NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

December 18, 2019

Attachment 12 – Miami Air Operations Manual [Excerpts]

OPERATIONAL FACTORS/HUMAN PERFORMANCE

DCA19MA143

737-800
Operations Manual - Vol 1
Miami Air International, Inc.

The 737 Operations Manual consists of three (3) independent volumes:

- AOM I (this manual)
- AOM II
- QRH

ISSUED TO:_____

CONTROL #:_____

Revision 30
03-28-18

General

This chapter contains Airplane Flight Manual (AFM) limitations and Boeing recommended operating limitations. Limitations that are obvious, shown on displays or placards, or incorporated within an operating procedure are not contained in this chapter.

Airplane General

Operational Limitations

Runway slope	+/– 2%
Maximum Takeoff and Landing Tailwind Component	15 knots (specific takeoff or landing performance data required when over 10 knots tailwind component)
Maximum speeds	Observe Vmo, gear and flap placards
Maximum Operating Altitude	41,000 ft
Maximum Takeoff and Landing Altitude (pressure altitude)	8,400 ft
Turbulent Penetration	280 knots /.76 M, whichever is lower

Maximum flight operating latitude for -800 aircraft is 82° North and 82° South, except for the region between 80° West and 130° West longitude, the maximum flight operating latitude is 70° North, and the region between 120° East and 160° East longitude, the maximum flight operating latitude is 60° South.

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

Verify that an operational check of the flight deck door access system has been accomplished according to the approved procedures in the supplementary section once each day.

On revenue flights, the escape slide retention bar (girt bar) must be installed during taxi, takeoff and landing. (not a limitation)

The maximum demonstrated takeoff and landing crosswind is 33 knots.

Altitude Display Limits for RVSM Operations

Standby altimeters do not meet altimeter accuracy requirements of RVSM airspace.

The crew builds a waypoint at 35 nm (37 nm for a more conservative method) prior to the airport with a 10,000 feet AFL/250 knots speed restriction. If the landing runway heading is approximately 90 degrees to the aircraft's heading at 10,000 feet AFL, place the waypoint at 33 nm (35 nm for a more conservative method) from the airport. If the landing direction is 180 degrees from the aircraft's heading at 10,000 feet AFL, place the waypoint 25 nm (27 nm for a more conservative method) from the airport. Maintaining the desired descent profile and using the Map mode to maintain situational awareness will ensure a more efficient descent. To account for a tailwind, consider adding 2 nm (35 nm + 2 nm, 33 nm + 2 nm or 25 nm + 2 nm).

Descent Now/Cruise Descent

Use Descent Now if a descent is required prior to reaching the TOD on the Descent Page but not greater than 50 nm before the TOD. Outside 50 nm use a Cruise Descent.

Descent Approach Checklist

The PF shall call for the Descent Approach checklist no later than 18,000 feet MSL. Where the transition level is lower, the checklist should be completed down to “Altimeters Transition.” The Pilot Monitoring reads aloud the challenges and responses. Shoulder Harness checklist item is a all crew response (Captain, F/O, and jumpseat rider.)

Fasten Belts ..... ON

Shoulder Harness ..... ON

Captain responds first, followed by First Officer, then cockpit jumpseat rider.

Anti-Ice ..... DECLARE

Air Cond & Pressurization ..... Checked & Set

Verify/Reset Landing altitude.

Verify cabin descending / climbing.

Confirm Cabin Altitude, Cabin Rate and Differential Pressure are appropriate.

Duct pressure should be 18-50 psi with split between left and right duct pressure needles not exceeding 16 psi.

Approach Speeds ..... Set

Select Approach Reference Page and verify correct flap setting and correct Vref set on PFD.

Note: Approach speed bug must always be set at or above the top of the minimum maneuvering speed (amber) band.

Approach Briefing ..... COMPLETED

As per FOM.

Minimums ..... _____ SET & XCHECKED

Verify DA/DDA/DH for approach is set on both sides as appropriate.

Autobrake .....DECLARE

Recall ..... CHECKED

Check for any annunciator lights. Announce (if appropriate) any annunciator illuminated and the associated non-normal (example, ELECT - IDG Inop.)

Altimeters Transition..... _____ SET & XCHECKED

Set when cleared below transition level and descent has begun.

At 10,000 feet MSL:

"Flight Attendants Arrival Check Please." May adjust altitude for higher altitude airports.

The Captain turns on Fixed Landing lights and Runway Turnoff lights. In addition, if nighttime, turn on Logo lights and Wing Illumination Lights.

LVL CHG or V/S will normally be used below 10,000 feet MSL for descents unless operating on a published STAR/FMSP, in a holding pattern or on a VNAV approach.

LVL CHG is the preferred mode for altitude changes of more than 1000 feet. Vertical Speed is preferred if the altitude change is 1000 feet or less.

The FMC Descent page provides the best guidance when to accomplish deceleration/configuration changes for the approach and landing.

Terrain Display:

At least one Pilot shall have TERR display selected if Terrain/Obstacles are a factor.

10 miles from landing:

"Flight Attendants, Landing Check Please."

Approach Speed

Fly approach speed of Vref plus 1/2 headwind component plus gust factor, not to exceed 20 knots over Vref. For a tailwind, fly Vref plus 5 knots.

Approach Procedures

All instrument approaches should include descent planning, a careful review of the approach procedure, and good crew coordination. If there is a published approach for the landing runway, crews will program the approach in the FMC, tune/select the appropriate navigation frequencies/courses and brief the approach. On any runway which has operating vertical descent guidance equipment (PAPI, VASI, or ILS glide slope) the aircraft will be flown at or above the glide slope until 200 feet AFL. 'Duck under' approaches are not authorized.

Disengage autopilot and autothrottles no later than 50 feet below DA, DDA or DH on all approaches, except auto-landings.

Flap Extension

Flaps are not to be used as drag devices. Selection of flaps should not be accomplished until approaching (approximately 10-15 knots above) the appropriate maneuver speed. In the 230-250 knot speed range, speedbrakes should be used as the primary drag device rather than flaps. Do not use speedbrakes with flaps greater than 10 degrees. Additionally, in the 230-250 knot speed range, the landing gear is the second best choice for increasing drag.

The pilot flying should not call for a flap setting until well below the maximum extension speed. The pilot monitoring should never position the flap lever until confirming the aircraft is below the maximum extension speed. Under most circumstances, usage of the standard flap gates in sequence (1, 5, 15, 25, 30/40) is recommended. When using the 25 position in lieu of selecting flaps 30 directly from 15, the increased aerodynamic deceleration helps prevent inadvertent flap load from flaps 30 to 25 at 176 knots. The speed tape provides an easily recognizable method to avoid exceeding the maximum flaps extension speed for either Flaps 10 or Flaps 15.

When flaps are at 5 degrees, the Speed Tape displays an “upper zipper” that shows the maximum flap speed of 250 knots. Extending from the “upper zipper” is a “yellow fish hook.” The bottom of the “yellow fish hook” displays the maximum flap extension speed for the next anticipated flap setting. The next anticipated flap setting after 5 degrees is Flaps 15, with a maximum extension speed of 200 knots.

Note: Flap maneuver speeds provide approximately 15 to 20 knots speed protection above the minimum maneuvering speed for each flap setting.

