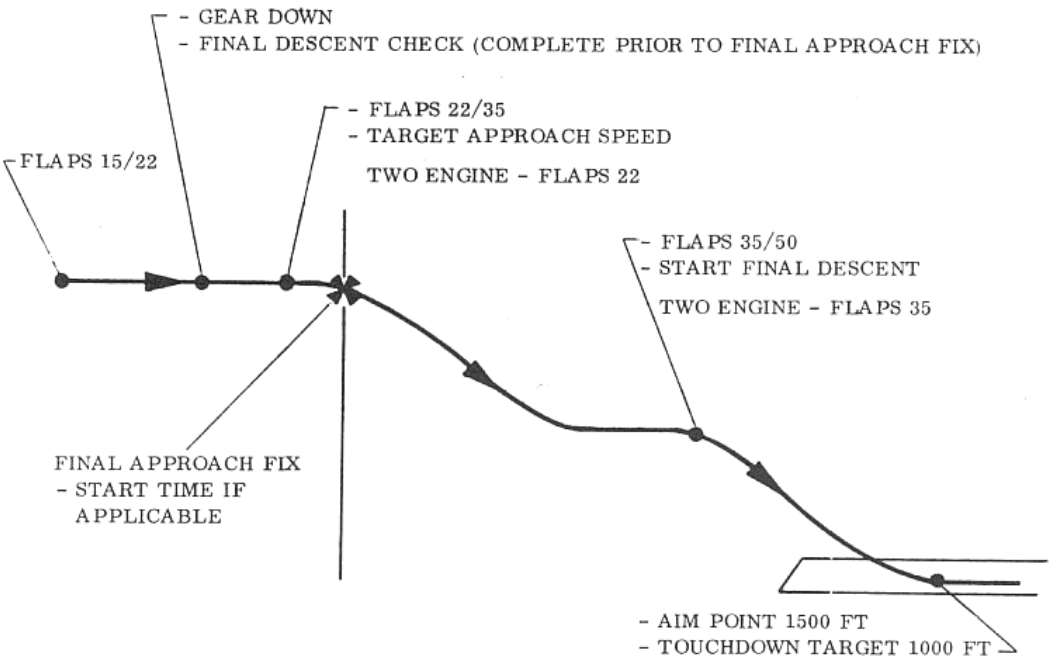


ILS APPROACH
THREE ENGINE/TWO ENGINE

Non-Precision Approach
Immediately after passing the FAF start the descent to MDA. Rate of descent should be adequate enough to ensure reaching MDA early enough to permit alignment with the runway and interception of a normal landing profile.

Step down altitudes required on the approach, including MDA, should be set in the altitude alert system so that visual alerts will be received as the altitudes are reached.

DC-10 Non-Precision Approach



NONPRECISION APPROACH
THREE ENGINE/TWO ENGINE

Missed Approach/Rejected Landing
As the missed approach is initiated, the pilot flying should simultaneously advance the throttles, rotate promptly to the initial go-around attitude, and call for takeoff thrust, and flaps to the missed approach setting of 22°. Initial climb speed for a missed approach is the target approach speed or push the TAKEOFF/GO-AROUND button and use the GO-AROUND mode. Retract the landing gear when a positive rate of climb is established.

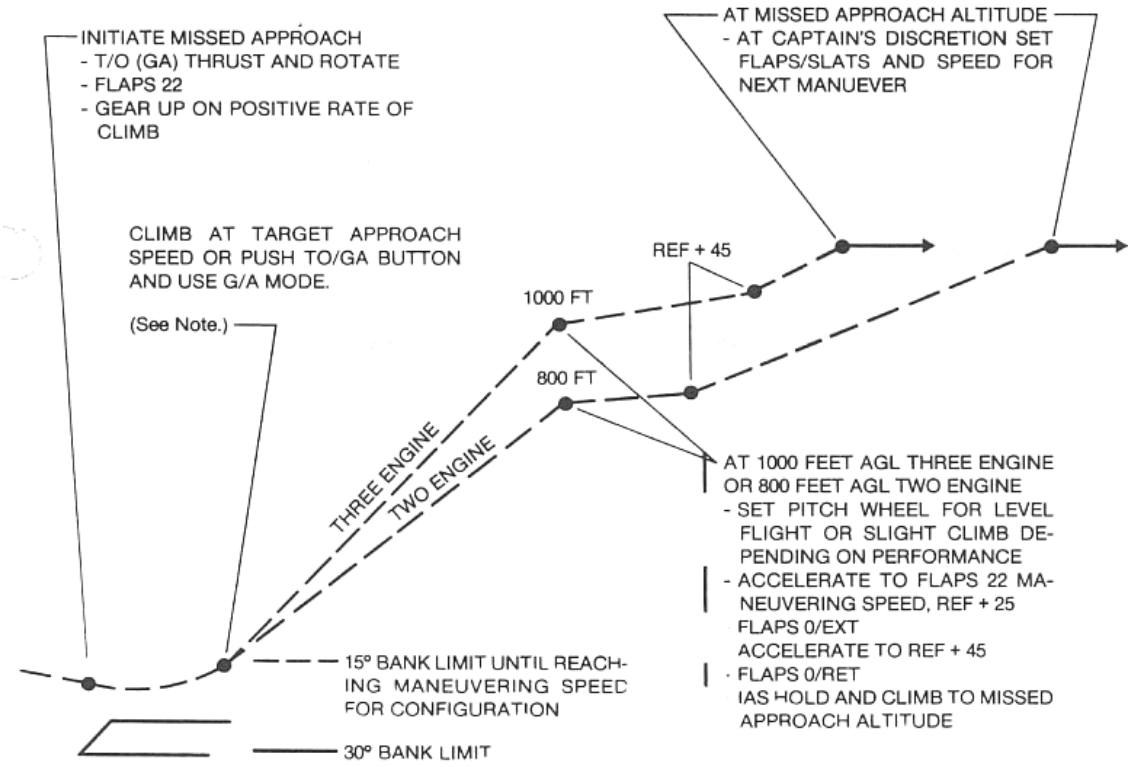
DC-10 Missed Approach

FLAP/SLAT RETRACTION SCHEDULE	
AT	SELECT FLAPS/SLATS
REF + 25 REF + 45	0/EXT UP/RET

NOTE

GA mode may result in a speed slightly above (3 engine) or below (2 engine) no wind target approach speed.

