Attachment 5

to Operations/Human Performance Group Chairmen's Factual Report

CAL's 737 Flight Manual Excerpts

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DCA09MA021

8. If landing weight exceeds the chart value in the Maximum Quick Turn Around Weight Limits chart, Section 5, wait at least

3 5	7	8 9
53 Minutes	62 Minutes	67 Minutes

then check wheel thermal plugs before making a subsequent takeoff. Maintenance may use an alternate approved procedure to ascertain acceptable brake temperatures for dispatch.

9. 7 8 9 Installation of handle covers on the overwing exits must be verified prior to departure whenever passengers are carried.

PARAMETERS

1. Severe turbulent air penetration speeds:

- Climb & Descent

3 5	7 8 9
280 knots / .73 Mach	280 knots / .76 Mach

- Cruise
  TURB N_1 setting from cruise page.

Note: If severe turbulence is encountered at altitudes below 15,000 feet and the aircraft gross weight is less than the maximum landing weight, the aircraft may be slowed to 250 knots in the clean configuration.

2. Maximum tire speed: 195 knots

3. 7 8 9 Takeoffs and landings with tailwind components over 10 knots up to 15 knots are permitted with the following restrictions:

Takeoffs (Dispatch Requirements):

- Actual tailwind component does not exceed value authorized by Accuload Pilot Weight Manifest.
- Runway is clear and dry.
- Antiskid and thrust reversers are fully operational.
- Max takeoff rated thrust is used.
- Auto spoilers are used.

Landings (Dispatch Requirements):

- Antiskid and thrust reversers are fully operational.
- Landing Flaps 15/30/40.
- Auto spoilers are used (unless correction is taken).
- Braking action reported at least GOOD.

Landings (In-flight equipment failure and/or unplanned tailwinds of 11-15 knots):

- Landing distances are verified by reference to Section 5, CONFIGURATION LANDING DISTANCE CHARTS (UNFACTORED).

4. Crosswind Guidelines

Note: Refer to Wind Component chart in Sec.5 for determining Crosswind Component.

Note: The crosswind guidelines presented below were derived through flight test data, engineering analysis, and piloted simulation evaluations. Therefore, the use of these guidelines should be based on the current weather conditions and the pilot's ability and experience level.

Recommended **Takeoff** Crosswind Component Guidelines

Runway Condition	**Crosswind Component (Knots)**
Dry	33
Wet	23
Standing Water / Slush	16
Snow – No Melting *	21

* Takeoff on untreated snow should only be attempted when no melting is present.

- Applicable for runways 148 ft (45 m) or greater in width.
- Assumes an engine failure RTO.
- On slippery runways, crosswind guidelines are a function of runway surface condition, airplane loading, and assume proper pilot technique.

Note: Engine surge can occur with a strong crosswind component if takeoff thrust is set prior to brake release. Therefore, rolling takeoffs are strongly advised when crosswinds exceed 20 knots.

REJECTED TAKEOFF PROCEDURE

A Rejected Takeoff (RTO) is a maneuver performed during the takeoff roll to expeditiously stop the aircraft on the runway.

Rejected Takeoff Decision

At low speeds (up to approximately 100 knots), the energy level is low. Therefore, the aircraft should be stopped if an event occurs that would be considered undesirable for continued takeoff.

As the airspeed approaches V_1, the effort required to stop the aircraft can approach the aircraft's maximum stopping capability. After 100 knots and before V_1, the takeoff should be rejected only for engine failure, a confirmed unsafe configuration, or other conditions that severely affect the safety of flight. V_1 is the maximum speed at which the RTO should be initiated. Therefore, the decision to stop must be made **prior** to V_1.

Historically, rejecting a takeoff near V_1 has often resulted in the aircraft coming to a stop beyond the end of the runway. Common causes include initiating the RTO at or after V_1 and failure to use proper procedures (maximum stopping capability).

Do not reject the takeoff after V_1 unless the Captain judges the aircraft incapable of flight. Even if excess runway remains after V_1, there is no assurance that the brakes and/or reversers will have the capacity to stop the aircraft prior to the end of the runway.

Rejected Takeoff Maneuver

The Captain is responsible for performing all rejected takeoffs. When the First Officer is making the takeoff, he/she will place both hands on the yoke after initially setting takeoff power and the Captain has assumed control of the throttles. The Captain will be prepared to perform the rejected takeoff maneuver, if required. If a rejected takeoff is required or called for by the Captain prior to the First Officer removing his/her hand from the thrust levers, the First Officer will retard the thrust levers to idle and assist the Captain in the rejected takeoff maneuver.