Stabilized Approach

The approach profiles contained in the Flight Crew Training Manual are intended as guidelines for configurations during approaches. Weather and traffic conditions may require deviations from the standard profiles.

In either IMC or VMC, no later than 1000 feet AFL, the aircraft must be:
- Fully configured with the Landing Checklist complete
- At a sink rate of no greater than 1000 feet per minute
- Stabilized at the proper approach speed
- Trimmed for zero control forces and
- Engines spooled up

Note: If the aircraft is not stabilized by 1000 feet AFL, a missed approach is MANDATORY.

Note: Momentarily exceeding 1000 feet/min rate of descent below 1000 feet AFL is permitted as long as the descent rate is immediately corrected.

Pilots should be alert for higher than normal descent rates as an indication of possible wind shear.

Go-Around Callout and Immediate Response

For the purpose of flight safety, the following policy is instituted:
- Either the PF or the PM may make a go-around callout, and
- PF’s immediate response to a go-around callout by the PM is execution of a missed approach.

Note: The go-around response is mandatory.

Approach RNP

Until further notice, Miami Air crews will set the RNP to 0.3 prior to the approach.

Missed Approach Briefing

The crew will brief the following conditions that will prompt a missed approach:

- Unable Req'd Nav Perf RNP alert, FMC Disagree alert or Verify Position alert
- GPWS warning
- Cross track limits exceeded (RNP times 1)
- Vertical deviation limits exceeded (+ 75 feet/- 50 feet)
- Primary altimeters not within + or - 100 feet at start of Final Approach Segment (GS Intcpt wpt)

Note: Approach may be continued if the approach lights/runway environment are/is in sight.

Missed Approach Procedure:

- TOGA, Go around thrust, Flaps 15, positive rate, gear up
- At 400 feet AGL, engage LNAV immediately. Engage autothrottle (if required)

On a missed approach, while below 400 feet AGL, especially on an RF leg, it is critical that the crew follow the magenta line and trend vector precisely. Upon reaching 400 feet AGL, engage LNAV immediately.

If executing a missed approach after passing the start of the Final Approach Segment (GS Intcpt wpt), do not exceed 165 knots until reaching the end of the RF leg.

Note: Miami Air is authorized to conduct RNP AR approaches where the published missed approach RNP is less than 1.0.

Failures During Approach

If total GPS failure occurs prior to the start of the Final Approach Segment (GS Intcpt wpt), revert to a ground based nav approach.

After starting the Final Approach Segment (GS Intcpt), if a total GPS failure occurs and ANP does not exceed RNP, continue approach; if total GPS failure occurs and ANP exceeds RNP, execute a missed approach (unless approach lights and/or runway environment are/is in sight).

Note: If a single GPS fails during the approach, the ANP will be unaffected.

Accomplish the following actions if there is a single failure of either an Autopilot or Flight Director:

- if flight director fails, continue approach

Braking

If braking action is less than good, it is recommended to use Autobrakes MAX AUTO from touchdown until stopping on the runway is assured.

Landing

Bleed off the headwind component add-on by the threshold, reducing airspeed to Vref + gust factor for touchdown.

The target touchdown point is 1000 feet from the threshold. Touchdown should occur within -250 feet to +500 feet of the target touchdown point.

When the threshold passes under the airplane nose and out of sight, shift the visual sighting point to 3/4 the runway length. Initiate the flare when the main gear is approximately 20 feet above the runway by increasing pitch approximately 3 degrees. This will slow the rate of descent. After the flare is initiated, smoothly retard the thrust levers to idle, and make small pitch adjustments to maintain the desired rate of descent to the runway. Ideally the main gear touchdown should occur simultaneously with thrust levers reaching idle. A touchdown attitude of 4 to 7 degrees is normal with an airspeed of approximately Vref plus any gust correction. Do not trim the stabilizer during the flare.

Typically, the pitch attitude will increase slightly during the actual landing, but avoid over-rotating. Do not increase pitch attitude after touchdown; this could lead to a tail strike.

Avoid rapid control column movements or trimming during the flare. Such actions are likely to cause pitch to increase at touchdown and increase the potential for a tail strike. Do not allow the airplane to float. Fly the airplane onto the runway and accomplish the landing roll procedure. Do not attempt to increase the flare by increasing pitch attitude to attempt to achieve a perfectly smooth touchdown. Do not attempt to hold the nose wheel off the runway. Deceleration on the runway is approximately three times greater than in the air. If airspeed is higher than desired, accept it and land the airplane.

Upon main gear contact, the speedbrakes should automatically deploy. Be prepared to manually deploy the speedbrakes.The speedbrakes can be fully raised after touchdown while the nose wheel is lowered to the runway, with no adverse pitch effects. The speedbrakes spoil the lift from the wings, which places the airplane weight on the main landing gear, providing improved brake effectiveness.

Commitment to Stop Point on Landing

A go around will not be attempted after the thrust reversers are deployed on landing.

Bounced Landing

If a bounced landing occurs, re-establish the normal landing attitude, roll wings level, and if necessary, add thrust to control the rate of descent. Do not push over, since this will probably cause another bounce and may damage the nose gear. Do not increase the pitch attitude above the normal landing attitude since this will only increase the height of the bounce and may cause an approach to stall condition followed by a tail strike. After the airplane touches down the second time, use normal landing procedures. When a high, hard bounce occurs, initiate a go-around. If speedbrakes are deployed or reverse thrust is initiated, do not attempt a go-around.

Crosswind Landing Techniques

Three methods of performing crosswind landings are presented. They are the touchdown in a crab, the de-crab technique (with removal of crab in flare), and the sideslip technique. Whenever a crab is maintained during a crosswind approach, offset the flight deck on the upwind side of centerline so that the main gear touches down in the center of the runway.

Touchdown In Crab

The airplane can land using crab only (zero side slip) up to the landing crosswind guideline speeds. (See the Landing Crosswind Guidelines table, this chapter).

On dry runways, upon touchdown, the airplane tracks toward the upwind edge of the runway while de-crabbing to align with the runway. Immediate upwind aileron is needed to ensure the wings remain level while rudder is needed to track the runway centerline. The greater the amount of crab at touchdown, the larger the lateral deviation from the point of touchdown. For this reason, touchdown in a crab-only condition is not recommended when landing on a dry runway in strong crosswinds.

On very slippery runways, landing the airplane using crab only reduces drift toward the downwind side at touchdown, permits rapid operation of spoilers and autobrakes because all main gears touchdown simultaneously, and may reduce pilot workload since the aircraft does not have to be de-crabbed before touchdown. However, proper rudder and upwind aileron must be applied after touchdown to ensure directional control is maintained.

Autolandings will always touch down in a crab if there is a crosswind.

Landing Crosswind Guidelines (30 & 40 Flaps)

Crosswind guidelines are not considered limitations. On slippery runways, crosswind guidelines are a function of runway surface condition, airplane loading, and assume proper pilot technique. The following crosswind guidelines are based on steady wind (no gust) and either all engines operating or one engine inoperative. Gust effects were evaluated and tend to increase pilot workload without significantly affecting the recommended guidelines.

Runway Conditions	Crosswind – Knots *
Dry	33/35 ***
Wet	25 ***
Standing Water/Slush	15
Compact Snow **	25 ***
Dry Snow **	25 ***
Slippery/Good **	25 ***
Slippery/Medium **	20 ***
Slippery/Poor **	15 ***

Note: Reduce crosswind guidelines by 5 knots on wet or contaminated runways whenever asymmetric reverse thrust is used.