Do not use autopilot in command mode for 2 engine missed approach.



MISSED APPROACH
THREE ENGINE/TWO ENGINE

LANDINGS

The airspeed bugs should be set prior to starting the approach. The recommended setting is for the slat extended maneuvering, 22 flap maneuvering, and threshold speeds (uncorrected for wind). The airspeed command bug should be set on the speed for the configuration being flown.

In a typical approach, the pitch attitude is 3°-4° for the DC-10. As speed is decreased to threshold speed, the pitch attitude will increase about 1°. Landing flare is normally initiated at approximately 30-40 feet above the runway surface. With a typical low rate of descent at touchdown, the pitch attitude will normally be 7°-8°. Landing with a 50 flap setting decreases pitch attitude approximately 1° over that for 35 flap. Fuselage contact with the runway will not occur until approximately 14° pitch attitude.

One of the most important factors leading to ground contact with the tail is holding off in the flare, allowing the airplane to float prior to touchdown. Trimming the stabilizer or leaving considerable power on throughout the flare contributes to floating and thus will delay the touchdown. If touchdown does occur with a higher than normal pitch attitude, the nose must be lowered immediately to prevent spoiler deployment from further increasing the pitch attitude.

Wing tip/flap ground clearance must also be considered. Assuming a pitch attitude of 9° ANU at touchdown, normal strut extension, the wing tip will touch the ground at a bank angle of just under 12°.

Crosswind Landings
The preferred method for a crosswind landing is to fly the final approach using the crab method. When approximately 200 feet above the runway, align the fuselage with the runway using rudder and lowering the upwind wing.

Stopping and Directional Control
When maximum braking effectiveness is required, it is obtained by applying full steady brake pedal pressure. Braking effectiveness is drastically reduced by pumping the brake pedals.

Extension of ground spoilers is essential to effective braking. If automatic extension fails to occur, immediate manual extension is required.

Aerodynamic braking is not recommended as a method of decreasing landing roll-out distance for the DC-10. Airplane total drag in the landing configuration is significantly reduced if the nose wheel is held off the ground.

Reverse thrust should be used early in the landing roll-out. The preferred method is to bring the reverse levers to the idle-reverse detent upon main gear touchdown. Wing engine reversing can be used as soon as the thrust reversers are deployed (up to 80% N1 normally, and up to GA when required) and the center engine upon nose gear touchdown. Number one and three engine reverse thrust levers should be in forward idle at no less than 60 knots. Number two engine reversing may be used in reverse idle thrust until taxi speed is reached.

FUEL CONSERVATION

Fueling
Carrying extra fuel means extra weight added to the airplane. Extra weight results in a higher fuel burn. Reducing your over destination fuel can result in a direct fuel saving.

Pounds of Fuel Burned Per 5,000 Lbs Increase in Weight

FLT DIST	500	1000	1500	2000
FUEL LBS	250	500	750	1000

Starting
Delay APU starting as long as possible. The APU burns about 260 pounds of fuel per hour when supporting the electrical system and will burn an additional 175 pounds when supporting both the electrical and pneumatic systems.

Taxi Out
Each engine on the DC-10 burns approximately 20 pounds of fuel per minute during taxi. When possible, taxi from the gate on two engines. Delay starting the third engine until 3 minutes prior to

takeoff. If engines have been started and a taxi delay of more than 8 minutes will occur, shut down the third engine.

If you have a choice of runways for takeoff, remember that three minutes of taxi equals one minute of flight as far as fuel consumption is concerned.

Takeoff
You will have better acceleration, a higher climb rate and earlier flap retraction if you use the lowest possible flap setting for takeoff. The earlier flap and slat retraction improves fuel economy due to reduced drag. You will save an average 40 pounds per takeoff by using flaps 5 rather than flaps 10. Reduced flap takeoff also improves performance in the event of engine failure or wind shear. When using flaps 5, rotation speed will be about 7 knots faster than when flaps 10 are used.

Close adherence to the flap and slat retraction schedule is also helpful.

Use of normal N1 on takeoff extends engine life, reliability and efficiency.

Climb
When takeoff direction is away from your route of flight, a knowledge of local departure procedures is helpful. If departure control needs distance before they can turn you on course, you should complete the noise abatement procedure and accelerate to 250 knots.

If departure control needs altitude, climb at clean maneuvering speed. When cleared to turn, use 25° to 30° of bank. Slower speeds in the turn will decrease the turn radius and miles flown. When heading toward your destination, accelerate to normal climb speed.

With regard to the total flight, 300 knots gives the best rate of climb above 10,000 feet. Use 300 knots until indicating .83 Mach (.82M -30) then climb at .83 Mach (.82M -30) until reaching your cruise altitude. If your cruise Mach is lower than .83 Mach then climb at the lower cruise Mach.

If ATC stops your climb at an intermediate level, do not increase airspeed but maintain 300 knots.

Cruise
Maximize fuel efficiency by optimizing your cruise altitude. Consider conditions such as ATC clearances, gross weight, temperatures, winds and segment distance before choosing your altitude. Variations above or below the optimum altitude cost fuel.

