NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

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Attachment 8 – Trans States Airlines

Standard Operations Manual [Excerpts]

OPERATIONAL FACTORS

DCA16LA100

4.1 Approach Speed Calculation

Note: See paragraph 4.1.V for sample landing V-speed chart (example shown is for –LR)

- V_{APP} = V_{REF} + wind correction.
- Wind correction = ½ headwind component + gust (see crosswind component chart)

  Note: Gust is defined as the difference between the steady-state wind and the maximum gust velocity.
- For Flaps 45 landing, minimum wind correction is 5 kts and the maximum is 15 kts.
- For Flaps 22 landings, the minimum wind correction is 5 kts, and the maximum is 20 kts.
- On occasion, such as a strong and/or gusty wind at heavy weights, the calculated Flaps 45 V_{APP} may be greater than the Flaps 45 limit speed. In such cases, the Captain must decide to use one of the following corrections:

  1. Approach and land using Flaps 22.
  2. If landing with Flaps 45, use a slightly reduced V_{APP} (up to 5kt) from the normally calculated V_{APP}.

  The maximum flap placard speed (VFE) must always be observed since this is the official AFM limitation.
- For Emergency and Abnormal procedures using non-standard flap settings, obtain V_{REF} as directed by the QRH and apply a minimum wind correction of 0 kts and maximum of 20 kts.

The Internal Speed Bugs are set left to right in the sequence of use, i.e; **V_{APP}, V_{REF}, V_{AC}, V_{FS}**

Note: The PFD Airspeed Labels below refer to the labels displayed on the IAS tape. Reference speed buttons on the MFD are labeled: **V1**, **VR**, **V2**, **VAP**

Target V Speed	(V_{APP})	(V_{REF})	($V_{APP\ CLB}$)	(V_{FS})
Boxed Number (Example only)	134	129	150	160
PFD Airspeed Label	1	R	2	AP
MFD Box Label	V1	VR	V2	VAP

4.1.A Approach Deviation Callouts

The PM will callout aircraft deviations from the proper approach course and descent profile during any portion of a visual or instrument approach in plain language.

The PM will callout using plain language any navigational abnormalities or flight instrument malfunctions as they occur.

During the initial and intermediate segments of an instrument approach when operating between 2000' AGL and 1000' AGL, the PM will callout **"SINK"** if vertical speed exceeds 2000 FPM

Additionally, the PM will callout Airspeed, Vertical Speed, Course and GS deviations as follows while the aircraft is descending on the final approach segment:

Airspeed Deviations – The PM will callout sustained deviations ± 5 knots from the target VAPP speed. The PM will callout airspeed deviations using the call **"SPEED"**. At approximately 100 feet above touchdown and after the landing is assured, the PM will call any speed deviation from VREF in the same manner as above.

Vertical Speed Deviations – The PM will callout VS deviations ± 200 FPM from the planned vertical speed for the approach. The word "**SINK**" will be called.

Lateral Course Deviations - The PM will callout LOC/VOR/FMS deviations of ±1/2 of a DOT for CAT I approaches. For CAT II approaches, the PM/FO will call out LOC deviations of ±1/2 of a DOT prior to the **"FIVE HUNDRED ABOVE"** callout. After the **"FIVE HUNDRED ABOVE"** callout the PM/FO will call out deviations of ±1/4 of a DOT. The word **"COURSE"** will be called.

ILS Glideslope Course Deviations - The PM will callout ILS GS deviations of ±1/2 DOT for CAT I approaches. For CAT II approaches, the PM/FO will call out LOC deviations of ±1/2 of a DOT that occur prior to the **"FIVE HUNDRED ABOVE"** callout. After the **"FIVE HUNDRED ABOVE"** callout the PM/FO will call out any deviations of ±1/4 of a DOT. The word **"GLIDESLOPE"** will be called.

Deviations from Planned Vertical Descent Path – The PM will callout using plain language if the aircraft deviates from the planned vertical descent path and is not flying the correct descent path.

The PF will acknowledge all approach deviations whenever they occur by stating, **"CORRECTING"** and make thrust, pitch or heading changes to correct the deviation. If the PF is unable to bring the aircraft back within acceptable stabilized approach parameters an immediate missed approach will be executed. Either pilot may initiate a missed approach by calling **"GO AROUND"**.

4.1.S Stabilized Approach

Flying a stabilized approach has proven to be the safest way to operate the aircraft during the final approach segment of visual and instrument approaches. Advance planning and careful management of the aircrafts energy, course, and descent path during the approach reduces the workload of the crew. Reducing workload during this critical flight segment increases the ability of the crew to recognize and manage threats/errors.

Trans States Airlines defines stabilized approach height for all visual and instrument approaches as follows;

1000' AFE while conducting visual approaches and straight-in instrument approaches in both IMC and VMC weather conditions.

MDA or 1000 AFE (whichever is higher), if a circling maneuver is to be conducted after completing an instrument approach.