Note: With the yaw damper inoperative, do not exceed flaps 30 if crosswinds exceed 30 knots.

*Winds measured at 33 feet (10 m) tower height and apply for runways 148 feet (45m) or greater in width.

** Landing on untreated ice or snow should only be attempted when no melting is present.

*** Sideslip only (zero crab) landings are not recommended with crosswinds in excess of 15 knots at flaps 15, 18 knots at flaps 30, or 21 knots at flaps 40. This recommendation ensures adequate ground clearance and is based on maintaining adequate control margin. Maximum crosswind for autolands are: Category I or better weather: 20 knots; Category II or III weather: 15 knots.

Landing on Slippery Runways

When landing on slippery runways (braking action less than good), it is recommended to land with Max Auto brakes selected. On landing rollout allow the aircraft to decelerate in Max Auto until stopping on runway is assured.

Landing Checklist

PM reads items with responses as indicated.

When cleared to land, the Captain turns on the Landing Lights, Runway Turnoff Lights and Taxi Light.

F/A Signal	GIVEN	PM
"Flight Attendants Landing Check Please" at approximately 10 miles prior to landing.		
Engine Start switches	CONT	PM
Speedbrake	ARMED, GREEN LIGHT	PM
Armed by the Captain.		
Landing Gear	DOWN, 3 GREEN	PF
Flaps	_____°, GREEN LIGHT	PF

Go–Around/Missed Approach Procedure

General

The use of LNAV should be used to reduce workload.

Once the decision to "Go-around" has been made, it must not be revoked.

On a single autopilot approach, when the TOGA button is pushed, the autopilot will disengage and the go-around will have to be flown manually until the autopilot can be re-engaged.

If the autothrottle is armed or engaged and the aircraft is below 2000 ft AGL, pressing a TO/GA button will engage the A/T in G/A mode. The thrust levers will advance to a reduced go-around thrust and give a 1000-2000 fpm climb rate. Once established in the climb the F/D pitch commands target speed for each flap setting. If the A/T is disengaged, it may be reengaged at or above 400 feet AGL.

If the flight director is off when the TO/GA button is pressed, the AFDS will automatically engage in the TO/GA mode and the flight director command bars will appear. Upon selection of a roll mode the flight director command bars will disappear.

Procedure

Push the TO/GA button.

The autopilot will disengage for single channel approach, if engaged.

Call “GO AROUND THRUST” .....PM insures G/A thrust is set

Call “FLAPS 15” ..... PM selects flaps 15

Start an initial rotation to 15 degrees and follow the Flight Director commands.

With a positive rate of climb
(altimeter and VSI) ..... PM Calls “POSITIVE RATE.”

Call “GEAR UP” ..... PM positions gear lever to UP

If full GA thrust is required, push the TO/GA button a second time.

Insure missed approach altitude is set in MCP altimeter window.

The MCP speed window blanks, the FMC commands climb and flap target speeds.

The Autothrottle should be re-engaged (typically at 400 ft AGL), if disengaged.

Above 400 ft AGL,
select the appropriate roll mode .....PM selects LNAV or HDG SEL.
Verify on FMA.

Advise ATC of missed approach .....PM advises ATC

Tune and select radio aids, as required .....PM selects radio aids

If two autopilots were engaged for the approach, the second autopilot will disconnect at ALT ACQ.

Hand Flown Missed Approach

Retract flaps on schedule.

When airspeed accelerates to existing flap minimum maneuvering speed, select next flap setting.

If “ALT ACQ” occurs prior to flap retraction, the MCP speed window opens at current speed, BUG UP to flaps up speed and continue flap retraction.

Landing Roll Procedure

PILOT FLYING	PILOT MONITORING
Ensure thrust levers at idle.	
Verify autothrottle disengages automatically (autoland approach). On Autoland, disengage the autopilot manually.	Verify autothrottle is disengaged. On Autoland, confirm the autopilot is disconnected after touchdown.
Verify SPEED BRAKE lever (ground spoilers) - UP. Do not attempt a Go-Around if the speed brakes have been deployed.	Verify SPEED BRAKE lever UP. Call out "SPEED BRAKES UP." If SPEED BRAKE lever not UP, call "NO SPEED BRAKES."
Verify proper auto brake operation. (If in use)	
Announce "Manual Braking" when brakes are manually applied or when the PM selects Autobrakes to OFF, as directed by PF.	
Without delay, raise reverse thrust levers to the interlocks, hold light pressure until release, and then apply reverse thrust up to the maximum amount consistent with conditions. Do not attempt a Go-Around if reverse thrust has been selected.	Verify reverser operation. Call "NO REVERSE" or "___ REVERSER ONLY", is appropriate.
By 80 knots, start movement of the reverse thrust levers to be at the reverse idle detent before taxi speed, approximately 30 knots.	Call "80 KNOTS"
Approaching taxi speed, move the reverse thrust levers to the full down position.	Verify "REV" indication extinguished.
Prior to taxi speed, disarm the auto brake, call "manual braking" and continue manual braking as required.	

The objective of a stabilized approach is to arrive at the flare point at the correct airspeed in trim and with stable thrust. The landing itself should be within the touchdown zone and on the center of the runway.

Selecting reverse thrust immediately after touchdown will provide rapid deceleration.

After touchdown the PM will monitor automatic speedbrake operation. He/she will call “SPEED BRAKES UP” or “NO SPEED BRAKES”, as appropriate.

Do not attempt to hold the nose wheel off the runway. Aerodynamic braking is not an effective braking technique.

Unless speedbrakes are raised after touchdown, braking effectiveness may be reduced initially as much as 60%, since very little weight will be on the wheels and brake application may cause rapid anti-skid modulation.

If reverser is not selected or the reverser does not activate on selection, the PM will call “NO REVERSE”, “LEFT REVERSER ONLY” or “RIGHT REVERSER ONLY” as applicable. Failure of a reverser will require immediate application of wheel brakes.

Move the thrust levers aft to the interlock position, then to the number 2 reverse thrust detent. The normal target reverse thrust is approximately 80% N1 for passenger comfort, but if required, up to go around thrust is available. Maintain reverse thrust as required until the airspeed approaches 80 knots. At this point start reducing the reverse thrust so that the reverse levers are moving down at a rate commensurate with the deceleration rate of the airplane. The thrust levers should be positioned to reverse idle by taxi speed (approximately 30 knots), then to full down after the engines have decelerated to idle. The pilot monitoring should call out “80 KNOTS” to assist the pilot flying in scheduling the reverse thrust. If an engine surges during reverse thrust operation, quickly select reverse idle on both engines.

WARNING: The reverse thrust levers should be moved from idle reverse to stowed with a single motion in not more than approximately 3 seconds. This eliminates the possibility of REVERSER fault lights illuminating.

Normally, a constant brake pedal pressure should be maintained. Either increasing or decreasing the pressure recycles the anti-skid computer memory and temporarily reduces braking effectiveness. If additional braking pressure is required, increase brake pedal pressure.

When using auto brakes, immediate initiation of reverse thrust at main gear touchdown and full reverse thrust will allow the auto brake system to reduce brake pressure to the minimum level. Since the auto brake system senses deceleration and modulates brake pressure accordingly, the proper application of reverse thrust will result in reduced braking for a large portion of the landing roll.