During the takeoff roll, the Pilot Monitoring will monitor all instruments and indicators. Below 100 knots, any abnormality should be called out. Above 100 knots the only callout normally made is "POWER LOSS." This callout is made when any crewmember observes a confirmed engine power loss. Above 100 knots, other conditions that severely affect the safety of flight should also be considered and, if appropriate, a callout made. If a non-normal is verbalized during the takeoff roll, the Captain will evaluate the situation and make the go / no-go decision. If the Captain elects to continue he/she should clearly and loudly call out "CONTINUE." In this case, the Pilot Flying will continue the takeoff using normal procedures.

If the Captain initiates a reject, he/she will clearly and loudly announce, "REJECT." As the aircraft decelerates, the First Officer should ensure that proper aileron control input is maintained. Additionally, during a First Officer takeoff and after the Captain assumes control of the thrust levers, the First Officer will relinquish control of the aircraft to the Captain as soon as "REJECT" is heard.

Transition to manual braking should be verbalized with the call "MANUAL BRAKES."

As soon as conditions permit, the First Officer should notify ATC of the rejected takeoff, and will make a "REMAIN SEATED", "REMAIN SEATED" announcement to the cabin.

During any rejected takeoff, the Captain should:

- Close the throttles.
- Disconnect autothrottle.
- Apply maximum reverse thrust.
- Ensure that the speedbrakes automatically deploy.
- Use RTO autobrakes (if available).

In the event the speedbrakes do not deploy, the First Officer will call "SPEEDBRAKES" and the Captain will manually deploy the speedbrakes. Use RTO brakes or manual braking as required. On a wet or slippery runway, or takeoff at or near maximum runway limit weight, an aborted takeoff at or near V_1 will require <u>MAXIMUM</u> use of all deceleration devices until reaching a full stop.

Whenever a decision is made to reject a takeoff, the following limiting criteria must be considered: weather conditions, runway length and conditions, aircraft weight and takeoff performance limits, and MEL/CDL items affecting aircraft performance.

REJECTED TAKEOFF CONSIDERATIONS	
Below 100 Knots	**Above 100 Knots**
• Engine Failure / Fire	• Engine Failure
• Unsafe / Unable to Fly	• Unsafe / Unable to Fly
• Cabin Smoke / Fire	
• System Failure	
• Unusual Noise or Vibration	
• Tire Failure	
• Abnormal Acceleration	
• Takeoff Configuration Warning	
• Windshear Warning	

Once the aircraft has slowed to a safe speed, it is up to the Captain:

- When and where to exit the active runway.
- When and if to set the parking brake.
- To make a decision whether to evacuate the aircraft, return to the gate, or return for takeoff. Additional information may be required.

In order to determine the best course of action, the following factors should be considered:

- What was the reason for the rejected takeoff – a mechanical problem, an ATC call, etc?
- What is the overall status of the aircraft – is it able to safely taxi?
- What is the status of the F/As, passengers and emergency exits – are they seated and are all doors closed?
- Is emergency equipment required, and can they access the aircraft better on the runway or taxiway?
- Is it prudent to set the parking brake while evaluating the situation if the brakes are <u>very</u> hot?
- What are the effects of hot brakes and tires as it pertains to brake fires, blown fuse plugs, and hazards to ground personnel?
- Is there any other relevant information pertinent to assessing the situation?

If there is doubt as to the most appropriate course of action, the aircraft should be stopped straight ahead on the runway until the situation can be resolved. After the aircraft comes to a complete stop, the Captain will call for the **REJECTED TAKEOFF CHECKLIST**.

REJECTED TAKEOFF DUTIES

During takeoff, the crewmember recognizing the malfunction will call it out clearly and precisely.

CAPTAIN	FIRST OFFICER
Calls "REJECT" Simultaneously brings both thrust levers to idle and disengages the autothrottles. Confirms RTO braking or initiates maximum manual braking. Initiates maximum reverse thrust consistent with runway and aircraft conditions. Raise speedbrake lever if not already up. Announces "MANUAL BRAKES" when autobrakes disengage. Calls for "REJECTED TAKEOFF CHECKLIST."	Confirms the following actions: • Both thrust levers idle. • Autothrottles disengaged • RTO or manual brakes. • Reverse thrust: • (Calls if other than both reversers operating normally, such as "LEFT REVERSER ONLY.") • Speedbrake lever full up. (If speedbrake lever is not up calls "SPEEDBRAKES.") Call "80 KNOTS." Calls "MANUAL BRAKES" if not called by the Captain. Notify Tower/Ground of reject and status. Notify cabin to "REMAIN SEATED, REMAIN SEATED." Accomplish **REJECTED TAKEOFF** checklist.

* * * *

REJECTED TAKEOFF

Tower / Ground .... NOTIFY

First Officer should advise ATC that the takeoff has been rejected, state aircraft location, and request assistance if applicable.