During the final approach phase, when operating below stabilized approach height, in both VMC and IMC, on instrument and visual approaches, the following operational parameters must be maintained to consider the approach stabilized. Prolonged deviation from these parameters means the approach has become unstabilized and an immediate missed approach should be initiated. Either the PF or PM may initiate the missed approach utilizing the callout **"GO AROUND"**

a. In-Range and Before Landing Checklists not complete.

b. Aircraft not properly configured. Final flap setting on circling approaches may be delayed as per EMB SOP Sec 1, 5.9.

c. Airspeed outside the range: **V_{REF}-5 knots** to **V_{APP}+10 knots**.

d. VOR/LOC/FMS course deviation exceeds one dot deflection.

e. Glideslope deviation exceeds one dot deflection.

f. Descent rate deviates ± 300 FPM from planned descent rate and is no greater than 1000 FPM, unless specifically briefed. (Example: a planned rate of descent 800 would result in a maximum rate of 1100 FPM)

g. The aircraft is not descending along the proper descent path or is unable to maintain obstacle clearance.

h. In addition to the above, after the FAF on a CAT II approach, either the PF or PM should initiate the go-around for:

   1. Autopilot disengagement without adequate visual reference
   2. A hard-over (AFM Supplement 1 S1-8)
   3. A slow-over (AFM Supplement 1 S1-8)

i. In addition to the above, below 500' above minimums on a CAT II approach, either the PF or the PM should initiate the missed approach for:

   1. An amber CAT II annunciator
   2. An amber LOC, GS, or RA annunciator
   3. An amber lateral deviation bar
   4. An amber GS pointer

4.2 Landings

The key factor for a successful landing is a stabilized approach and proper thrust/flare coordination. At an average weight and V_{REF}, the aircraft is traveling down the runway at over 150 feet per second while in the flare. Long flare times can lead to a touchdown outside the TDZ and/or subsequent hard braking. Reducing to idle before the flare will also require an increase in pitch. Too high a pitch attitude at touchdown, and the resultant low airspeed, can degrade elevator control, making it difficult to stop the descent of the nose after spoiler deployment. Flaring high and quickly reducing thrust to idle can cause the plane to settle abruptly. Do not apply stabilizer trim during the flare.

When the aircraft is approximately 200 feet above the touchdown zone, the PF should verify the Yaw Damper OFF and reduce thrust slightly to cross the runway threshold at 50 feet and V_{REF}. The PM will call out 20 Feet Radio Altitude and at that time the PF will smoothly reduce thrust to IDLE. The touchdown should be made on the main landing gear and the nosewheel gently lowered to the runway.

The desired touchdown point is within the first 800 to 1,500 feet beyond the landing threshold. Aircraft must touch down in the first third of the available landing distance, but in no case more than 3,000 feet down the available landing distance. If this is not accomplished, a go-around must be executed.

Tail strikes may occur at pitch attitudes greater than 10 degrees, especially if flaring abruptly or excessively to "save" a nice landing. Accept a firm landing to avoid a tail strike.

During landing, when the runway threshold passes under the airplane nose and out of sight, shift the visual sighting point to approximately ¾ the runway length. Shifting the visual sighting point down the runway assists in controlling the pitch attitude during the flare. Maintain constant airspeed and descent rate. Initiate the flare when the main gear is approximately 20 feet above the runway by increasing pitch attitude approximately 2 degrees. This will slow the rate of descent. After the flare is initiated, smoothly retard the thrust levers to idle, and make small pitch attitude adjustments to maintain the desired descent rate to the runway. Ideally, main gear touchdown should occur simultaneously with thrust levers reaching idle. Hold sufficient back pressure on the control column to keep the pitch attitude constant. Do not increase pitch attitude further as floating may result causing an excessive amount of runway to be used. Also, increasing pitch attitude may cause the aft body to contact the runway. Touchdown at a speed significantly below V_{REF} seriously reduces aft fuselage runway clearance, and can result in a tail strike.

The PM should monitor the pitch attitude during landing. If the pitch attitude approaches 10 degrees, the PM should make a call out of **"ATTITUDE"** to alert the PF not to pitch up aggressively before touch down.

4.2.A Landing with a Crosswind

If a crosswind is present, use the crab method for correction on final. Just before touchdown, a sideslip should be used to cause the upwind main wheel to touch down first. Aileron deflection should be increased as the aircraft slows. See the limitations section for maximum recommended crosswind limits.

4.2.B Landing with a Tailwind

The tailwind performance penalty shown on performance charts must be applied before accepting a tailwind landing. See SOP Sec 3 for maximum tailwind limits. A tailwind will result in a higher groundspeed and descent rate on glideslope. Analyze and verify runway performance criteria before accepting clearance and landing with any tailwind component. Be prepared to execute an immediate go-around if the approach exceeds stabilized parameters or the tailwind limitation is exceeded.

4.2.C Landing with Standard and Non-Standard Flap Settings

Normal landing flaps setting for CAT I and visual approaches is 45 degrees.

The use of landing Flaps 22 is only authorized if one or more of the following applies:

- CAT II approach (required configuration)
- The wind corrected approach speed is at or above 145 KAS
- If directed by the QRH
- If in the Captain's opinion the use of Flaps 22 is a safer course of action

The dispatch package performance section and the landing speed charts will contain data for both. If a flap setting is non-standard OR is dictated by the QRH due to an aircraft malfunction, the speeds indicated in the QRH will be used. With Flaps at 0 or a minimal deflection, a minimum amount of flare will be required. The crew should be aware that the landing roll will be longer due to loss of drag and high touchdown speed. Therefore, MAX reverse* and heavy braking will be applied as soon as the nosewheel is on the ground, and maintained until it is evident they are no longer required.

- Always confirm available runway length is acceptable when landing with nonstandard flaps settings.

4.2.D Non-Standard Landing Distance Computation

When landing with non-standard flap settings or malfunctions that negatively affect landing performance, the QRH may instruct the flight crew to apply a multiplier to the unfactored landing distance to obtain the minimum runway length required for the situation. Normally this distance is computed by the ACARS Electronic Weight & Balance/Performance program. Ref EMB SOP Sec 6.5 (ACARS LDG CONDITION 3/3). If this distance is unavailable electronically, multiply the QRH factor by the distance located on the appropriate unfactored landing distance chart contained in the Flight Planning Manual Landing tab.