To achieve a minimum distance landing on short runways, the aircraft should be landed at the 1000 foot point, even if a few knots high on airspeed. The speedbrake handle should be verified as fully deployed, and reverse thrust and wheel brakes applied immediately to achieve desired braking. The auto brakes should be selected to give the required deceleration based on runway length, and overridden if necessary with smooth application of desired pedal brakes.

It should be remembered that maximum manual braking yields far more deceleration than maximum autobraking. However, braking effort is often reduced by the pilot after the initial maximum effort, and the auto brake will usually give a smoother retardation than manual braking. Any delay in performing these actions after touchdown will markedly increase the stopping distance.

After Landing Flow

When clear of the active runway or where "back taxi" operations are accomplished on the runway, after the aircraft has completed the 180 degree turn on the runway, the Captain positions the SPEED BRAKE lever to the DOWN detent and calls for the "FLAPS UP, AFTER LANDING FLOW."

Note: After the flap lever is moved to the flaps up position and the APU switch is moved to Start, the After Landing Flow stops. The First Officer proceeds with the remainder of the After Landing Flow items only after the ATC taxi clearance is received and understood by the Captain and First Officer.

The First Officer accomplishes all items except the positioning of the Speed Brake and Landing/Taxi lights.

Speed Brake Lever ..... Verify DOWN

Flap Lever .....UP

Following an approach in icing conditions, do not retract flaps past 15 degrees until the flaps have been inspected.

Onboard Performance Tool (OPT)

The Onboard Performance Tool (OPT) is an EFB application used to calculate performance. The OPT will be used in conjunction with Form OPS-513 in order to record calculations.

Operational Procedures

Starting the OPT Application

A button labeled "OPT" appears on the iPad Home Screen that will start the OPT application.

Airport Database Verification

When the OPT first boots up, check for database updates to ensure currency. Database updates are remotely administered and require pilot action to finalize the update.

If the OPT database has not been updated to the current database (within 6 days as shown on Dispatch Release), refer to MEL item 46-1.

Flight crew may not continue to use OPT data after the six (6) day transition period. Takeoff and landing performance calculations must be obtained from Dispatch.

Takeoff Information

Max Take Off Weight Limit Calculation

On the Takeoff Page, complete the following in this recommended order:

ARPT (airport) press to select SEARCH dialog. Search by the ICAO code (four letter identifier) is the most expedient. Other search criteria may be used, such as IATA code (three letter identifier), city or airport name.

RWY (runways), select a runway. Choose either the most restrictive or coordinate with ATC for runway assignment.

COND (runway condition), select runway condition.

WIND enter the reported wind in this field using ddd/kk format.

OAT enter reported OAT using format **tt** in degrees Celsius. If temperature is followed by letter "F", system assumes Fahrenheit.

QNH enter current reported QNH using format #### or ###.# for inHg or hPa (mbar), as given. The system can discern the difference. Verify the entry.

RTG (engine thrust rating) Select OPTIMUM, unless operational requirements such as windshear or MEL / CDL entries require a specific thrust selection such as 26K, 24K or 22K.

FLAP (takeoff flaps) select OPTIMUM unless other setting needed.

BLDs (engine bleeds) select Eng Bleed ON (default) or Eng Bleed OFF, as appropriate.

A/I (anti-ice) select either OFF or ENGINE, as appropriate.

AltCG select FORWARD LIMIT, 18, or 22. Normally, use Forward Limit unless weight limited.

ImpCL select OPTIMUM. Selection NONE is available, if needed.

When all entries have been made the CALC button becomes active. Press CALC to obtain the Takeoff Weight Limit at departure station.

Takeoff weight limit will be calculated for 26k full thrust if OPTIMUM was selected in the RTG field. Optimum thrust (Derate / Assumed Temperature) calculations will not take place until the Actual Take Off weight determined in form OPS-513 is entered in the Takeoff Weight field.

A calculated ACCEL HT (Engine-out Acceleration Height) will be displayed.

- Write the Engine-out Acceleration Height on the Flight Plan.

Note: ACCEL HT is the altitude to be used in case of an engine failure on T/O and selected as reference in the BARO EFIS display for departure.

ACCEL HT has no bearing on standard or non-standard noise abatement takeoff profiles.

- Write the Takeoff Limiting Weight on form OPS-513 block (A)

Max Landing Weight Limit Calculation - Preflight (Dispatch tab)

Press the LANDINGDISPATCH button on the left menu.

Ensure the Performance – Landing – DISPATCH is displayed. If the Performance - Landing - ENROUTE page is displayed, press the LANDING DISPATCH button on the left menu.

On the Performance - Landing - DISPATCH page complete the following in this recommended order:

CONDITION select WET unless DRY runway limits are necessary for dispatch. If DRY is used, the Flight Release must be amended.

Input all the forecast environmental conditions for landing the same as accomplished for the Takeoff page (use data from a METAR not older than 4 hours before departure.)

FLAP (landing flaps) select landing flaps.

BLDs (engine bleeds) select Eng Bleed ON or Eng Bleed OFF, as appropriate.

A/I (anti-ice) select OFF, ENGINE or ENG+WING, as appropriate.

REVr (reverser) select One Inoperative if both thrust reversers are operational. Select No Credit if one or both are inoperative.

LCatg select Category III if dispatching to an airport forecasting less than CAT II weather minimums at ETA, otherwise select Non-Cat III.

VRefADD enter a Vref add-on of 0 knots (default). If gusts are anticipated, enter the gust factor. Do not exceed 20 knots.

When all entries have been made (all buttons green, no blank fields) the CALC button in the upper right of the screen becomes active. Press CALC. The FAA regulatory dispatch limit weight will be calculated.

Note: OPT calculates this weight assuming Max Manual braking.

Use the "With Ice:" Limit Weight result if flight in icing conditions is anticipated and the destination airport temperature is forecast to be at or below 10°C, otherwise use "Normal:" Limit Weight result.

The "With Ice:" Limit Weight result will not be displayed if the destination airport temperature input is above 10°C.

Record the applicable result on the Dispatch Landing Limit Weight block on form OPS-513. The computed result will never exceed Max Structural Landing Weight Limit.

If runway conditions are forecast to be other than DRY or WET, or braking action is forecast to be less than good, it is recommended to accomplish the following:

Landing Distance Required Calculation - Preflight (Enroute page)

Press the SHOW ENROUTE button on the right menu.

On the Performance - Landing - ENROUTE page complete the following in this recommended order:

- Input all the environmental conditions for landing the same as accomplished for the Performance - Landing - DISPATCH page (use data from a METAR not older than 4 hours before departure.)
- Most fields will be pre-filled from the Landing - DISPATCH page,
- COND (runway condition), select forecast runway condition.
- BRKS (brakes) select MAX. OFF: assumes maximum manual braking and yields shortest landing distance. Select MAX AUTO if runway braking action is anticipated to be less than GOOD.
- NNC (non-normal condition) select NONE.
- LANDING WT Enter the anticipated landing weight.
- When all entries have been made (all buttons green, no blank fields) the CALC button in the upper right of the screen becomes active. Press CALC.
- The calculated landing distance (includes actual landing distance plus an additional 15%) is displayed.