Use the cruise tables in the Performance section when considering a change in altitude. To get even better fuel economy, use the Nautical Ground Miles comparison to improve flight altitude optimization. The data in the Performance section cruise tables is given in terms of specific range and presented as nautical air miles (NAM) per 1000 pounds of fuel. In order to take wind into consideration, it is necessary to work in terms of ground miles. To convert air miles to ground miles, multiply by the ratio of the ground speed to the true airspeed. The formula is:

NAM per 1000 pounds (from cruise table) x Ground Speed ÷ True Airspeed = Nautical Ground Miles (NGM) per 1000 pounds

Temperature does not affect the NAM/1000 pounds figures, but it does influence the TAS indicated in the cruise tables.

Speed management is just as important as speed selection. An increase of .01 Mach will cost an additional 300 pounds per hour.

Cruise thrust must be set when at the planned cruise Mach number. If cruise thrust is set at a speed above .83 Mach (.82M -30) or below the planned cruise Mach number, it will cost fuel. To assure more mileage from the fuel burned, reduce N1 to maintain the planned cruise Mach number as the airplane weight decreases.

Consider using an indicated cruise airspeed of 300 knots on short segments (300 miles or less).

Descent
You can save more fuel in descent than in any other phase of flight. The ideal point for start of descent should be based on idle thrust and the lowest speed compatible with ATC. Normal descent speed is 280 knots and 250 knots will conserve even more fuel if planned block time can still be achieved.

If you are unable to reach a crossing altitude and distance simultaneously and cannot get relief from ATC on either altitude or airspeed, it is more eceonomical to slightly overshoot and correct with speed brake than to slightly undershoot and have to add extra thrust.

Holding
The flight crew can improve the fuel efficiency while holding by:

- Slowing the airplane as soon as possible when a hold is expected.
- Flying the holding airspeed found in the Performance section.
- Using the longest legs possible and keeping the airplane in a clean configuration.

Holding in a race track pattern increases fuel flow 4% and the use of slats (below 15,000 feet) increases fuel flow another 10%.

Approach
Maintain a clean configuration as long as possible. The cost of using slats over clean is 20 pounds per minute. Use only the flap position necessary to meet speed requirements. Delay gear extension as long as possible. It costs an extra 100 pounds per minute to fly with the gear down. Always be in the landing configuration and stabilized by 500 feet, or earlier if IFR. A flaps 35 landing only increases the landing distance by 240 feet, yet saves an average of 145 pounds per landing.

Taxi In
After landing, an engine can be shut down following a one minute cooling period, if EGT has not exceeded 650°C during approach or 750°C during reverse thrust.

Based on an average 5 minute taxi in, if one engine was shut down one minute after landing, the fuel savings could be as much as 80 pounds per arrival.

FLIGHT GUIDANCE SYSTEM (FGS)

Speed Command Bug
The speed command bug should always be set on the intended steady state speed whether or not the autothrottle system is engaged. (Exception...on takeoff, the bug is set to the first intended steady state speed after the takeoff profile.)

Autothrottle System
Should be used when advantageous. Generally in N1 mode for climb; SPD mode for level flight, small altitude changes and approach; and OFF for descents.

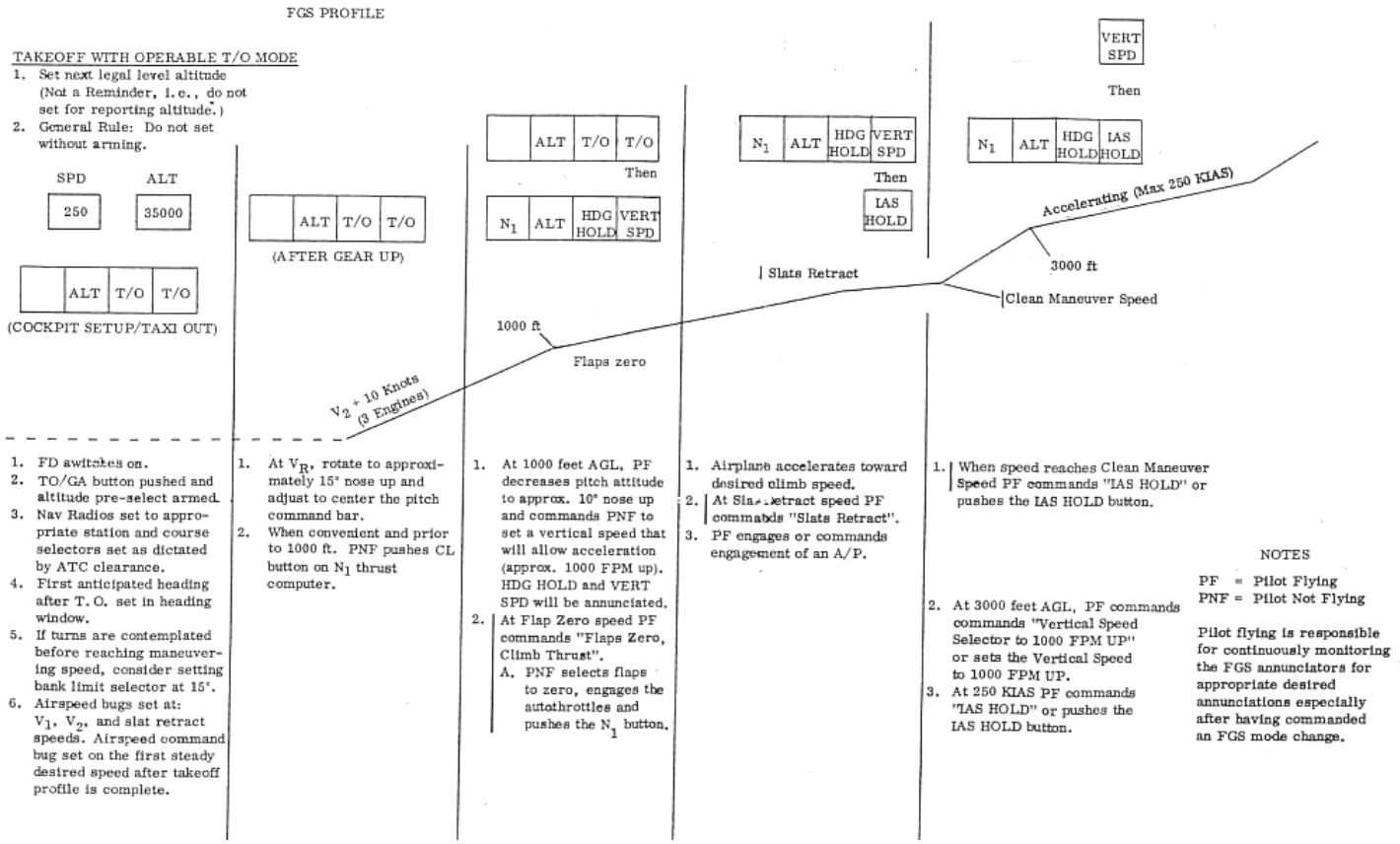
Bank Angle Selector
Set as desired...generally 15° on takeoff and final approach, 25° for maneuvering during departure and arrival, and 5° during cruise.