CAUTION: These distances represent a maximum effort by the pilot in landing and stopping, and a suitable margin of safety should be added when selecting a runway for landing.

4.2.T Sample Flaps 45 Unfactored Landing Distance Table

TRANS STATES AIRLINES

UNFACTORED LANDING DISTANCE TABLE
EMB-145 — EP/LR/LR2/MP FLAPS 45°

Weight (lb)	ALTITUDE							
	0 ft				1000 ft			
	WIND – (kt)							
	-10 Kt	0 Kt	10 Kt	20 Kt	-10 Kt	0 Kt	10 Kt	20 Kt
43000	3246	2781	2634	2493	3317	2845	2697	2553
41000	3139	2684	2542	2409	3207	2745	2600	2462
39000	3032	2591	2455	2323	3097	2647	2508	2375
37000	2924	2500	2366	2236	2989	2554	2419	2288
35000	2823	2408	2276	2148	2879	2459	2326	2197
33000	2720	2311	2181	2056	2772	2360	2229	2103
31000	2611	2209	2082	1959	2661	2256	2128	2003
29000	2501	2107	1982	1861	2549	2151	2025	1903
27000	2391	2003	1881	1762	2435	2045	1921	1802

Weight (lb)	ALTITUDE							
	2000 ft				3000 ft			
	WIND – (kt)							
	-10 Kt	0 Kt	10 Kt	20 Kt	-10 Kt	0 Kt	10 Kt	20 Kt
43000	3391	2912	2762	2616	3469	2983	2830	2682
41000	3277	2809	2661	2519	3351	2876	2726	2581
39000	3165	2707	2565	2429	3235	2770	2625	2484
37000	3054	2610	2473	2341	3121	2669	2528	2394
35000	2939	2513	2379	2248	3006	2569	2433	2302
33000	2827	2411	2279	2151	2884	2464	2331	2202
31000	2713	2304	2175	2049	2766	2355	2224	2097
29000	2597	2196	2069	1946	2648	2244	2116	1992
27000	2481	2087	1963	1842	2529	2132	2007	1885

Weight (lb)	ALTITUDE							
	4000 ft				5000 ft			
	WIND – (kt)							
	-10 Kt	0 Kt	10 Kt	20 Kt	-10 Kt	0 Kt	10 Kt	20 Kt
43000	3550	3056	2900	2750	3635	3132	2974	2821
41000	3428	2945	2794	2647	3508	3018	2864	2715
39000	3307	2836	2687	2544	3382	2904	2754	2608
37000	3189	2729	2585	2448	3259	2793	2646	2504
35000	3073	2626	2488	2356	3143	2687	2545	2411
33000	2947	2519	2385	2254	3015	2577	2441	2310
31000	2822	2407	2275	2147	2881	2461	2328	2199
29000	2701	2293	2164	2039	2756	2345	2214	2088
27000	2578	2179	2052	1929	2630	2227	2099	1976

Note: Landing distance in ft.

EMB (EP/LR/LR2/MP) BUFF Page 1 of 2 FO 0048 TS APR15

4.3 Touchdown and Rollout

On touchdown, the ground spoilers will automatically deploy and IDLE REVERSE* may be selected after the main wheels are on the ground. After touchdown, REVERSERS* should be deployed as soon as possible since they are most effective at high speeds. Reverse thrust* above idle should be used only after the nosewheel is on the ground, and then only when the situation warrants, and should always be reduced to idle below 50 kts. Idle reverse* may be maintained throughout the rollout until forward thrust is required for taxi.

If the CA is the PF, the F/O will call **"FIFTY KNOTS"** and take control of the control wheel at that time.

Tiller steering is not normally required for maintaining runway heading, and it should not be engaged until needed for a sharp turn.

The EMB-145 is equipped with carbon brakes that have different wear characteristics than steel brakes, therefore the braking techniques differ. The most efficient braking for the EMB-145 is constant brake application. The landing conditions will determine the amount of brake application required.

Apply the brakes with no delay after the nose landing gear wheels have touched down. Use a single firm and steady brake application and hold pedal pressure until decelerated to taxi speed. Apply brake pressure as required to control the deceleration rate, up to a maximum comfortable deceleration. If the brakes are released, release them fully then reapply them early enough to allow constant pressure until taxi speed is achieved. Do not pump the brakes.

4.3.A Bounced Landing Recovery

When a light bounce occurs, maintain or re-establish a normal landing attitude. Increasing pitch can lead to a tail strike. Beware of the increased landing distance and use power as required to soften the second touchdown. When a more severe bounce occurs, initiate a go-around – do not attempt to land. Press the go-around button and advance thrust levers to MAX. Hold the flare attitude until the engines spool up and reset stabilizer trim, then follow normal go-around procedures.

4.4 Transfer of Control to Captain

If the F/O was the PF, transfer of control will normally take place at 50 kts by the CA calling out **"FIFTY KNOTS, MY AIRCRAFT"** at which time the F/O will maintain control of the control wheel but yield steering and thrust levers to the CA. At the transfer of controls, the F/O assumes responsibility for the communication radios.

4.4.A Taxi to the Gate

After clearing the runway, or if the aircraft is being back-taxiied on the runway, the F/O will silently do the After Landing flow and checklist, and then announce "**AFTER LANDING CHECKLIST COMPLETE"**. After a cool down period, one engine will be shut down, unless some over-riding condition requires both engines. The APU should not be started until gate parking is assured, and not at all if the flight is terminating or has significant ground time and a GPU is available.