If the calculated landing distance indicates insufficient runway available, flight crews must contact dispatch. The company may decide to change the destination airport or continue dispatch to destination with the expectation that the runway condition will improve prior to landing.

Landing Limited Takeoff Weight Calculation

- Complete the Trip Fuel Burn field on form OPS-513. Add the two values to obtain Landing Limited Takeoff Weight. Write the result in Landing Limited Takeoff Weight field (block (C)).
- Enter in Limiting TOGW field the most restrictive takeoff weight. A, B, C or Structural.
- Circle the items in the Penalties/Additions box on the form that have been applied in the calculations.

Optimum Thrust Rating/Assumed Temperature/Flap Setting and V Speeds Calculation

- Once the W&B data is complete, input the Actual Take Off weight determined on the Weight and Balance form to the OPT Takeoff page in the Takeoff Weight field.
- Press CALC to calculate the Optimum thrust/assumed temperature/flap combination and V Speeds.
- FULL / ATM is a toggle button. When results are initially displayed, OPT will display the ATM results if applicable. To view the full thrust results, click on the FULL button. Clicking this button will display full thrust results for the thrust rating selected by the OPTIMUM thrust setting (26k, 24k, or 22k) and change the button name to ATM to allow the data to be toggled back and forth between ATM and FULL.

Note: It is Miami Air's policy is to allow the OPT to calculate the most efficient thrust/assumed temperature/flap combination through the use of the OPTIMUM selections.

- Once calculated, write the Optimum computed takeoff flap setting, thrust rating and assumed temperature (if applicable) in the fields provided in form OPS-513. These calculation outputs should also be entered in the Flight Plan, along with the V speeds.

Viewing Airport Information

- ARPT INFO button displays a screen which summarizes the airport data for the selected airport and runway. This button is only active if both, airport and runway have been selected. A typical airport information screen is shown below.

- ARPT COMMENT - if airport comments are available, this button displays a screen with those comments.
- RWY COMMENT - if runway comments are available, this button displays a screen with those comments. It will also display any special procedures such as Engine Out procedures.
- ACTIVE NOTAMS - if there are currently active NOTAMs being applied to the calculations, this button will become active and will list those NOTAMs.
- TAKEOFF DETAILS - will provide details about the calculated takeoff information.

Landing Information

Landing Distance Required Calculation - Prior to landing (Enroute page)

If conditions have not changed or have improved since accomplishing pre-departure calculations, it is not necessary to calculate the required landing distance.

A new landing distance required calculation is **mandatory** if conditions have changed or worsened, such as:

1. Actual landing runway is shorter from the runway used for pre-departure calculation, or
2. Runway conditions have changed requiring greater runway length (less of a headwind, stronger tailwind, braking action reports have worsened), or
3. Flap configuration has changed due to non-normal configuration (e.g. asymmetrical flaps.), or
4. Destination airport has changed.

Note: The enroute landing distance calculation is not required if all of the following conditions exist:

- Runway is 7000 feet or longer
- Landing flaps are either 30 or 40 degrees
- Airport elevation is 3000 feet MSL or lower
- Tailwind is 5 knots or less
- Airport temperature is 40 degrees C or less
- Braking action is good or better.

In the Performance - Landing - ENROUTE page enter appropriate information in data fields, including anticipated landing weight.

- Input all the environmental conditions using current METAR or ATIS data.

- **COND** (runway condition), select current reported runway condition.
- **FLAP** (landing flaps) select landing flaps.
- **BLDs** (engine bleeds) select Eng Bleed ON or Eng Bleed OFF, as appropriate.
- **A/I** (anti-ice) select OFF, ENGINE or ENG+WING, as appropriate.
- **BRKS** (brakes) select Autobrake setting of 1, 2, 3, or MAX. Selecting OFF assumes maximum manual braking and yields shortest landing distance. If stopping distance is critical, use MAX Manual if Dry or Wet; use MAX Auto for all other conditions.
- **NNC** (non-normal condition) select condition from popup list that may be applicable.
- **REVr** (reverser) select One Inoperative if both thrust reversers are operational. Select No Credit if one or both are inoperative.
- **LCatg** (Landing Category) select CAT III if conducting approach to less than CAT II weather minimums, otherwise select Manual.
- **VRefADD** enter a Vref add-on of 0 knots unless gusts exist. Add-on may not exceed 20 knots.
- **LANDING WT** Enter the anticipated landing weight. When all entries have been made (all buttons green, no blank fields) the CALC button in the upper right of the screen becomes active. Press CALC.

Calculation displayed opposite the Landing Distance Required field includes actual landing distance plus an additional 15%. This distance must be equal to or less than the available runway length. If the calculation exceeds the landing distance available, the Landing Distance Required calculation will be displayed in amber.

The landing distance available will be displayed below the landing distance required field.

If ARPT INFO > LANDING DETAILS, is selected, additional landing details are displayed.

Adding a Temporary NOTAM

The NOTAM button will display an entry screen to allow the user to input Temporary NOTAM information that affects takeoff or landing performance. This may be necessary to accomplish between database updates. The temporary NOTAM information that is input is retained by OPT until cleared by the user; it is not deleted in a manner similar to the temporary runways.

CAUTION: Miami Air policy is to only use the NOTAM section of OPT for RWY length problems and not for Obstacles.

Note: The airport and runway to which this NOTAM will apply is displayed as the Title to the uppermost group box. This enables the user to verify that the correct runway is being affected. As with the temporary airport input, there are fields at the bottom of the screen to specify the input units and obstacle reference points. The inputs at the top are used for the actual calculations. The Comments input is used only to allow a note to be written to remind others what the NOTAM is based on.

- **Clear Selections** - deletes the displayed temporary NOTAM from the database.

After inputs have been made and the user returns to the main takeoff or landing screen, there will be an amber bar displayed below the NOTAM button to alert the user that there is currently an active NOTAM on the selected runway.

MEL and CDL Adjustments

Clicking on the MEL button will display the MEL Chapters screen. Select the appropriate MEL Chapter, then the desired MEL item. A check mark will appear to the right of the MEL item and a summary of all active MEL items appear at the bottom.

Note: Selection of certain MEL items will prevent OPT from performing a takeoff or landing calculations.

Verification Procedures

- Two OPT qualified crewmembers must verify all data entries and calculations by any available method. By signing the Weight and Balance form OPS-513, the Captain acknowledges the verification process.
- If two OPT qualified crewmembers are not available to verify all data entries, dispatch must supply OPT takeoff/landing OPT calculations.

Contingency Procedures

- MEL criteria: Under 46-01.
- If one of the OPT applications is not available, the verification process by two crewmembers still applies. Verify data and calculations by any available means.

At the heart of the TALPA ARC recommendations is the “Runway Condition Assessment Matrix” or simply the “Matrix.” The “Matrix” identifies 7 “Runway Condition Codes.” These Codes are derived from runway “Assessment Criteria” that includes type of contaminant (frost, slush, dry snow, wet snow, compacted snow, and ice), depth of contaminant and temperature. From the Runway Condition Codes, pilots can determine the anticipated runway braking action and more importantly, the correct “Runway Condition” to enter in the OPT. The tower will issue an RCC Report for each 1/3 of the runway; touchdown, midpoint and rollout. For example, an RCC Report might read 5, 5, 3

Matrix RCC and Pilot Braking Action Equivalent

6 - Dry

5 - Good

4 - Medium Good

3 - Medium

2 - Medium Poor

1 - Poor

0 - Nil

Upon receiving a RCC report, Miami Air pilots will “translate” the report into an equivalent braking action (e.g. good, good to medium, medium, medium to poor, poor or nil) for the OPT calculation.