Heading Bug
Set on intended heading or next anticipated heading, as appropriate. An anticipated heading can be preset, if operating in other than HDG SEL, as a reminder and to minimize the actions required when time for the turn occurs. In a TRK mode during final approach, the bug should be aligned with the approach course unless a preset missed approach heading has been set.

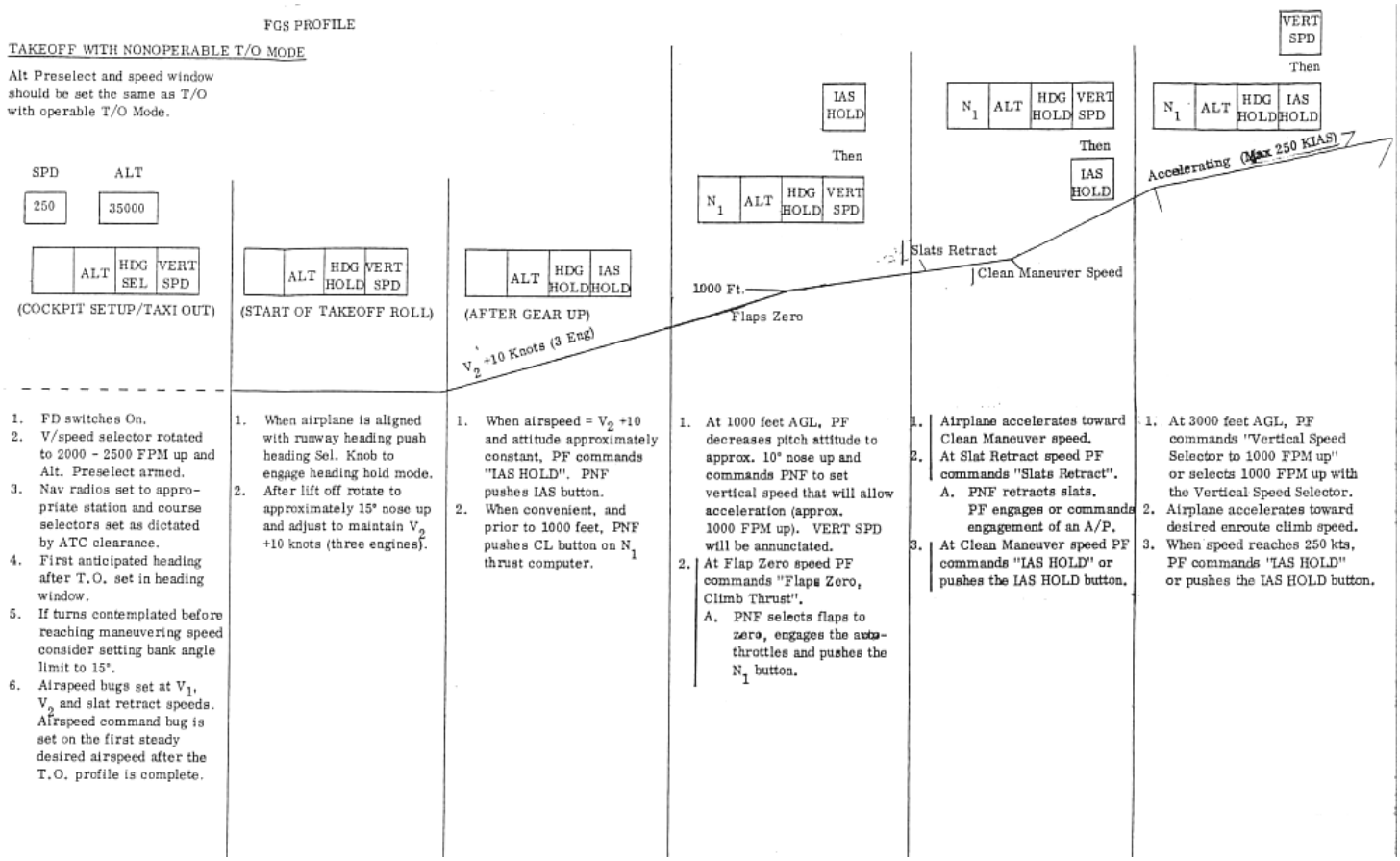
Altitude Alert/Preselect
Generally, the next maintain altitude should be set into the system. It should not be used for reminder altitudes. When a new altitude is received/required it should be set and armed for capture. Non-precision approach stair-step altitudes can be set. On all approaches when weather is less than VFR, the missed approach altitude or the MDA should be set after passing the final approach fix.