Passenger PA .... "REMAIN SEATED, REMAIN SEATED"

First Officer should make announcement.

Parking Brake .... AS REQUIRED

IF Engine Failure, Engine Fire, or APU Fire:

> **Engine Start Lever (Affected Engine) .... CUTOFF**
>
> Position start lever to cutoff on affected engine. This will close fuel valves to stabilize engine and reduce possible fuel leakage from damaged fuel lines.
>
> **Fire Handle (If Illuminated) ... PULL & ROTATE LEFT & RIGHT**
>
> Pull, rotate and hold to the stop for one second. Reverse direction to discharge remaining engine fire bottle.

IF Evacuation Is NOT Required:

- Identify the malfunction.
- Accomplish the required checklist(s) at an appropriate time and location. If actions required crew to address engine failure, engine fire, or APU fire, no additional checklist is to be accomplished.
- If the aircraft has been brought to a complete stop, do not resume taxiing until the Flight Attendants have verified all passengers are seated and all doors / exits are closed. Make a brief PA reassuring customers and Flight Attendants that the situation is under control and inform them of your intentions.

OR

Caution: If tire damage is suspected, do not retract flaps.

- Note: If returning to the gate, accomplish the AFTER LANDING checklist. Or if returning to runway for takeoff, accomplish the BEFORE TAKEOFF checklist and confirm Autobrake system is reset to RTO.

(Continued)

Brake Cooling .... DETERMINE

Refer to the appropriate aircraft **RTO BRAKE COOLING CHART**.

* * * *

IF Evacuation <u>IS</u> Required:

Accomplish **EMERGENCY EVACUATION** Checklist.

* * * *

TAILSTRIKE ON TAKEOFF

<u>Caution</u>: Do not pressurize aircraft due to possible structural damage.

Pressurization Mode Selectors.. MAN DC / MAN

Outflow Valve Switch .... OPEN

Hold outflow valve switch in the OPEN position until outflow valve position indicator shows valve full open.

Land At Nearest Suitable Airport.

* * * *

- Rejected Takeoff & Evacuation Coordination

  As per SOP, in the event of a rejected takeoff or a non-normal landing, you can expect the flight deck will give the PA command "REMAIN SEATED, REMAIN SEATED" as soon as possible. Keep the passengers seated and calm while evaluating your assigned exit door window. As soon as the flight crew is able, they will make an appropriate announcement, explaining what the course of action will be. If you observe something inside or outside the aircraft that is of **obvious danger**, relay the information to the flight deck. If contact with the flight deck is not possible, signal with 4 chimes and if absolutely necessary, initiate an evacuation.

- Sterile Light

  Brief any deviations from SOP regarding the STERILE LIGHT due to equipment or unique operational issues. Recall that communicating a valid safety of flight issue takes priority over an illuminated sterile light.

- Flight Deck Entry Procedures

  Emphasize the necessity for ***everyone*** desiring access to identify themselves on the interphone and keeping the flight deck door open only long enough for prompt transit of authorized individuals or articles.

- Security or Unusual Incidents

  Appropriate security information and any unique security measures for the specific flight should be shared, including the presence of FAMs, LEOs, etc. The flight attendants should advise the flight deck of all security incidents or other unusual problems. *Effective communications between the cabin and flight deck are paramount.* All crewmembers should refer to the ONBOARD SECURITY INCIDENT guide for individual responsibilities during a security incident.

- Questions or Additional Information From Flight Attendants

  Address any questions or open issues and ask if the flight attendants have any additional information for the flight crew. Have any assigned FAMs provide their briefing.

- Airport Information (-7 page) and Taxi Plan (-9 page)

  A comprehensive review of all general information on the –7 page(s) in addition to the appropriate DEPARTURE CONSIDERATIONS block. Review as necessary the anticipated taxi plan for departure including the route, planned runway entrance points, parallel runways operations, taxiway restrictions for size or weight, gate/pushback procedures, and single engine taxi information if anticipated.

- Weather / Runway Conditions / Takeoff Weight

  A review of current weather for departure including considerations for adverse weather operations such as deicing procedures, necessity of engine/wing anti-ice, low altimeter, windshear, etc. Additionally review the planned runway, wind considerations, any braking action reports or performance limitation/penalties, and anticipated takeoff weight.

- Reject Take Off & Evacuation Issues

  Review rejected takeoff considerations and crew evacuation duties if other than SOP due to runway issues, inoperative components, or unique crew complement.

- Air Return / Alternate

  Review the plan for an immediate air return, including estimated landing weight, performance limitations. If applicable, review the takeoff alternate details, including weather, approximate distance and time.