Note #1: If the PIREP braking action category is “Good to Medium” use the “Medium” for OPT computations. If the PIREP braking action category is “Medium to Poor,” use “Poor” for OPT computations.

Note #2: If the RCC report includes multiple codes, use the most restrictive. For a RCC report of 5, 5, 3, a pilot should use “3” for OPT computations.

Note #3: Pilots should use “Dry,” “Wet,” **“**Slippery Good,” **“**Slippery Medium” or “Slippery Poor” for OPT computations. Do not use “Standing Water,” “Slush,” “Compact Snow” or “Dry Snow”, unless TALPA RCCs are not available.

Note #4: Use the RCC that is applicable to the runway length being used. For example, assume an aircraft is landing on a very long runway (e.g. 12,000 feet), the aircraft is light weight and the aircraft will be stopped well before the last 1/3 of the runway. Assume also the RCC is 5, 5, 3. It would not be necessary to compute the landing distance based on the RCC of 3. Only the first 2/3rd of the runway would be used and therefore, only an RCC of 5 should be used for OPT computations.

See Matrix below.

Example #1

RCC report is 5, 5, and 5. Looking at the "Matrix," locate the "Code" column and find "5." Moving to the right of the "Matrix," find the "PIREP" column. An RCC of "5" translates into a PIREP of "Good." Therefore, the pilot would use a "Runway Condition" of "Slippery Good" for the OPT takeoff or landing calculation.

Exception: Tower reports the runway is "Wet" with an RCC of 5, 5, 5. Use "Wet" for OPT computations, not "Slippery Good."

Example #2

RCC report is 5, 5 and 3. The lowest reported RCC is 3 (Medium). Therefore, use "Slippery Medium" for OPT computation. See Note #2 above.

Example #3

Tower reports the runway is covered with "Compact Snow" and the OAT is warmer than -15°C. RCC is 3, 3, 3. Use "Slippery Medium" for OPT computation.

See **Note #2** above

Runway Condition Assessment Matrix (RCAM)

Assessment Criteria		Control/Braking Assessment Criteria	
Runway Condition Description	**RCC**	**Deceleration or Directional Control Observation**	**Pilot Reported Braking Action**
Dry	**6**	---	---
Frost Wet (Includes damp and 1/8 inch depth or less of water) 1/8 inch (3mm) depth or less of: Slush Dry Snow Wet Snow	**5**	Braking deceleration is normal for the wheel braking effort applied AND directional control is normal.	Good
-15ºC and Colder outside air temperature: Compacted Snow	**4**	Braking deceleration OR directional control is between Good and Medium.	Good to Medium
Slippery When Wet (wet runway) Dry Snow or Wet Snow (any depth) over Compacted Snow Greater than 1/8 inch (3 mm) depth of: Dry Snow Wet Snow Warmer than -15ºC outside air temperature: Compacted Snow	**3**	Braking deceleration is noticeably reduced for the wheel braking effort applied OR directional control is noticeably reduced.	Medium
Greater than 1/8 inch(3 mm) depth of: Water Slush	**2**	Braking deceleration OR directional control is between Medium and Poor.	Medium to Poor
Ice	**1**	Braking deceleration is significantly reduced for the wheel braking effort applied OR directional control is	Poor
Wet Ice Slush over Ice Water over Compacted Snow Dry Snow or Wet Snow over Ice	**0**	Braking deceleration is minimal to non-existent for the wheel braking effort applied OR directional control is uncertain.	NIL

VNAV:

- Select when established on course on approach procedure or flaps extended.
- VNAV path deviation limits: 50 feet low or 75 feet high after the Final Approach Fix.

MCP Altitude:

- Initially set to FAF altitude.
- No sooner than two miles prior to FAF set MCP to DA/DDA or nearest 100 feet increment above the DA/DDA.

FAF:

- Verify crossing altitude and FMA displays VNAV PATH.
- Contact the tower for landing clearance.
- Captain's and First Officer's altimeters must be within + or - 100 feet at the FAF.

At 1000 feet AFL, PM calls “1000 feet” and sets Missed Approach altitude (PF acknowledges).

PM------ calls “100 above” when 100 feet above DA or DDA. (PF acknowledges)

PM------calls “Approach lights” or “Runway” and direction (e.g. 12 o’clock) when approach lights or runway environment in sight.

PF--------calls “Minimums” at DA or DDA.

PF------- If suitable visual reference established, call “Visual.”

Autopilot and Autothrottle must be disengaged by no later than 50 below the DA or DDA.

Missed approach is required for any of the following:

- At DA/DDA runway or approach lights not in sight.
- UNABLE REQD NAV PERF-RNP message displayed without runway in sight (RNAV approach).
- If the airplane symbol on the 10 mile scale from the FAF inbound is not touching the LNAV track (RNAV approach) anytime from the FAF to the DA/DDA.

Vertical Speed (V/S) Procedures

General

V/S procedures must be used on the following approaches:

- No coded GP angle on the LEGS page.
- In WGS-84 non-compliant country or non-compliant area.
- Pilot Constructed approaches.

- VNAV will not engage.
- Gradient Path not within 2.75 degrees to 3.50 degrees.

Use LVL CHG or V/S prior to the FAF, and V/S after the FAF.

Cross the FAF at published crossing altitude to avoid excessive rates of descent inside the FAF.

Preparation Procedures

Set inbound course.

Minimums set to DDA (MDA + 50 ft)

Select approach procedure:

- Verify approach chart waypoints and altitudes against the FMC LEGS page (No modifications after FAF).
- Select the runway and insert on the Descent page on line 3R for V/B reference (recommendation).

Approach reference page-----Select flap setting.

Brief the Approach

Complete the Descent Approach Checklist.

Tune and select (LOCs, VORs, ADFs, as required).

EFIS Panel:

- Navigation Display select MAP MODE and 10 mile scale (RNAV approach only).

CDU:

- Pilot Flying selects Descent Page/ Pilot Monitoring selects the LEGS page, if RNAV approach.

Approach Procedure

Roll Mode:

- For RNAV approach use LNAV (WGS 84 compliant airspace / at least one operational GPS)
- For LOC, LDA approaches use VOR/LOC or LNAV. For BC-LOC approaches use LNAV. For LOC, BC-LOC or LDA approaches, raw data must be monitored if LNAV is used.
- For VOR or ADF approaches use HDG SEL or LNAV. It is recommended raw data be monitored.

MCP Altitude:

- Set charted altitudes as approach is flown in LVL CHG or V/S down to FAF altitude.
- Verify altitude hold on FMA or present descent will cross FAF at charted altitude.
- No later than the FAF, set MCP to DDA or nearest higher 100 foot altitude.

At FAF, verify crossing altitude and FMA displays V/S.

- Set target approach speed based upon tower reported winds.
- Final approach speed is Vref plus one half the headwind plus all of the gusts. The minimum approach speed is Vref+5 with a maximum of Vref+20.

