



CL-350

Bombardier
CHALLENGER 350



CL-350 SUPPLEMENTAL MANUAL

ROPAT

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SECTION 1 INTRODUCTION

INTRODUCTION

The purpose of this ROPAT (Recommended Operational Procedures And Techniques) section is to provide recommendations and procedural guidance for operation of the Challenger 350 airplane. If the information contained herein conflicts with the approved Airplane Flight Manual (AFM), the AFM shall take precedence.

The scope of this manual is limited. Absolute numbers and variables covering all conditions are impossible to present. For example, power settings and airspeeds are may be approximate. A common sense approach to any given situation is stressed. Information contained within is subject to change. The latest revision should be referenced.

The guidance presented is intended to facilitate the safe and efficient operation of the Challenger 350. The airplane is very sophisticated with high levels of system integration. There may be several alternative means for accomplishing some actions/procedures. Generally, the examples used in this section represent the preferred, recommended method(s). An attempt is made to highlight where other, alternate means are available and acceptable.

Airmanship and its best practices are implied and not usually called out specifically as substantiating reasons for particular procedures or recommendations.

The procedures outlined should not be taken as Standard Operating procedures (SOPs). Each operator is responsible for developing and implementing their own SOPs. The guidance presented in this manual may be used to facilitate such development.

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SECTION 2 NORMAL PROCEDURES & TECHNIQUES

GENERAL

The ROPAT in this manual is not intended to be mandatory or to supersede any individual company SOPs. They are provided as examples of good operating practices.

Furthermore, SOPs can not address every circumstance in flight and the pilot may deviate from SOPs for that reason. A good CRM technique is to preface any non-standard operations with the call "Non-Standard".

e.g.: ATC request you to slow to Vref 15nm from the straight in runway for spacing. Where gear down would normally be called perhaps an extra flap setting without gear deployment would be preferred in order not to drag the gear for that long a time. Before requesting the said flap setting, you should use the term "Non-Standard".

RESPONSIBILITIES

The pilot-in-command (PIC) is designated by the company and is responsible for the conduct and safety of the flight. The second-in-command (SIC) is responsible for assisting the PIC in accomplishing the same goal. The pilot flying (PF) controls the aircraft with respect to heading, altitude, airspeed, and directs the necessary operations to safely accomplish the flight. The pilot monitoring (PM) maintains ATC communications, obtains clearances, accomplishes checklists, makes altitude and deviation callouts, and other tasks as directed by the PF. The crew must work together as a team. Both crew members should always maintain situational awareness. They should communicate and complement each other to enhance the efficiency and safety of the flight.

CREW COORDINATION

Efficient crew coordination is an absolute necessity for operating the aircraft with utmost safety. Crew coordination and teamwork are essential in performing Normal, Non-Normal, and Emergency procedures, as well as in the division of cockpit workload. Areas enhanced by good crew coordination are situational awareness, visual observation of other traffic, use of checklists, airspeed, altitude and deviation callouts, handling of communication, navigation radios, use of flight guidance panel (FGP), display controllers (DCP/CCP), operation of gear and flaps, departures, and approaches.

When an action is noted as not completed but the PM suspects it may have been forgotten due to workload or other, a good CRM technique would be to prompt the PF for the impending checklist or item via a question.

e.g.:

"Would you like... the Descent Checklist?"

"Would you like... flaps 20?"

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CHECKLISTS

The checklist creates an efficient motion sequence or flow in the cockpit. The Normal checklist follows a normal sequence from preflight to shutdown. The Emergency and Non-Normal checklists allow the crew to quickly turn to the appropriate checklist by matching the engine indicating and crew alerting system (EICAS) indexes to the corresponding CAS message displayed. In many cases when using these checklists, there is no need to return to the Normal checklist. Once a Non-Normal Landing checklist has been initiated, it guides the crew to landing.