4.5 Two-Engine Visual Approach and Landing

A visual approach should be flown with a standard traffic pattern in accordance with the AIM or as directed by ATC. Traffic pattern entry should be made at not less than 1,500 feet AFE at a maximum airspeed of 200 kts. In icing conditions, select Flaps 9 before slowing below 200 kts. In normal conditions, Flaps 9 should be delayed until ready to slow below 180 kts. Abeam the threshold, select Flaps 9, (unless already selected) Gear DOWN and slow to 160 kts. On base, select Flaps 22 and slow to 145 kts. On final, select Flaps 45. Slow to V_{APP} and sync the HDG bug. The PF will verify Gear DOWN and Flaps 45, and state **"I SEE GEAR DOWN, FLAPS _____ BEFORE LANDING CHECKLIST"**. The PM will complete the checklist. The aircraft will be stabilized and configured at not less than 1000 feet AFE. Appropriate callouts will be made by the PM with the PF responding with the required action and call out.

Note: Airspeeds are those suggested for normal operations, and will be used during training. In day-to-day operations, at altitudes above the minimum stabilized approach height, speeds may be modified at the request of ATC.

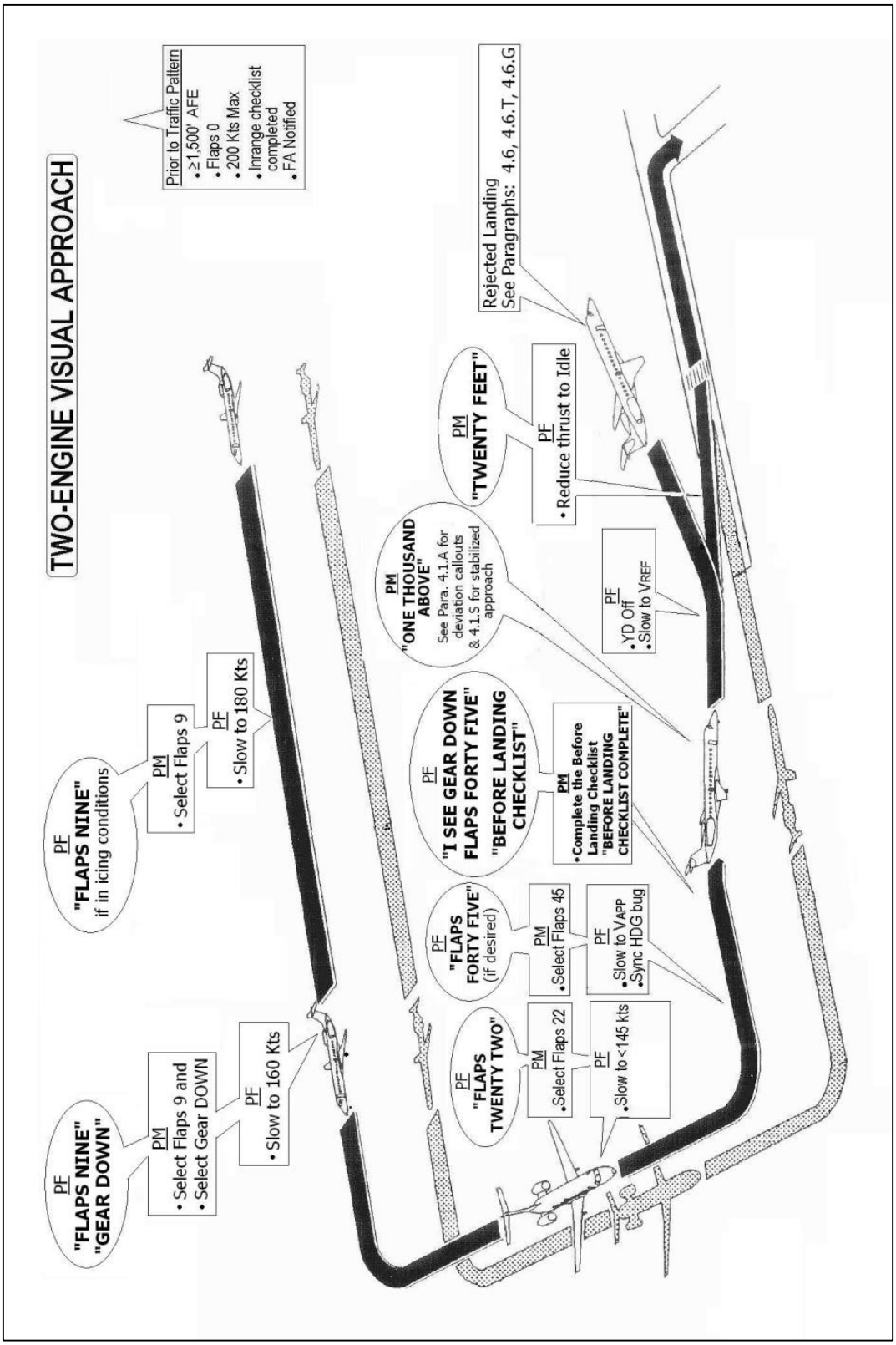
4.5.T Two-Engine Visual Approach and Landing, Table of Actions and Callouts

Actions: With bullets (•) in plain text – Callouts in "**BOLD CAPS**"