Descend to DDA using V/S based upon:

- Charted descent rates based upon ground speed, or
- If available, use VNAV PATH on ND or Vertical Deviation on Descent page as a reference, or
- Matching charted approach gradient path and Vertical Bearing (V/B) on Descent Page of FMC.
- Establish a 3 degree path by calculating a vertical speed based upon the airplane's ground speed on final. Use a V/S equal to ½ of the ground speed X 10. e.g.140 kts GS---700 fpm, 160 kts GS---800 fpm.

At 1000 ft AFL, PM calls "1000 feet" and sets Missed Approach altitude (PF acknowledges).

PM------ calls "100 above" at 100 feet above DDA (acknowledged by PF).

PM------calls "Approach lights" or "runway" and direction (e.g. 12 o'clock) when approach lights or runway environment is in sight.

PF--------calls "Minimums" at DDA.

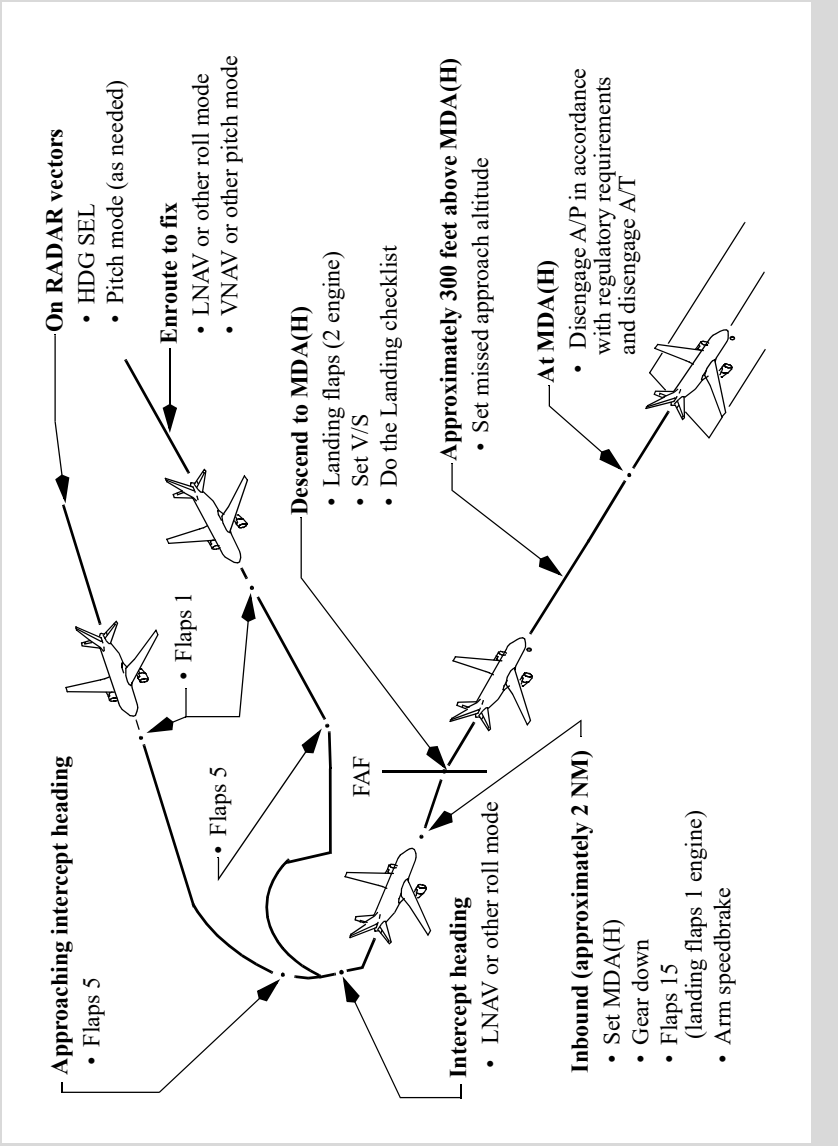
PF------- If suitable visual reference established call "Visual."

Autopilot and Autothrottle must be disengaged by no later than 50 feet below DDA.

Missed approach is required if:

- At DDA, runway or approach lights not in sight.
- UNABLE REQD NAV PERF-RNP message displayed without runway in sight (RNAV Approach).
- If the airplane symbol on the 10 mile scale from the FAF inbound is not touching the LNAV track (RNAV Approach).

Instrument Approach Using V/S



737-800

Aircraft Operations Manual - VOL 2

Miami Air International, Inc.

Control Number:_____

Issued To:_____

Document Number D6-27370-81Q-MIB

Revision Number: 4
Revision Date: 03-10-12

Thrust Reverser

Each engine is equipped with a hydraulically operated thrust reverser, consisting of left and right translating sleeves. Aft movement of the reverser sleeves causes blocker doors to deflect fan discharge air forward, through fixed cascade vanes, producing reverse thrust. The thrust reverser is for ground operations only and is used after touchdown to slow the airplane, reducing stopping distance and brake wear.

Hydraulic pressure for the operation of engine No. 1 and engine No. 2 thrust reversers comes from hydraulic systems A and B, respectively. If hydraulic system A and/or B fails, alternate operation for the affected thrust reverser is available through the standby hydraulic system. When the standby system is used, the affected thrust reverser deploys and retracts at a slower rate and some thrust asymmetry can be anticipated.

The thrust reverser can be deployed when either radio altimeter senses less than 10 feet altitude, or when the air/ground safety sensor is in the ground mode. Movement of the reverse thrust levers is mechanically restricted until the forward thrust levers are in the idle position.

When reverse thrust is selected, an electro–mechanical lock releases, the isolation valve opens and the thrust reverser control valve moves to the deploy position, allowing hydraulic pressure to unlock and deploy the reverser system. An interlock mechanism restricts movement of the reverse thrust lever until the reverser sleeves have approached the deployed position. When either reverser sleeve moves from the stowed position, the amber REV indication, located on the upper display unit, illuminates. As the thrust reverser reaches the deployed position, the REV indication illuminates green and the reverse thrust lever can be raised to detent No. 2. This position provides adequate reverse thrust for normal operations. When necessary, the reverse thrust lever can be pulled beyond detent No. 2, providing maximum reverse thrust.

Downward motion of the reverse thrust lever past detent No. 1 (reverse idle thrust) initiates the command to stow the reverser. When the lever reaches the full down position, the control valve moves to the stow position allowing hydraulic pressure to stow and lock the reverser sleeves. After the thrust reverser is stowed, the isolation valve closes and the electro–mechanical lock engages.