EICAS indexes in the Quick Reference Handbook (QRH) 2 – appear exactly as the CAS messages appear. The checklists are arranged by color and alphanumeric order by system. In addition, they are portrayed in the same nomenclature as the EICAS messages for ease of reference.

The QRH2 is fitted with links/hyperlinks to facilitate checklist flows when cross referencing other procedures.

We urge operators to be vigilant when using links/hyperlinks to ensure they direct the user to the intended destination (page/procedure). Operators are to confirm that the referenced procedure title on the origin page is the same as the procedure title on the destination page.

PF: Calls for procedure by its title.

PM: Locates and Reads the title aloud to confirm.

PF: Acknowledges correct procedure has been chosen.

This applies to all cross referenced procedures as well.

e.g.: If an amber GEAR DISAGREE CAS message is displayed (supported by a single chime and flashing master caution lights), the flight crew should reference the GEAR DISAGREE checklist located within the Caution Procedures in the QRH 2 GEAR / BRAKES section.

NOTE: For efficient use of QRH 2 and its associated Quick Reference Card (QRC), refer to the QRH2 introduction chapter.

Flow patterns are not used for non-normal or emergency procedures. During an emergency, with or without reference to the Quick Reference Card (QRC) accomplish any immediate actions items, then call for the proper checklist. It should be noted that the QRC was developed to be used by crew to more efficiently perform the Immediate Action Items without relying solely on memory. Not using the QRC could cause omission or commission errors and thus is a good confirmation tool. Maintain control of the airplane with one pilot always flying while the other reviews all the items of the appropriate emergency procedure. The PM reads out loud both the challenge and the response. Do not proceed to the next item until both pilots confirm completion of each item.



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SECTION 2 NORMAL PROCEDURES & TECHNIQUES

If the checklist was overlooked, good cockpit resource management requires the PM to ask the PF if the checklist should be started. After the completion of any checklist, the PM states that the specific “checklist is complete”. This increases the PF situational awareness and prompts the PF to call for the next appropriate checklist when required.

Some checklist procedures call for the movement or manipulation of controls or switches critical to safety of flight (e.g.: Engine fire switches, Generators, Engine Run switches). Prior to initiating the action, the pilot performing the action verifies with the other pilot that the correct control or switch is being moved.

Any checklist action pertaining to a specific control, switch, or equipment that is duplicated in the cockpit is read to include its relative position and the action required (e.g.: Left Thrust Lever – IDLE, Left Fuel Pump – OFF).

PILOT INCAPACITATION (TWO CHALLENGE RULE)

If the PM observes and challenges a flight deviation or critical situation, the PF should respond immediately usually by either “correcting” or “check”. If the PF does not respond by oral communication, the PM must issue a second challenge that is loud and clear. If the PF does not respond after the second challenge, the PM must assume the PF has become incapacitated. PM must announce “I have control” and then take the necessary action.

This can be a difficult concept to convey but in light of cultural norms in some countries where the PM may have far lesser qualifications and the Captain is thought of as not challengeable. Too many accidents have occurred where the lowly copilot who didn't take control was actually the one who was right.

If the incapacitated PF is able to, they should respond immediately “you have control”. Any normal transfer of control should be done with the same verbiage.

FLOW PATTERNS

For normal procedures, a flow pattern is an efficient method for accomplishing the cockpit setup for each phase of flight. After using the flow pattern, accomplish the checklist to verify the proper setup of the cockpit. Under this concept, a normal checklist is a “done list” instead of a “do list”.

RADIO TUNING AND COMMUNICATION

The PM accomplishes navigation and communication radio tuning, identification of proper signal, ground contacts, and clearances. Before changing any navigation radio, the flight crew confirms the change does not affect autopilot or airplane control, and then selects the new frequency. This confirmation helps coordinate and use proper sequences with the autopilot, FMS, and other aids. After the NAVAID is tuned and identified, the PM announces, “(Facility) tuned and identified”.