Event or Task	PF	PM
Prior to entering traffic pattern	• Slow to 200 kts or less (non-icing) • Enter traffic ≥ 1,500' AFE	• In range checklist completed • FA notified
Abeam midfield	• Before slowing < 180 kts (non-icing) or 200 kts (icing) **"FLAPS NINE"**	• Select Flaps 9
Abeam touchdown	**"GEAR DOWN"** • Slow to ≤ 160 kts	• Select Gear DOWN
Base leg	**"FLAPS TWENTY TWO"** • Begin slowing to ≤ 145 kts	• Select Flaps 22
On final approach	**"FLAPS FORTY FIVE"** *if desired • Slow to V_{APP} • Sync the HDG bug	• Select Flaps 45
Final checklist	**"I SEE GEAR DOWN, FLAPS _____, BEFORE LANDING CHECKLIST"**	• Complete the "Before Landing" checklist **"BEFORE LANDING CHECKLIST COMPLETE"**
At 1000' AFE		**"ONE THOUSAND ABOVE"** (See paragraph 4.1.A for deviation callouts and 4.1.S for stabilized approach)
At 200' above TDZ	• Verify Y/D OFF • Slow to reach V_{REF} at threshold	
At 20' Radio Alt	• Thrust to IDLE	**"TWENTY FEET"**

If a Rejected Landing (Go-around) is necessary, see Paragraphs 4.6, 4.6.T and 4.6.G

4.5.G Two-Engine Visual Approach and Landing, Graphic View



4.6 Two-Engine Missed Approach or Rejected Landing

By definition, a missed approach and a rejected landing are two separate maneuvers. However, the procedures for execution of these two maneuvers are identical (Figure 4-6.G). Upon reaching the DDA, missed approach point or DA on a precision approach, if a landing cannot be accomplished, the pilot must comply with the missed approach instructions for the procedure being used (or with alternate missed approach instructions given by ATC). If for any reason an early missed approach is executed, the pilot should (unless otherwise cleared by ATC) fly the procedure as specified on the approach to the missed approach point at or above DDA, MDA or DA before executing a turning maneuver.

The PF or the PM may initiate a go-around. The PF's immediate response to a **"GO AROUND"** callout by the PM is execution of a missed approach. When the decision is made to initiate a missed approach or rejected landing, the PF should immediately disconnect the autopilot, press the go-around button while advancing the thrust levers to the MAX THRUST position and pitch to the command bars (10° nose up). The PF should call out **"GO AROUND, SET MAX THRUST, FLAPS NINE"**. The PM will verify that the thrust levers are in the MAX THRUST position and select Flaps 9. The PM will monitor aircraft performance and announce a positive rate of climb. The PF shall verify a positive rate of climb and call out **"GEAR UP, HEADING"** (the FGC reverts to Roll mode on Go-Around). The PM will select the gear lever UP, confirm that MAX THRUST and Flaps 9 have been achieved, and select HDG on the FGC.

CAUTION: The PF should make callouts in a disciplined, measured cadence. Saying the commands more rapidly than the PM can accomplish them can lead to missed items.

The PF should allow the aircraft to accelerate to approach climb speed. The PM will callout Approach Climb speed and monitor aircraft performance. The PF will call "Select Vertical Speed" and ensure vertical speed is between 1500 and 2000 feet per minute by tapping the TC's button or commanding the PM to set a vertical speed. (the FGC will default to "Speed" mode after 20 seconds, unless some other mode is selected). At 1000' AFE, the PM will call out Acceleration Height.

Note: *The Acceleration Height for a Missed Approach or Go-Around is not published; therefore a universal height of 1000' AFE shall be used.*

The PF should respond by verifying the airspeed and requesting Flaps 0 and the Climb Sequence, followed by the desired vertical mode. The PM should select Flaps 0, retard the thrust levers to the THRUST SET position, and accomplish the remainder of the Climb Sequence items as in a normal departure.

At 1500' AFE, the PF will verify the Gear UP and Flaps 0, then request the After Takeoff Checklist. The checklist will be completed by the PM. The PM should advise ATC of the rejected landing or missed approach. The missed approach procedure or other ATC instructions should be followed, as appropriate. The F/A will be advised of the situation, and the company contacted as time and conditions permit.

4.6.T Two-Engine Missed Approach or Rejected Landing, Table of Actions and Callouts

Actions: With bullets (•) in plain text – Callouts in "**BOLD CAPS**"

Event or Task	PF	PM
Go-Around	**"GO AROUND, SET MAX THRUST, FLAPS NINE"** • Disconnect Autopilot, Press Go-Around button and Advance Thrust Levers to MAX, Pitch to the Command Bars on the FD (10° up) **"GEAR UP, HEADING"** • Accelerate to VAC • Comply with published Missed Approach route or ATC instructions **"SELECT VERTICAL SPEED"** **NOTE:** Adjust vertical speed 1500 to 2000 feet per minute **"FMS, NAV"**	• Verify Thrust levers MAX • Select Flaps 9 • Monitor PFD for indication of climb **"POSITIVE CLIMB"** • Select Gear UP • Verify MAX THRUST achieved • Verify Flaps 9 achieved • Select HDG mode on the FGC **"APPROACH CLIMB"** • Select vertical speed mode on the FGC **"V_{FS}"** • Select FMS on PF side • Select NAV made on the FGC
At 1000' AFE	**"FLAPS ZERO, CLIMB SEQUENCE, _____**	**"ACCELERATION HEIGHT"** • Select Flaps 0, Retard Thrust levers to "Thrust Set" notch • Accomplish "Climb Sequence" tasks as in Normal Takeoff • Notify ATC
At 1,500' AFE	"**I SEE GEAR UP, FLAPS ZERO, AFTER TAKEOFF CHECKLIST"** **"NOTIFY THE F/A"** **"NOTIFY THE COMPANY"**	• Complete the "After Takeoff" checklist **"AFTER TAKEOFF CHECKLIST COMPLETE"** • Notify the F/A • Notify the Company

7.2 Windshear

The most important way to cope with windshear is to avoid areas of known windshear.