- TERR Considerations

  WARNING: Prior to departure at airports near mountainous or significant terrain the following procedures will be accomplished:

  - All appropriate SIDS, STARS, approach charts, **ENGINE FAILURE ON DEPARTURE / ONE ENGINE INOPERATIVE MISSED APPROACH** procedures, and associated enroute charts for the departure and arrival will be reviewed and readily available.

  - The flight crew will review all Grid MORAs, MEAs, MOCAs, MSAs to include position of high terrain along the departure/arrival route.

TAKEOFF

TAKEOFF PROCEDURE

CDU Display

To allow quick access to data normally required during takeoff and departure the recommended CDU display on takeoff is as follows:

- PF on the TAKEOFF page
- PM on the LEGS page

After takeoff, the VNAV CLB page may be displayed to facilitate climb constraint modification. However, climb constraint modification immediately after takeoff is normally accomplished on the mode control panel.

FMC Accuracy Check

5 7 8 9

Prior to takeoff, both pilots must ensure that the aircraft symbol on the MAP display overlays the takeoff runway symbol using lowest scale, and that the MAP-displayed departure routing is attached to the runway without discontinuity, consistent with the departure procedure requirements (i.e. may not be present or attached if there is no designated DEP procedure). If either of these checks reflect issues, do not takeoff until fully resolved.

Caution: Failure to ensure the correct runway and correct SID/TRAN is programmed in the FMC will lead to subsequent vertical/lateral navigation errors, compromising both ATC separation and/or noise abatement requirements.

③ FMC Update Feature and Runway Verification

On the TAKEOFF REF page, the prompt **FMC POS UPD RWXXX (5R)** when selected and executed will update the FMC to the runway coordinates. The runway coordinates in the FMC Nav database are for the landing threshold on that runway.

For the **FMC POS UPD RWXXX** to be visible, entry of the departure runway is required. The update command must be selected and executed prior to 60 knots. If the runway is not entered on the ROUTE page, prompt **5R** on the TAKEOFF REF page will be blank.

Depressing TOGA on the ③ aircraft **will not automatically update the aircraft position.** Depressing the (5R) key and then executing the update is the only way to drive the FMC position to the departure end of the runway for the ③.

Prior to takeoff, the First Officer will select the FMC POS UPD RWXXX (5R) and verbalize, "Runway XXX update selected." The Captain will verify the appropriate runway is in the FMC and it is the correct runway assigned for takeoff. Both pilots will monitor that the aircraft heading is within acceptable limits of the magnetic heading of the departure runway. If the magnetic heading does not coincide with the runway heading as published on the airport diagram, do not takeoff until fully resolved.

Position verification in-flight is required. Select the FIX page, type in the identifier for the VOR that is manually being tuned by the VHF navigation panel and crosscheck the radial and DME from raw data vs. the computed data. Selecting and executing FMC UPD should ensure RNP/ANP requirements if needed. If LNAV is required at 400 feet AGL, the monitoring pilot should display raw data.

When FMC position is confirmed, both Nav radios should be selected to AUTO. This gives the FMC maximum capability to use navaids for position updating.

VHF Nav tuning is automatically selected when the HSI switch is positioned to NAV.

<u>Note</u>: Aircraft not utilizing the FMC POS UPD feature may require several minutes of airborne time to acquire an accurate FMC position (dependent on navaid update availability).

<u>Caution</u>: Failure to ensure the correct runway and correct SID/TRAN is programmed in the FMC will lead to subsequent vertical/lateral navigation errors, compromising both ATC separation and/or noise abatement requirements.

Setting Takeoff Thrust

A rolling takeoff is recommended. As the aircraft is aligned with the runway, the Pilot Flying will smoothly advance both throttles, ensuring symmetrical engine acceleration, to approximately 40% N_1 and allow the engines to stabilize. The throttle position will be about ¾" forward of idle. Unrestricted advancement of the throttles can cause asymmetric thrust with directional control problems, especially on slippery runways.

<u>Caution</u>: The nose wheel steering (tiller) should not be used above normal taxi speeds (20 knots).

After the engines are stabilized, the PF will manually advance the throttles toward the takeoff power setting, and engage TOGA when satisfied that engine acceleration is normal. Normally TOGA will be engaged as the throttles reach the vertical (70% N_1) position. As the throttles reach the end of their forward movement, the PF calls "CHECK POWER," and the PM ensures that the throttles stabilize at takeoff N_1 (referencing the TAKEOFF PAGE of the FMC) and replies "POWER SET ______%."

<u>Note</u>: Both F/D switches must be on to engage the F/D Takeoff mode (TOGA). The F/D switches are not required to engage autothrottle only.