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CHECKLISTS

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SECTION 2 NORMAL PROCEDURES & TECHNIQUES

PREFLIGHT BRIEFINGS

The PIC should conduct a preflight briefing prior to each flight. This briefing should address flight details:

Anticipated weather: Low weather conditions and what is the plan in case of an engine failure,

Potential problems: Delays, Unruly Passengers,

Safety considerations: Aircraft evacuation, number of passengers,

Operational issues: Deicing and expiration of HOT, Performance limited airports (Gradients, Take off from short runways), and any potential Threats, etc.

Preflight briefings should include all crewmembers to enhance and set the tone for the flight. The briefing may be formal or informal but should include some standard items such as: "Advise me" of any abnormality and company operational procedures (if required).

A technique used for multi-day pairings is to discuss and focus on one emergency per day expanding on that emergency between legs on the same day. This tends to bring the crew together, help create open dialog, refresh procedures and help build crew confidence in dealing with possible issues.

EMERGENCY EVACUATION PLAN

During the preflight briefing with the Flight Attendant (if applicable), in addition to the items listed in the previous paragraph, it is good practice to go over the emergency evacuation contingency plan. Typically, the evacuation checklist is a two crew procedure. Additionally, if the flight is planned without an F/A, the copilot will have to assume the F/A duties. For example: During an emergency evacuation, the copilot leaves the cockpit upon the evacuation command, opens the proper emergency exit, informs the pilot of the exit, and takes the passengers upwind and away from the airplane to a rendezvous point. The copilot then counts the number of people on the airplane, including the pilots. The pilot completes the emergency evacuation checklist, and then joins the other occupants and copilot outside the airplane.

ADVISING OF AIRCRAFT CONFIGURATION CHANGE

A crewmember about to make an aircraft control or configuration change should alert the other crewmember. If time permits, the crewmember should announce any abrupt flight path changes so there is always a mutual understanding of the intended flight path. Sometimes a PA announcement to the passengers is advised before maneuvers involving unusual pitch or bank angles.

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**SECTION 2
NORMAL PROCEDURES & TECHNIQUES****CRITICAL MALFUNCTIONS IN FLIGHT**

In flight, the observing crewmember positively announces an indication of a malfunction. If the PM is the first to observe any indication of a critical failure, the PM should announce what is seen and attempt to identify the malfunction to the PF.

After verifying the malfunction, the PIC announces a decision and commands or accomplishes any checklist or Immediate action items. The PF monitors the PM during the accomplishment of those tasks that have been assigned.

NONCRITICAL MALFUNCTIONS IN FLIGHT

Procedures for recognizing and verifying a noncritical malfunction or impending malfunction are the same as for time-critical situations. Time, however, is not as critical and allows a more deliberate response to the malfunction.

NON-NORMAL/EMERGENCY PROCEDURES

The preflight briefing includes a discussion of non-normal or emergency conditions. When a crewmember recognizes this situation:

- Who controls the aircraft?
- Who performs the tasks?
- What items should be monitored?

Following these designations, the PF calls for the appropriate checklist. The designated crewmember accomplishes the checklist items with the appropriate challenge and response.

Both pilots must be able to respond to an emergency that requires immediate action. The QRC can be used by the crew to more efficiently perform the Immediate Action Items without relying solely on memory, thus reducing the possibility of omission or commission errors. This does not negate the importance of a thorough understanding of the QRC/QRH and can validate the items done from memory.

Crewmembers must make every effort to confirm and identify a malfunction before initiating any non-normal or emergency action. Use positive oral communication and it is good practice to reference graphic tools (Synoptic Pages) to identify and direct the proper response.

REJECTED TAKEOFFS

Every takeoff must be regarded as a possible rejected takeoff (RTO) and is, therefore, a planned event. Both pilots may call for a rejected takeoff after the decision is made, the crew applies the proper procedure, brings the aircraft to a full stop, and follows with either the "Rejected Takeoff" or "Engine Failure below V_1 " Checklist.