- **Definition**

  Severe windshear may be defined as a rapid change in wind direction and/or velocity that results in airspeed changes greater than 15 kts or vertical speed changes greater than 500 fpm.

- **Flight Crew Actions**

  To prepare for encountering possible windshear, the flight crew accomplishes the following:

  - Evaluates the weather
  - Avoids known windshear
  - Considers precautions
  - Follows standard operating techniques
  - Performs windshear recovery technique

Evaluate the Weather

Although an advanced-technology windshear detection and annunciation system is installed, flight crewmembers should develop an awareness of the causes and danger signals of windshear to successfully avoid it.

Convective weather conditions have produced the majority of known windshear accidents. Thus the most dangerous form of windshear is a convective weather microburst of either the dry or wet type.

Avoid Known Windshear

The policy is to avoid areas of known windshear. Consider one or more of the following actions as appropriate:

- Delay takeoff until conditions improve
- In flight, divert around the area of known windshear.
- If windshear is indicated during approach, initiate a go-around or hold until conditions improve.

Consider Precautions

Precautions are recommended whenever the probability of windshear exists but avoidance action is not necessary.

The following precautions are for takeoff:

- Use maximum takeoff thrust instead of reduced thrust.
- Use the longest suitable runway away from potential windshear

The following precautions are for approach:

- Achieve a stabilized approach not later than 1,000' AFE.
- Avoid large thrust reductions or firm changes in response to sudden airspeed increases, as these may be followed by airspeed decreases.
- Use the longest suitable runway away from potential windshear.
- Consider using increased approach speed up to a maximum of 20 kts.
- Use the autopilot for the approach to provide more monitoring and recognition time.

Follow Standard Operating Techniques

Certain procedures and techniques can prevent a dangerous situation from developing if windshear is inadvertently encountered. These procedure and techniques are of such importance that they should be incorporated into each crewmember's personal standard operating techniques and practiced on every takeoff and landing, whether or not windshear is anticipated. Develop a cockpit atmosphere that encourages awareness and effective crew coordination, particularly at night and during marginal weather conditions.

The following are takeoff standard operating techniques:

- Be alert for any airspeed fluctuations during takeoff and initial climb
- Minimize reductions from the initial climb pitch attitude until terrain and obstruction clearance is assured.
- Develop an awareness of normal values of airspeed, attitude, vertical speed, and airspeed buildup.
- The PM closely monitors the vertical flight path instruments, such as vertical speed and altimeters and calls out any deviations from normal.

The following are approach standard operating techniques:

- Develop an awareness of normal values of vertical speed, thrust and pitch.
- Crosscheck flight director commands, using vertical flight path indications.
- Know the go-around decision criteria, and be prepared to execute an immediate go-around if the parameters are exceeded.
- The PM closely monitors the vertical flight path instruments, such as vertical speed, altimeters and glide-slope displacement and calls out any deviations from normal.

Windshear Recovery Techniques

General

The windshear escape maneuver below should be performed whenever the red **WDSHEAR** warning is annunciated or when flight path control becomes marginal below 1,000' AGL. Marginal flight path control may be indicated by uncontrolled changes from normal, steady state flight conditions in excess of any one or more of the following:

- 15 kts
- 500 fpm vertical speed
- 5 degrees pitch attitude
- 1 dot displacement from the glide slope

Windshear Escape Maneuver

The following maneuver is used if a red **WDSHEAR** warning is encountered in flight:

- Apply maximum available thrust.
- Disengage the autopilot, press the go-around button and rotate smoothly at a normal rate toward a target pitch attitude of 10º or as indicated by the command bars in the windshear escape mode.
- Adjust pitch attitude smoothly and in small increments to control vertical speed and altitude. Pilots should be aware that speed might decay below reference speeds and that stick forces necessary to maintain increased pitch attitude may be well above normal.
- Maintain present configuration (gear and flaps) until verified clear of windshear.
- Re-select a vertical mode after exiting the windshear, as the FGS will not capture an altitude in **WDSHEAR** mode.
- Caution should be used when an amber WDSHEAR is encountered because a red **WDSHEAR** warning may follow.

Communication

Anytime a wind shear escape maneuver is initiated the crew must notify ATC, as time permits. The phraseology can be very simple such as "Dulles tower, Waterski 7769, wind shear escape". The purpose of this communication is to inform ATC that the flight may no longer be following ATC clearance/routing.

Once the escape maneuver is complete, the crew must notify ATC. The phraseology can be very simple such as "Dulles tower, Waterski 7769 wind shear escape complete." The crew may ask for further clearance or advise returning to previous altitude and routing.

2.18 CRUISE FLOW
PM

- **Seat Belt Sign**

  Seat belt sign may be selected appropriate to flight conditions.

- **Thrust Rating**

  Cruise thrust will be set at the request of the PF. Stay in CLB mode until cruise speed is achieved. True Airspeed will be used as the primary parameter to set power, with a target TAS as found on the Flight Plan portion of the dispatch package.

  Note: Enroute cruise speed and the resulting fuel consumption information shown on the Release are selected by the dispatcher to meet fuel economy and schedule goals. Pilots must compare the actual fuel used and remaining to the detailed flight plan, and alert the dispatcher if the projected fuel remaining at destination becomes a concern.

  Alternate and reserve based on long range cruise charts.

- **Pressurization**

  Pressurization indications should be checked on the EICAS for proper operation of the system.