Flight Director
Should be on and operating in appropriate modes at all times. If then follows that, if the modes are correct, the command bars should be centered at all times, as they are providing useful information.

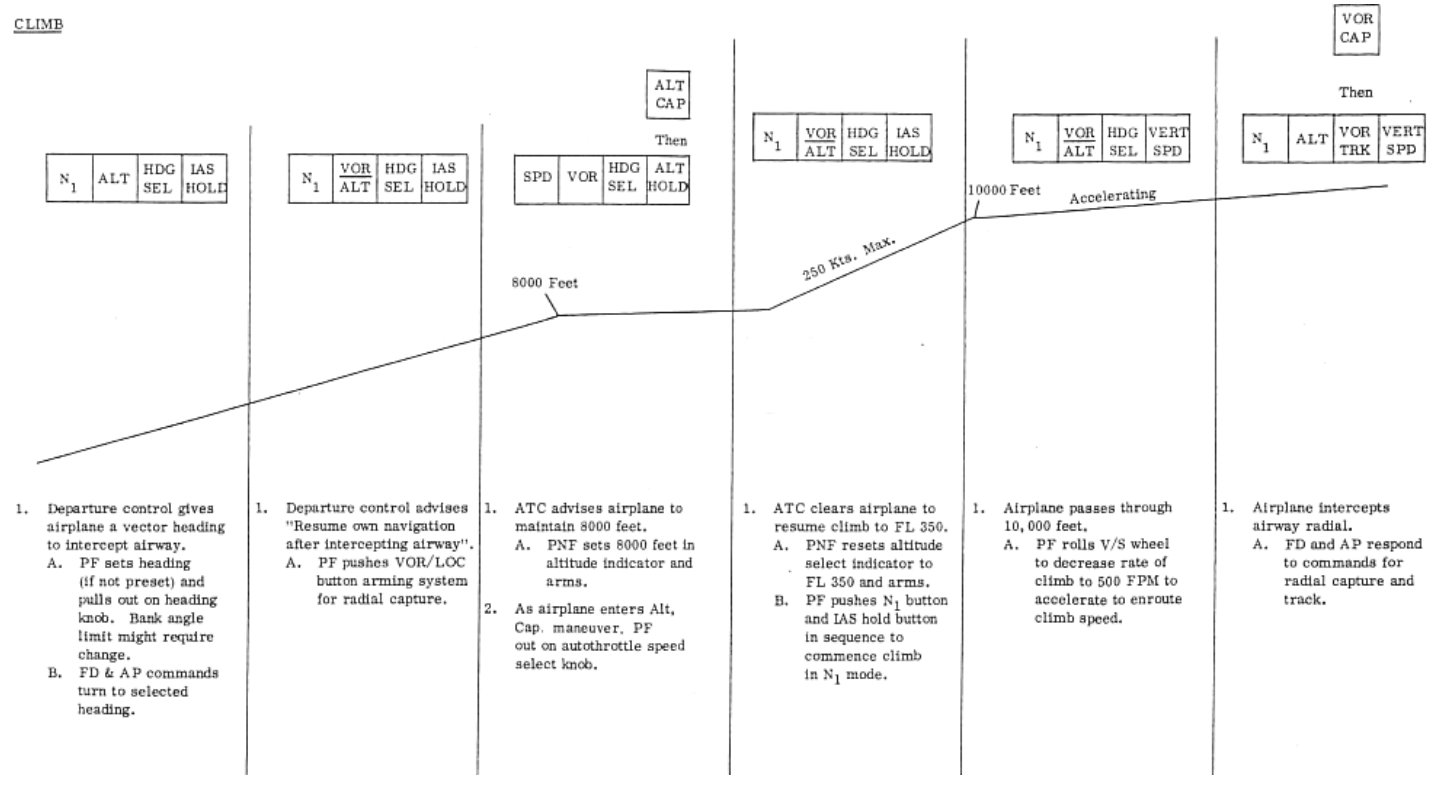
DC-10 FGS Takeoff With Operable T/O Mode