A/T annunciates N_1 and AFDS annunciates TOGA. The thrust levers drive forward and flight director bars command 10 degrees nose down. The F/D does not provide runway steering guidance or rotation commands. At approximately 60 knots, the F/D will command 15 degrees nose up.

③ At 64 knots (84 knots - 6 7 8 9), A/T annunciates THR HOLD.

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Takeoff Roll

Keep the airplane on the centerline with rudder pedal steering and rudder. The rudder becomes effective between 40 and 60 knots. Use of the nose wheel steering tiller during takeoff is not recommended.

The Captain will guard and retain exclusive control of the throttles from the time initial takeoff power is set until V_1, and will be prepared to perform the rejected takeoff maneuver if required. When the First Officer is making the takeoff, the First Officer will place both hands on the yoke after initially setting takeoff power.

The PM monitors essential instruments including both primary and standby airspeed indications, engine instruments, verifies proper oil pressure, and verifies A/T N_1 indication changes to THR HOLD. If the THR HOLD mode annunciation does not appear, no crew action is required unless a subsequent system fault caused unwanted thrust lever movement. Lack of the THR HOLD annunciation means the protective feature may not be active.

The PM will crosscheck the standby airspeed indicator against their own airspeed indicator, and then at 100 knots call "100 KNOTS." The PF will visually confirm that his/her airspeed indicator is in agreement.

The PM will call "V_1" at approximately 5 knots prior to the actual V_1 speed (depending upon acceleration rate) so as to complete the call by the time the airspeed indicator has reached actual V_1.

The PM will call "ROTATE" at V_R, and will then monitor the flight instruments throughout the remainder of the takeoff procedure.

After liftoff, THR HOLD mode remains engaged until:

3 $\boxed{5}$ a radio altitude of 400 feet RA is reached and 18 seconds have elapsed since liftoff.

$\boxed{7}\boxed{8}\boxed{9}$ a radio altitude of 800 feet RA.

The A/T mode cannot be changed during this time because power is taken away from the throttle drives to ensure no A/T movement occurs during the takeoff phase. The A/T will automatically annunciate ARM and thrust will remain at TO setting. A/T mode can be changed only after the ARM annunciation appears. If full thrust is desired during a reduced thrust takeoff, manually position the thrust levers to the thrust limit as indicated by the cursors on the N_1 gauges.

Takeoff With Aft Center-Of-Gravity (C.G.)

When taking off at lightweight and with an aft C.G., the combination of full thrust, rapid thrust application, and sudden brake release may tend to pitch the nose up, reducing nosewheel steering effectiveness. At lightweight and aft C.G., use of reduced thrust and rolling takeoff technique is recommended whenever possible.

Crosswind Takeoff

Refer to Recommended Takeoff Crosswind Component Guidelines, Section 1, Limitations. The crosswind takeoff characteristics are typical of most swept-wing transports. The upwind wing will tend to rise as the takeoff roll begins. This may be corrected by using aileron as required or by pre-setting a fixed amount of aileron into the wind prior to takeoff roll. Maintain a slight forward pressure on the control yoke until approaching rotation speed. In either case, large control wheel oscillations and inputs should be avoided.

Another indication of a crosswind condition is the tendency of the aircraft to weather vane into the wind, requiring rudder application for directional control. As speed increases, the aileron deflection requirement will decrease. Continue to maintain directional control with smooth rudder application. This will result in a cross control condition that must be maintained through liftoff. During rotation, hold the control wheel in a displaced position as required to keep the wings level. When airborne, aileron and rudder cross control should be slowly and smoothly relaxed.

For takeoff in gusty or strong crosswind conditions, consider using a higher thrust setting (up to maximum if appropriate) consistent with takeoff weight, weather conditions, runway length, and aircraft performance. When the prevailing wind is at or near 90° to the runway, the possibility of wind shifts resulting in gusty tailwind components during rotation or liftoff increases. The use of a higher thrust setting reduces the required runway length and minimizes the airplane exposure to gusty conditions during rotation, liftoff, and initial climb.

Avoid rotation during a gust. If a gust is experienced near VR, as indicated by stagnant airspeed or rapid airspeed acceleration, momentarily delay rotation. This slight delay allows the airplane additional time to accelerate through the gust and the resulting additional airspeed improves the tail clearance margin. Do not rotate early or use a higher than normal rotation rate in an attempt to clear the ground and reduce the gust effect because this reduces tail clearance margins. Limit control wheel input to that required to keep the wings level. Use of excessive control wheel may cause spoilers to rise which has the effect of reducing tail clearance. All of these factors provide maximum energy to accelerate through gusts while maintaining tail clearance margins at liftoff. The airplane is in a sideslip with crossed controls at this point. A slow, smooth recovery from this sideslip is accomplished after liftoff by slowly neutralizing the control wheel and rudder pedals.