- **Altimeters**

  At level off, verify PFD and standby altimeter error is not greater than that published in SOP 1.4.T. If PFD and standby altimeters do not agree within the maximum allowable error contained in SOP 1.4.T, flight in RVSM airspace is **prohibited**. Notify ATC immediately. When able, contact Flight Control and Maintenance Control.

  Note: The above altimeter check must be repeated in accordance with FCOM 3-1.10.

2.19 DESCENT FLOW — PM

- **Pressurization**

  Verify that the pressurization digital controller is set to the landing field elevation and that a cabin descent has begun.

2.20 18,000 FEET FLOW – DESCENDING — BOTH

- **PFD and Standby Altimeter**

  The PFD and standby altimeters should be set to the appropriate local altimeter setting and verbally crosschecked.

- **Seat Belt Sign**

  The seat belt sign should be selected ON as required.

2.21 10,000 FEET FLOW – DESCENDING — PM

- **Exterior Lights**

  All exterior lights should be selected ON.

  Nose landing and taxi lights may be delayed until approach and landing clearances are obtained.

- **FA**

  Sterile light selected ON, or verbal notification of sterile cockpit.

2.22 IN RANGE FLOW

PM

- **Windshield Heat**

  Verify the windshield heat is ON.

- **ATIS**

  Obtain ATIS and any other destination information, review ACARS landing data and check performance considerations, then verbally review the information with the PF. Any questions and discrepancies should be resolved at this time.

- **Landing Data & Bugs**

  Set landing speed bugs. Ref. SOP 4.1

- **Pressurization**

  Verify that the pressurization digital controller is set to the landing field elevation and that a cabin descent has begun.

- **Landing Performance Decision Tree**

  Review the Landing Performance Decision Tree when landing on runways with less than 9000 feet of available landing distance.

BOTH

- **Seat Belt Sign**

  The seat belt sign should be selected ON as required.

- **PRI & STBY Altimeters**

  The current altimeter setting will be set in each PFD altimeter, and Standby Altimeter, and verbally crosschecked.

- **Seat, Belts and Harness**

  Verify seat, belts and shoulder harness are adjusted and fastened

2.22 IN RANGE FLOW — PF

- **Approach Briefing**

A positive transfer of controls will be made, and the PM will assume PF duties while the briefing is completed.

The CAT I approach briefing should include:

1. Obstructions
2. Threat/Risk considerations
3. Aircraft configuration and speeds and planned descent rate (CDFA)
4. Approach title, airport and revision date, navaid frequency
5. Field elevation/minimum sector altitudes
6. Inbound course
7. Initial altitudes, step downs, descent point, minimums (DA(H), DDA)
8. Visibility requirements and reported visibility
9. VDP, as required
10. Missed approach point (MAP)
11. Initial missed approach procedures (immediate action items only, no turns until MAP)
12. For GPS based RNAV approaches (GPS, GNSS), the crew must verify each approach waypoint and the expected holding pattern in the FMS with the Jeppesen approach plate.
13. Taxi-in plan, including planned intersection to exit the runway.

Initial approach altitude and procedure turn altitude are not required to be briefed on radar-vectored approaches.

Note: Straight-in minimums are Category C. Circling minimums are Category D. The briefing may be abbreviated if a Visual Approach will be conducted and the reported ceiling is $\geq$ 3,000' and visibility $\geq$ 3 miles.

At the completion of the briefing, a positive transfer of controls back to the PF will be made.

Note: Both Pilots should adjust their seat using the Seat Adjustment Sight Device (AOM 2-02-05).

	A positive transfer of controls will be made, and the PM/FO will assume PF/CA duties while the briefing is completed. The CAT II approach briefing should include: 1. Obstructions 2. Threat/Risk considerations 3. Aircraft configuration. Flaps 22 is mandatory. 4. Speeds and planned descent rate

Continued on next page

5. Approach title, airport, revision date, and navaid frequency
6. Field elevation, TDZE, and minimum sector altitudes
7. Inbound course
8. Initial altitudes, step downs, and the FAF
9. Visibility requirements and reported visibility
10. Minimums
11. Initial missed approach procedures (immediate action items only)
12. Prior to reaching minimums, one of the following must be visually acquired:
    a. The red terminating bars (ALSF-2)
    b. The runway environment
13. If the missed approach will be flown using the FMS, the crew must verify each approach waypoint and the expected holding pattern in the FMS with the approach plate.
14. Taxi-in plan, including planned intersection to exit the runway and use of SMGCS charts.
15. Perform the Radio Altimeter test (this test may be performed previously in cruise flight)
    a. Set the DH to 200'
    b. Press and hold the test button
    c. Observe on the PFD:
        1) A magenta TEST annunciation is presented adjacent to the upper left side of the attitude sphere
        2) An amber MIN label is displayed in the RA Minimum annunciator. The label flashes for about five (5) seconds, and then becomes steady.
        3) An amber RA comparison label is displayed in the lower left side of the attitude sphere.
        4) The Radio Altitude field indicates 100 ±10'.
    d. Additionally, the following EICAS messages are presented according to the following configuration:
        1) For airplanes equipped with one (1) Radio Altimeter:
            a) When tested at LH side:
                i. (E)GPWS INOP
                ii. WINDSHEAR INOP
                iii. RAD ALT 2 FAIL
            b) When tested at RH side:
                i. (E)GPWS INOP
                ii. WINDSHEAR INOP
                iii. RAD ALT 1 FAIL

Continued on next page

2) For airplanes equipped with two (2) Radio Altimeters with RA1 connected to the EGPWS:

a) When tested at the LH side:

i. (E)GPWS INOP

ii. WINDSHEAR INOP

b) When tested at RH side:

i. No message associated

3) For airplanes equipped with two (2) Radio Altimeters with both connected to the EGPWS:

a) If LH or RH side are tested separately:

i. No message associated

b) If both sides are tested at the same time:

i. (E)GPWS INOP

ii. WINDSHEAR INOP

e. When released, the PFD indications resume the initial condition and the EGPWS voice message may occur "TOO LOW TERRAIN".