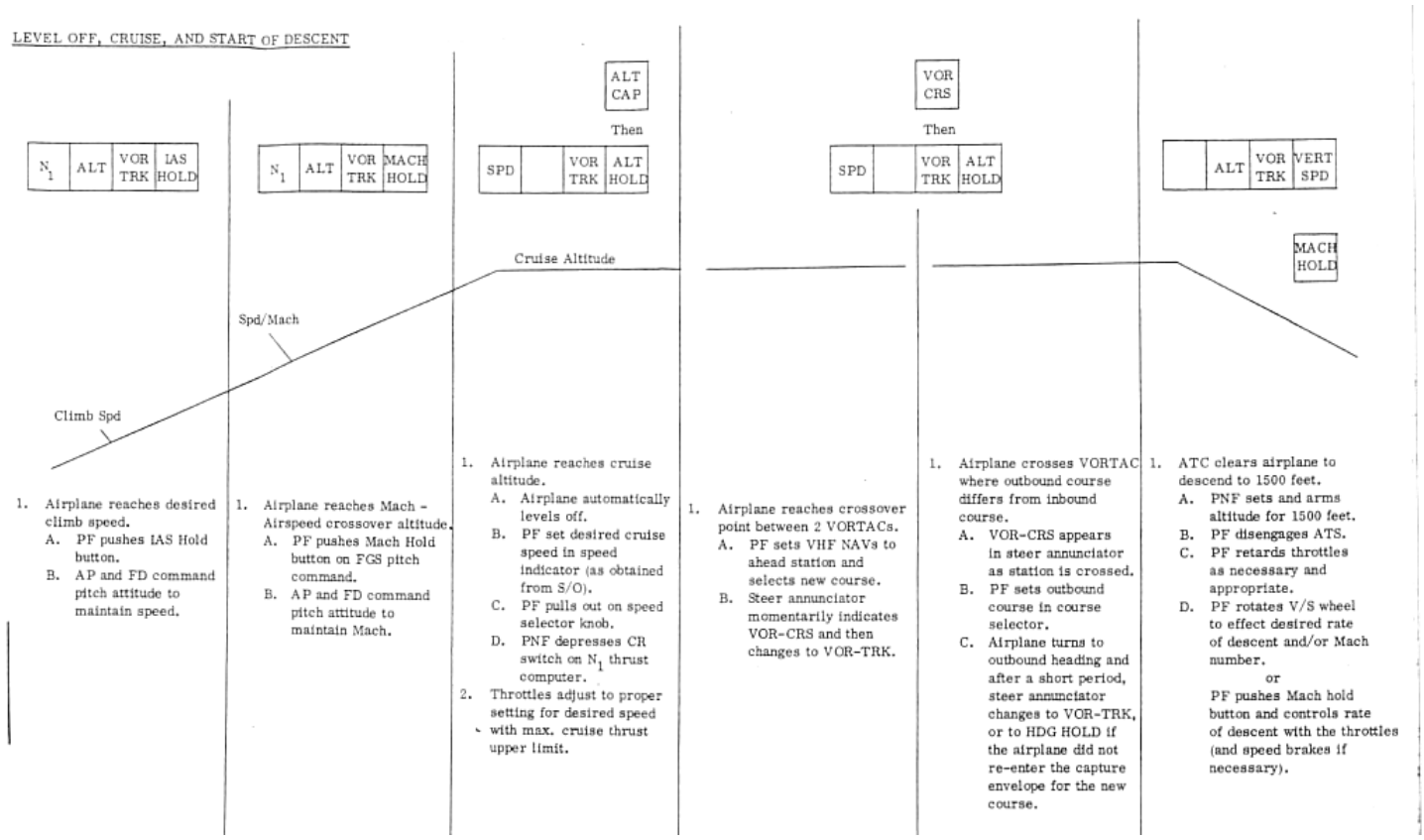
DC-10 FGS Takeoff With Inoperable T/O Mode