Rotation And Liftoff

As the airspeed approaches V_1, the slight forward control column pressure is relaxed to neutral, allowing for a smooth rotation to begin at V_R.

For optimum takeoff and initial climb performance, initiate a smooth, constant rate rotation at V_R toward 15 degrees of pitch attitude.

At V_R, rotate smoothly with one continuous motion approximating, but no more than 2.5 degrees/sec. Using the normal rotation rate, the aircraft flies off the runway as the pitch attitude increases, and a runway to fuselage clearance of approximately 20 inches results.

Note: The flight director pitch command is not used for rotation.

Proper rotation will result in an airspeed of approximately V_2 + 20 knots. Initially, the Flight Director will command 15 degrees nose up. Indicated airspeed and vertical speed are the primary instruments. After the radio altitude and vertical speed increase, the Pilot Flying will adjust pitch to coincide with F/D input. This pitch command under normal situations will be V_2 + 20 knots. The Flying Pilot will maintain the F/D input of V_2 + 20 until reaching initial flap retraction altitude.

At light gross weights, an initial climbout at V_2 + 20 will produce an excessive deck angle. A slight difference between aircraft symbol and F/D pitch command will be necessary to not exceed 25 degrees of pitch. This pitch limit is for passenger comfort. The F/D pitch command will become synchronized with the aircraft symbol as the flaps are retracted during acceleration to clean maneuvering speed.

Because the aircraft is geometrically limited, it cannot be rotated to a body angle that will prevent it from becoming airborne with takeoff thrust. Premature rotation will probably result in the aircraft becoming airborne before the normal liftoff point, and at a slower than normal speed. Since this speed will be considerably below the best angle of climb speed, the initial climb profile may be greatly reduced.

The aircraft has a very low angle of attack on the ground in three-point attitude. Delaying rotation (waiting for the aircraft to "Fly Itself" off the ground) will increase the liftoff distance considerably.

The airspeed indicator will lag momentarily during rotation due to the vertical movement of the static ports relative to the direction of flight as the nose is lifted.

When a positive rate of climb has been verified on the IVSI and altimeter, either pilot will call, "POSITIVE RATE." When a positive rate of climb is confirmed, the PF will call "GEAR UP," stabilize airspeed at V_2 + 20 knots, and transition to the F/D pitch command. Cross check indicated airspeed and other flight instruments. If the flight director is inoperative indicated airspeed and attitude become the primary pitch references.

In roll, the F/D commands wings level to 400 feet RA, then selected bank angle limit to the selected heading when a new roll mode is selected.

Selection of pitch and roll modes other than TOGA are inhibited below 400 feet RA.

During takeoff or initial climb, if a center tank **LOW PRESSURE** light(s) illuminates, the center tank pump(s) may remain on until the climb attitude is reduced and the light(s) extinguishes or workload allows for the pump(s) to be positioned to OFF. When established in a level attitude at cruise, if the center tank contains usable fuel and the center tank switches are off, center tank pump switches may be positioned to ON again. Verify the **LOW PRESSURE** light extinguish and position both switches to OFF when both **LOW PRESSURE** lights illuminate.

The windshear recovery enhancement system may include a prediction, a detection and a guidance system. Each system operates independently of the other.

Operational Precautions

Takeoff Considerations

If operating from an airport without Terminal Doppler Weather Radar and:

- PIREPS indicate a windshear of 15 knots or greater with increasing intensity, delay departure 30 minutes, or
- PIREPS indicate a windshear of less than 15 knots with diminishing intensity, delay departure 15 minutes.

If operating from an airport with Terminal Doppler Weather Radar:

- A Microburst Alert or Windshear Alert will be issued by the tower in conjunction with a clearance to a specific runway. If the clearance does not contain an alert, the flight crew may assume that no alert exists at the present time.
- If a Windshear Alert accompanied by a reported gain of airspeed is issued, the crew may take off, but be alert for sudden airspeed increase. If airborne, the pilot should adjust pitch attitude smoothly to maintain desired airspeed, but should not chase large rapid airspeed fluctuations.
- If a Windshear Alert accompanied by a reported loss of airspeed, <u>or</u> a Microburst Alert is received, a takeoff should not be attempted. If either alert is received during takeoff prior to 100 knots, the takeoff should be rejected. If either alert is received after 100 knots, the takeoff may be rejected or continued at Captain's discretion after considering runway available, gross weight, and related meteorological conditions.