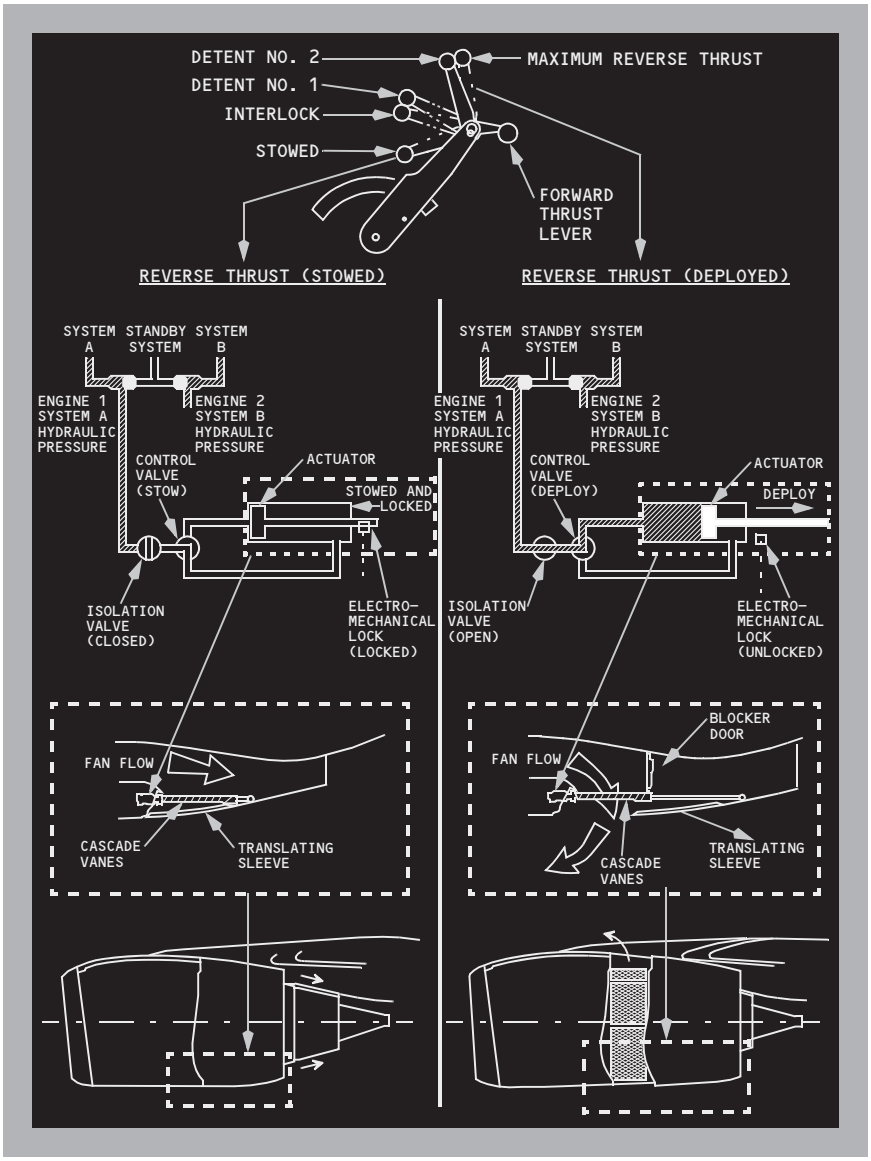
The REVERSER light, located on the aft overhead panel, illuminates when the thrust reverser is commanded to stow and extinguishes 10 seconds later when the isolation valve closes. Any time the REVERSER light illuminates for more than approximately 12 seconds, a malfunction has occurred and the MASTER CAUTION and ENG system annunciator lights illuminate.

Note: A pause in movement of the reverse thrust levers past detent No. 1 toward the stow position may cause MASTER CAUTION and ENG system annunciator lights to illuminate. A pause of approximately 18 seconds engages the electro-mechanical lock and prevents the thrust reverser sleeves from further movement. Cycling the thrust reversers may clear the fault and restore normal operation.

When the reverser sleeves are in the stow position, an electro–mechanical lock and a hydraulically operated locking actuator inhibit motion to each reverser sleeve until reverser extension is selected. Additionally, an auto–restow circuit compares the actual reverser sleeve position and the commanded reverser position. In the event of incomplete stowage or uncommanded movement of the reverser sleeves toward the deployed position, the auto–restow circuit opens the isolation valve and commands the control valve to the stow position directing hydraulic pressure to stow the reverser sleeves. Once the auto–restow circuit is activated, the isolation valve remains open and the control valve is held in the stowed position until the thrust reverser is commanded to deploy or until corrective maintenance action is taken.

WARNING: Actuation of the thrust reversers on the ground without suitable precautions is dangerous to ground personnel.

Thrust Reverser Schematic



Speed Brakes

The speed brakes consist of flight spoilers and ground spoilers. Hydraulic system A powers all four ground spoilers, two on the upper surface of each wing. The SPEED BRAKE lever controls the spoilers. When the SPEED BRAKE lever is actuated all the spoilers extend when the airplane is on the ground and only the flight spoilers extend when the airplane is in the air.

The SPEEDBRAKES EXTENDED light provides an indication of spoiler operation in-flight and on the ground. In-flight, the light illuminates to warn the crew that the speed brakes are extended while in the landing configuration or below 800 feet AGL. On the ground, the light illuminates when hydraulic pressure is sensed in the ground spoiler shutoff valve with the speed brake lever in the DOWN position.

In-Flight Operation

Operating the SPEED BRAKE lever in flight causes all flight spoiler panels to rise symmetrically to act as speed brakes. Caution should be exercised when deploying flight spoilers during a turn, as they greatly increase roll rate. When the speed brakes are in an intermediate position roll rates increase significantly. Moving the SPEED BRAKE lever beyond the FLIGHT DETENT causes buffeting and is prohibited in flight.

YC146

The speed brake load alleviation feature limits the deployment of the speed brakes under certain high gross weight/airspeed combinations. Under these conditions, if the speed brakes are deployed to the FLIGHT DETENT, they automatically retract to 50 percent of the FLIGHT DETENT. The SPEED BRAKE lever moves to reflect the position of the speed brakes. Manual override is available. Increased force is needed to move the SPEED BRAKE lever beyond the 50 percent position with load alleviation active. The SPEED BRAKE lever must be held in place when manual override is used between 50 percent and the UP position. The SPEED BRAKE lever will remain stationary if moved to UP with load alleviation active. When load alleviation deactivates, the speed brakes can be manually returned to the FLIGHT DETENT position.

Ground Operation

During landing, the auto speed brake system operates when these conditions occur:

- SPEED BRAKE lever is in the ARMED position
- SPEED BRAKE ARMED light is illuminated
- radio altitude is less than 10 feet

- landing gear strut compresses on touchdown

  Note: Compression of any landing gear strut enables the flight spoilers to deploy. Compression of the right main landing gear strut enables the ground spoilers to deploy.
- both thrust levers are retarded to IDLE
- main landing gear wheels spin up (more than 60 kts).

The SPEED BRAKE lever automatically moves to the UP position and the spoilers deploy.

If a wheel spin-up signal is not detected, when the air/ground system senses ground mode (any gear strut compresses) the SPEED BRAKE lever moves to the UP position and flight spoiler panels deploy automatically. When the right main landing gear strut compresses, a mechanical linkage opens the ground spoiler bypass valve and the ground spoilers deploy.

If the SPEED BRAKE lever is in the DOWN position during landing or rejected takeoff, the auto speed brake system operates when these conditions occur:

- main landing gear wheels spin up (more than 60 kts)
- both thrust levers are retarded to IDLE
- reverse thrust levers are positioned for reverse thrust.

The SPEED BRAKE lever automatically moves to the UP position and spoilers deploy.

After an RTO or landing, if either thrust lever is advanced, the SPEED BRAKE lever automatically moves to the DOWN detent and all spoiler panels retract. The spoiler panels may also be retracted by manually moving the SPEED BRAKE lever to the DOWN detent.

Speed Brakes Schematic