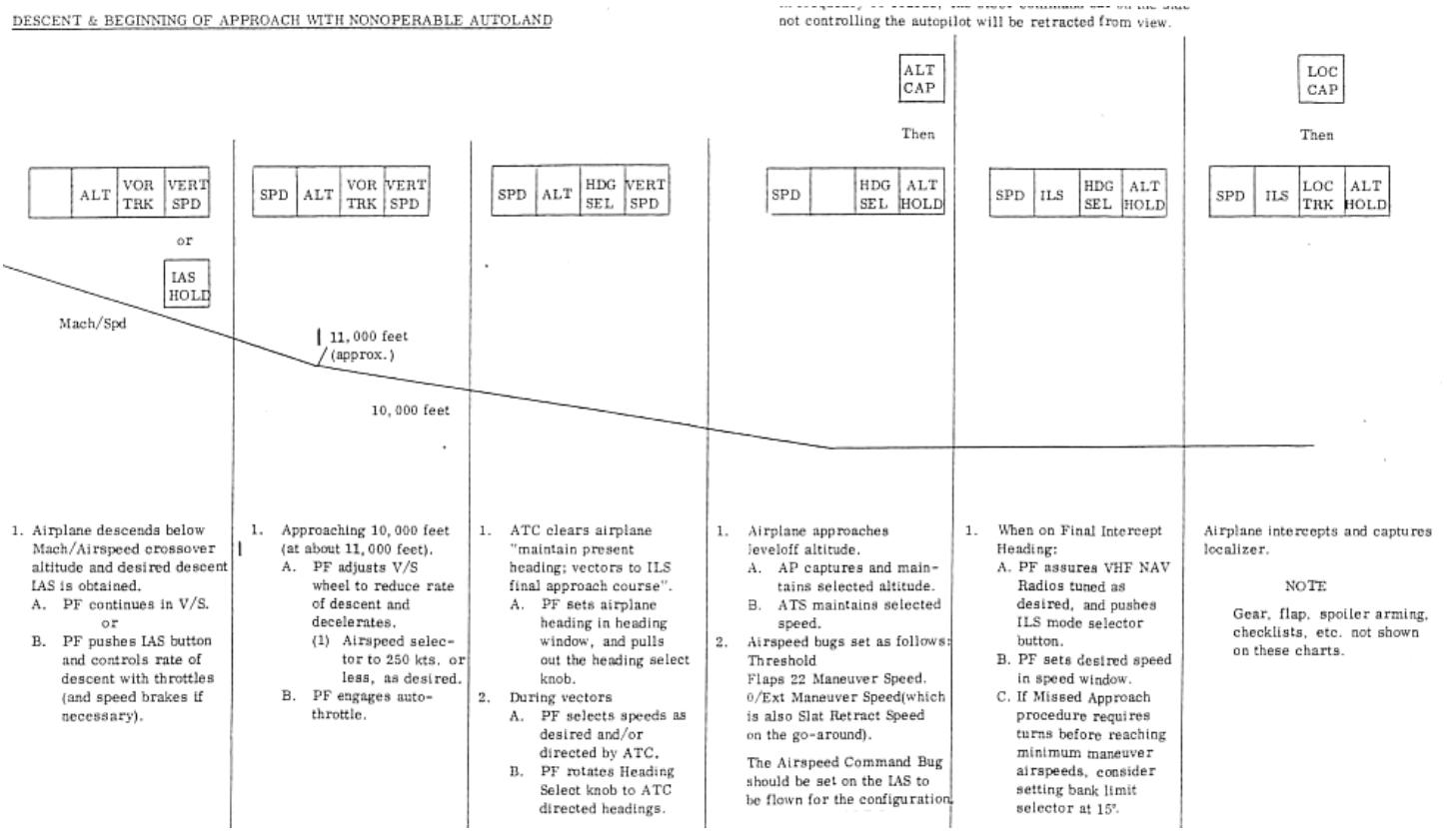
DC-10 FGS Climb



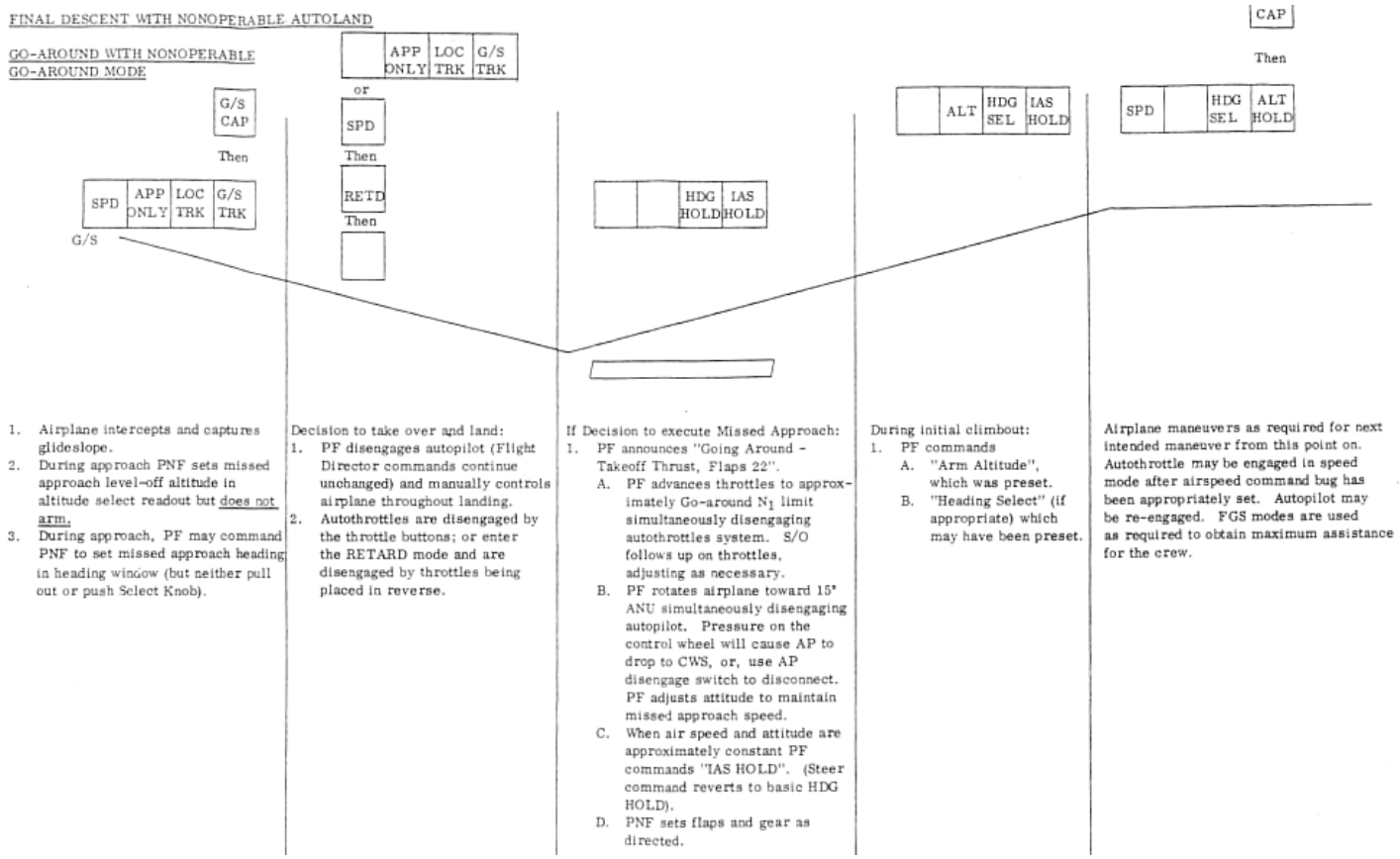
DC-10 FGS Level Off, Cruise, and Start of Descent



DC-10 FGS Descent & Beginning of Approach With Inoperable Autoland



DC-10 FGS Final Descent With Inoperable Autoland



1. Airplane intercepts and captures glideslope.
2. During approach PNF sets missed approach level-off altitude in altitude select readout but does not arm.
3. During approach, PF may command PNF to set missed approach heading in heading window (but neither pull out or push Select Knob).