Takeoff In Windshear Conditions

If, after careful consideration, the decision to takeoff is made:

1. Select the longest suitable runway that avoids suspected areas of windshear. The choice of a suitable runway involves consideration of exposure to obstacles after liftoff and crosswind and tailwind limitations.
2. Use a takeoff flap setting of 5 unless limited by obstacle clearance and/or climb gradient. This setting provides the best performance for countering windshear.
3. Maximum rated takeoff thrust should be used. (Reduced Thrust takeoff is prohibited.)
4. Use flight director display.
5. Use autothrottle.
6. Use increased airspeed at rotation when available. To compute the increased rotation airspeed:
   - Determine the V_1, V_R, and V_2 speed for the actual aircraft gross weight and flap setting. Set reference speeds to these values in the normal manner.

     Caution: Runway Analysis is not provided when scheduled for improved takeoff. If increased performance is desired, use the following procedures:

     - Contact load planning and request a "Windshear Takeoff" ACCULOAD.
     - Use the takeoff speeds on the new ACCULOAD.
   - From the automated runway analysis, pre-departure papers determine the runway limit weight for the selected runway. Then determine V_R for that weight (field length limit V_R).
   - If the field length limit V_R is greater than the actual gross weight V_R, (almost always the case) use the higher V_R (up to 20 knots in excess of actual gross weight V_R) for takeoff.

     Note: Reference speeds should not be reset to the higher airspeeds.
7. Rotate to normal initial climb attitude at the increased V_R and maintain this attitude. This technique produces a higher initial climb speed which slowly bleeds off to the normal climb speed.

8. Once the takeoff is initiated, the flight crew should be alert for airspeed fluctuations. If significant airspeed variations occur below V_1 the takeoff should be rejected if sufficient runway remains.

Caution: Accelerate / Stop distances are computed assuming a normal acceleration to V_1. Airspeed fluctuations may cause the aircraft to achieve V_1 at a point farther down the runway than anticipated. Therefore, the aircraft may not be able to stop on the runway.

9. When windshear is encountered:
   - At or above the actual gross weight V_R:
     - Do not attempt to accelerate to the increased V_R, but rotate without hesitation.
   - At or near the actual gross weight V_R and airspeed suddenly decreases:
     - There may not be sufficient runway left to accelerate back to normal V_R. If there is insufficient runway left to stop, initiate a normal rotation at least 2,000' before the end of the runway, even if airspeed is low. Higher than normal attitudes may be required to lift off in the remaining runway. Aft body contact may occur.
   - Throttles may be advanced to the mechanical stops.
   - If increased airspeed was not used prior to liftoff, accelerating to higher than normal airspeed after liftoff is not recommended. Reducing pitch attitude at low altitude to accelerate might produce a hazard if windshear is encountered.

Predictive Windshear Alerts

The following procedural chart applies to the predictive windshear system. Continental policy is to avoid all windshear and other hazardous weather.

Note: Windshear alerts are inhibited on the ground above 100 KIAS to 50 feet AGL.

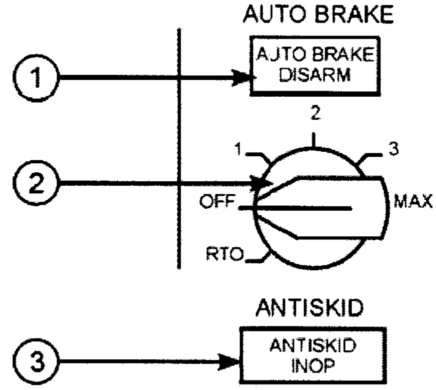
Phase of Operation	Warning Alert	Caution Alert	Advisory Alert	System Failure
Before Takeoff	Advise ATC of the location of the Warning Alert. Delay takeoff until the warning is no longer present.	Advise ATC of the location of the Caution Alert. At the Captain's discretion, delay the takeoff, or takeoff and maneuver to avoid the hazard.	Advise ATC of the location of the windshear hazard. After takeoff, maneuver to avoid the windshear hazard area.	Use other means of windshear avoidance in accordance with published FAA windshear recovery guidelines.
Takeoff: Prior to 100 kts.	Reject the takeoff. Advise ATC of the location of the windshear hazard.	Assure maximum rated thrust is applied. Continue the takeoff, and advise ATC of the hazard and maneuver around the hazard.	Assure maximum rated thrust is applied. Continue the takeoff, and advise ATC of the hazard, and maneuver around the hazard.	Same as above.
After Takeoff	Assure maximum rated thrust is applied. If the windshear is penetrated, utilize windshear recovery procedures. Advise ATC of the hazard.	Assure maximum rated thrust is applied. If the windshear is penetrated, utilize windshear recovery procedures. Advise ATC of the hazard.	Continue the climb out and monitor the windshear hazard. Advise ATC of the hazard.	Same as above.
During Approach	Initiate a normal go-around. If the windshear hazard is penetrated, utilize windshear recovery procedures. Advise ATC of the hazard.	At the Captain's discretion, maneuver around the windshear hazard if a safe stabilized approach can be continued after the maneuver, or initiate a normal go around.	Continue the approach, monitor the location of the windshear event. Advise ATC of the hazard.	Same as above.