16. Set the Radio Altimeter DH:

- The resolution of the Decision Height Setting is five (5) feet when set below 200'.
- For CAT II approaches, set the Decision Height Setting to the published RA or next higher increment. (ex. The RA minimums are 116', set the RA DH to 120'.)

17. Select the marker beacon audio ON both sides.

Initial approach altitude and procedure turn altitude are not required to be briefed on radar-vectored approaches.

Note: Both Pilots should adjust their seat using the Seat Adjustment Sight Device (AOM 2-02-05).

2.22 IN RANGE FLOW — BOTH

- **Radios**

When the aircraft is in position to begin a ground NAVAID-based instrument approach, or a visual approach backed up by ground-based electronic signal, each pilot shall verify the NAV radios are set to the correct frequency, and positively identify, or request identification of them.

Tip: Place the nose Landing light switch ON as a reminder you are Cleared for the Approach

2.23 BEFORE LANDING FLOW

PM

- **Flight Attendant**

  Notify Flight Attendant approximately 10 minutes before landing.

- **Landing Gear**

  The landing gear will be selected DOWN at the request of the PF, and verified.

- **Flaps**

  Flaps will be selected to the requested position, and verified.

- **Exterior Lights**

  All exterior lights should be selected ON

  Tip: Place the nose Taxi light switch ON as a reminder you are cleared to land.

- **APP RNP**

  If a GPS/GNSS approach is being conducted, the APP legend must be present on the PFD and acknowledged, no later than the FAF.

- **Speed Brake**

  Verify the speedbrake is closed, and indicating CLSD on EICAS.

- **Crossfeed**

  Verify that crossfeed is selected OFF and no EICAS message is present.

- **Autopilot/Yaw Damper**

  Verify the autopilot and yaw damper are disconnected before landing. Check the Yaw Damper OFF at 100 feet.

2.23 BEFORE LANDING FLOW — PF

- **Landing Gear**

  Verbally verify the gear is in the DOWN position.

- **Flaps**

  Verbally verify the Flaps are at the requested position

- **APP RNP**

  If a GPS/GNSS approach is being conducted, the APP legend must be present on the PFD and acknowledged, no later than the FAF.

- **Autopilot/Yaw Damper**

  Disconnect the Autopilot and Yaw Damper before landing. The autopilot may be used until 200 feet AFE on a precision approach. Descent below MDA with the autopilot engaged is prohibited on a non-precision approach.

2.24 GO AROUND FLOW

PM

The GO AROUND flow is identical to the AFTER TAKEOFF flow. Additionally, the FA should be notified of the GO AROUND, and the crew's intentions, as soon as workload and time permit.

DOORS

COCKPIT SECURITY DOOR

On airplanes equipped with a cockpit security door, two crewmembers must be in the cockpit during all flight phases.

If one of the pilots leaves the flight deck, he must be replaced in the cockpit by another crewmember.

Positive identification of the person wishing to enter the flight deck must be obtained before opening the door.

The security cockpit door must be kept closed and locked at all times during flight except to permit access and egress according to SSIM procedures 1-2.1 for opening, closing and locking the door.

Anytime that cockpit door is opened in flight, a challenge and response closing and locking verification procedure must be used to verify that the door is closed and locked.

Autopilot CAT I	Min Altitude Coupled to ILS	200′
	Min Engagement Height After Takeoff	500′
	Single-engine Go-around	Prohibited

Autopilot CAT II (autopilot is mandatory for CAT II approaches)	Min Altitude Coupled to ILS	50′
	Min Decision Height	100′
	Min Runway Visual Range	1,200′
	Max Tailwind XR models Max Tailwind all other models	9 kt 10 kt
	Max Crosswind	10 kt
	Min Engagement Height After Takeoff	500′
	Single Engine CAT II	Prohibited

Max Recommended Crosswind (Non-AFM)	Dry Runway	30 Knots
	Wet Runway	
	Runway with Compacted Snow	25 Knots
	Runway with Standing Water or Slush	20 Knots
	Runway with Ice (no melting)	10 Knots

Bleed/Pack Condition	Maximum operating altitude when one bleed or one pack is closed is 25,000′. (AFM). When operating with APU bleed supplying Pack 1 (Eng. 1 bleed – closed) and engine 2 supplying Pack 2 (crossbleed closed), maximum operating altitude is 37,000′. (Non-AFM)

EMB-145 ALL MODELS — MEMORY ITEMS

WINDSHEAR PREVENTION/RECOVERY

Thrust Levers	MAX
Go-around Buttons	PRESS

BATTERY OVERTEMPERATURE

Associated Battery	OFF

CABIN FIRE OR SMOKE

Crew Oxygen Masks	DON, SELECT 100%
Smoke Goggles or PBE	DON
Recirculation Fan	OFF
Crew Communication	ESTABLISH

BAGGAGE COMPARTMENT SMOKE

Baggage Fire Extinguishing Button (if installed)	PRESS

APU FIRE

APU Fuel Shutoff Valve	CLOSE

ENGINE FIRE, SEVERE DAMAGE OR SEPARATION

Identify the affected engine.	
Thrust Lever	IDLE
Start/Stop Selector	STOP
Fire Extinguishing Handle	PULL (DO NOT ROTATE)