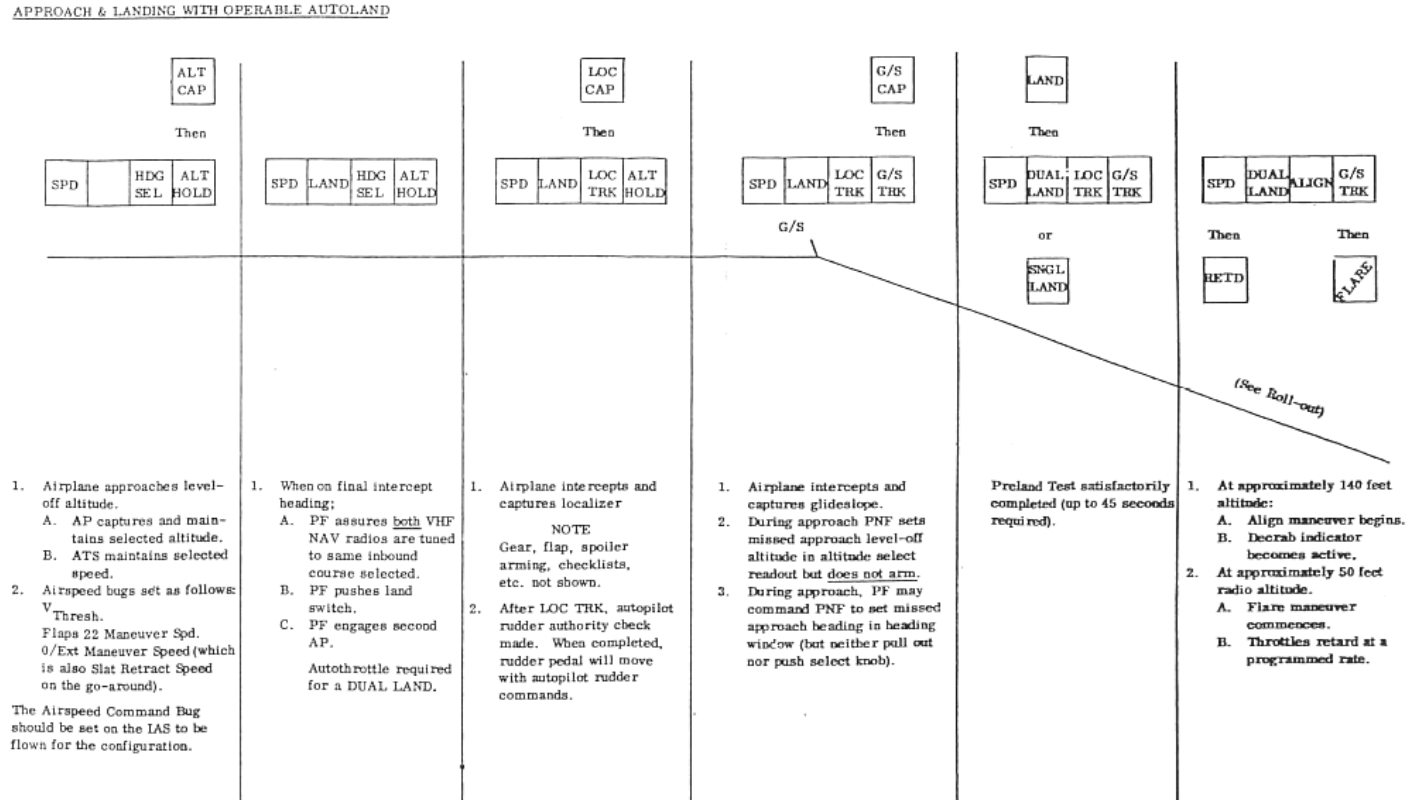
Decision to take over and land:
1. PF disengages autopilot (Flight Director commands continue unchanged) and manually controls airplane throughout landing.
2. Autothrottles are disengaged by the throttle buttons; or enter the RETARD mode and are disengaged by throttles being placed in reverse.

If Decision to execute Missed Approach:
1. PF announces "Going Around - Takeoff Thrust, Flaps 22".
   A. PF advances throttles to approximately Go-around N_1 limit simultaneously disengaging autothrottles system. S/O follows up on throttles, adjusting as necessary.
   B. PF rotates airplane toward 15° ANU simultaneously disengaging autopilot. Pressure on the control wheel will cause AP to drop to CWS, or, use AP disengage switch to disconnect. PF adjusts attitude to maintain missed approach speed.
   C. When air speed and attitude are approximately constant PF commands "IAS HOLD". (Steer command reverts to basic HDG HOLD).
   D. PNF sets flaps and gear as directed.

During initial climbout:
1. PF commands
   A. "Arm Altitude", which was preset.
   B. "Heading Select" (if appropriate) which may have been preset.

Airplane maneuvers as required for next intended maneuver from this point on. Autothrottle may be engaged in speed mode after airspeed command bug has been appropriately set. Autopilot may be re-engaged. FGS modes are used as required to obtain maximum assistance for the crew.

DC-10 FGS Approach and Landing With Operable Autoland



1. Airplane approaches level-off altitude.
   A. AP captures and maintains selected altitude.
   B. ATS maintains selected speed.
2. Airspeed bugs set as follows:
   $V_{Thresh.}$
   Flaps 22 Maneuver Spd.
   0/Ext Maneuver Speed (which is also Slat Retract Speed on the go-around).

The Airspeed Command Bug should be set on the IAS to be flown for the configuration.

1. When on final intercept heading;
   A. PF assures both VHF NAV radios are tuned to same inbound course selected.
   B. PF pushes land switch.
   C. PF engages second AP.

   Autothrottle required for a DUAL LAND.

1. Airplane intercepts and captures localizer

   NOTE
   Gear, flap, spoiler arming, checklists, etc. not shown.
2. After LOC TRK, autopilot rudder authority check made. When completed, rudder pedal will move with autopilot rudder commands.

1. Airplane intercepts and captures glideslope.
2. During approach PNF sets missed approach level-off altitude in altitude select readout but does not arm.
3. During approach, PF may command PNF to set missed approach heading in heading window (but neither pull out nor push select knob).

Preland Test satisfactorily completed (up to 45 seconds required).

1. At approximately 140 feet altitude:
   A. Align maneuver begins.
   B. Decrab indicator becomes active.
2. At approximately 50 feet radio altitude.
   A. Flare maneuver commences.
   B. Throttles retard at a programmed rate.

DC-10 FGS Approach and Landing With Operable Autoland (con't)