During takeoffs on icy runways, lag in rudder pedal steering and possible nose wheel skidding must be anticipated. Keep the airplane on the centerline with rudder pedal steering and rudder. The rudder becomes effective between 40 – 60 knots. If deviations from the centerline cannot be controlled either during the start of the takeoff roll or until the rudder becomes effective, immediately reject the takeoff.

Apply brakes and advance throttles to approximately 40% N_1 (35 - 45% N_1). After the engines are stabilized, manually advance the throttles toward the takeoff power setting, engaging TOGA when the Pilot Flying is satisfied acceleration is normal.

Autobrake And Anti-Skid Controls

7 8 9



CENTER FORWARD PANEL

7376-14015

① **AUTO BRAKE DISARM** Light

Illuminated (amber) –

- SPEED BRAKE lever moved to down detent during RTO or landing
- manual brakes applied during RTO or landing
- thrust lever(s) advanced during RTO or landing
  - except during first 3 seconds after touchdown for landing
- landing made with RTO selected
- RTO mode selected on ground
  - illuminates for one to two seconds then extinguishes
- a malfunction exists in automatic braking system.

Extinguished –

- AUTO BRAKE select switch set to OFF
- autobrakes armed.

② AUTO BRAKE Select Switch

OFF – autobrake system deactivated.

1, 2, 3, or MAX –

- selects desired deceleration rate for landing
- switch must be pulled out to select MAX deceleration.

RTO – automatically applies maximum brake pressure when thrust levers are retarded to idle at or above 90 knots.

③ Anti-skid Inoperative (**ANTISKID INOP**) Light

Illuminated (amber) – a system fault is detected by anti-skid monitoring system.

Extinguished – anti-skid system operating normally.

Autobrake System

The autobrake system uses hydraulic system B pressure to provide maximum deceleration for rejected takeoff and automatic braking at pre-selected deceleration rates immediately after touchdown. The system operates only when the normal brake system is functioning. Anti-skid system protection is provided during autobrake operation.

Rejected Takeoff (RTO)

The RTO mode can be selected only when on the ground. Upon selection, the **AUTO BRAKE DISARM** light illuminates for one to two seconds and then extinguishes, indicating that an automatic self-test has been successfully accomplished.

To arm the RTO mode prior to takeoff the following conditions must exist:

- aircraft on the ground
- anti-skid and autobrake systems operational
- AUTO BRAKE select switch positioned to RTO
- wheel speed less than 60 knots
- forward thrust levers positioned to IDLE.

With RTO selected, if the takeoff is rejected prior to wheel speed reaching 90 knots autobraking is not initiated, the **AUTO BRAKE DISARM** light illuminates and the RTO autobrake function remains armed. If the takeoff is rejected after reaching a wheel speed of 90 knots, maximum braking is applied automatically when the forward thrust levers are retarded to IDLE. Braking force is the equivalent of full manual braking.

789 The RTO mode is automatically disarmed when both air / ground systems indicate the air mode.

The **AUTO BRAKE DISARM** light does not illuminate and the AUTO BRAKE select switch remains in the RTO position. To reset or manually disarm the autobrake system, position the selector to OFF. If a landing is made with RTO selected (AUTO BRAKE select switch not cycled through OFF), no automatic braking action occurs and the **AUTO BRAKE DISARM** light illuminates two seconds after touchdown.

Landing

When a landing autobrake selection is made, the system performs a turn-on-self-test. If the turn-on-self-test is not successful, the **AUTO BRAKE DISARM** light illuminates and the autobrake system does not arm.

Four levels of deceleration can be selected for landing. However, on dry runways, the maximum autobrake deceleration rate in the landing mode is less than that produced by full pedal braking.

After landing, autobrake application begins when:

- both forward thrust levers are retarded to IDLE
- the main wheels spin-up.

To maintain the selected landing deceleration rate, autobrake pressure is reduced as other controls, such as thrust reversers and spoilers, contribute to total deceleration.

The autobrake system brings the aircraft to a complete stop unless the braking is terminated by the pilot.

Autobrake – Disarm

The pilots may disarm the autobrake system by moving the selector switch to the OFF position. This action does not cause the **AUTO BRAKE DISARM** light to illuminate. After braking has started, any of the following pilot actions disarm the system immediately and illuminate the **AUTO BRAKE DISARM** light:

- moving the SPEED BRAKE lever to the down detent
- advancing the forward thrust lever(s), except during the first 3 seconds after touchdown for landing
- applying manual brakes.