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SECTION 2 NORMAL PROCEDURES & TECHNIQUES

The PF should execute an abort prior to 80 KIAS for any abnormality observed. Between 80 KIAS and V_1 , a takeoff can be rejected for critical situations such as:

- Loss of directional control
- Master Warning
- Safety of flight

DEVIATIONS DURING FLYING

The PM shall call out any deviation from normal and accepted Standard Operating Procedures during various phases of flight.

As an example, during the approach phase of flight: "Drifting left of course". These announcements should be specific and timely.

Deviations include:

- Courses – left or right $\pm 5^\circ$
- Altitudes – climbing or descending from assigned altitude ± 100 ft
- Airspeed – exceeding desired or assigned speed ± 10 kt (also above and below VREF)
- Descent rates – descending greater than 1,000 fpm on the final approach phase
- Leaving DH/DA – one-quarter scale deflection of glideslope/localizer
- MDA – descending below selected altitude.

Some deviations calls would look like:

"Left of Course.....Correcting"

"Localizer.....Correcting"

ENGINE INDICATION AND CREW ALERTING SYSTEM

When CAS messages are displayed, always consider collateral indications. For example, an amber **L GEN FAIL** CAS message appears on the EICAS. In addition to a single aural chime and flashing master caution lights, the other indications can verify this condition:

- OFF appears in the L GEN switch and the BUS TIE may close.
- Review the ELECTRICAL and/or SUMMARY pages on the MFD and verify the parameters for the respective side in question
 - The generator outline is amber
 - The voltage/ amperage on the respective generator should be zero
 - Confirm that all electrical busses are still powered (or not)

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SECTION 2 NORMAL PROCEDURES & TECHNIQUES

By using system knowledge and looking at collateral indications, the crew can verify the anomaly, thus confirming the CAS message.

NOTE: It is good operational awareness to consult the Aircraft Minimum Equipment List (MEL) should a technical issue occur in flight because once landed, you may not be able to dispatch again. In those cases where the issue does not allow further dispatch and maintenance is not available at destination, a diversion to a more suitable airport may have been a better operational decision.

FLIGHT GUIDANCE SYSTEM/FLIGHT DIRECTOR

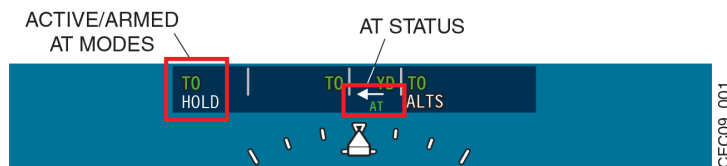
The flight guidance system (FGS) and flight director (FD) have lateral and vertical modes to manage navigation, climb, cruise, and descent. The FD is a valuable tool in helping the crew make accurate maneuvers and approaches, especially in adverse weather conditions. Remember the FD does not think ahead or anticipate, conversely it is a computer that calculates drift corrections based on track results. Consequently, the FD could command S-turns during the early part of a final approach. The crew should be aware of this, especially if given a tight or quick radar vector to an approach course. With this in mind, pilots should attempt to follow the command bars precisely to allow the FD to make accurate calculations. These computations command very gentle, slow, and deliberate corrections toward interception of a track and/or glideslope. An autopilot-coupled approach illustrates this capability. Following the command bars closely results in an accurate and well-stabilized approach.

AUTOTHROTTLE (AT) SYSTEM

The Challenger 350 Autothrottle (AT) System provides automatic thrust management to the flight crew for all phases of flight.

Thrust Mode is associated with vertical Flight Director (FD) Modes of FLC, TO and GA and the AT Speed Mode is associated with all other vertical FD Modes.

The Autothrottle can also be used with or without the Flight Director/Autopilot active. If the FD is selected Off, the AT can be engaged in Speed Mode. It is also permitted to be engaged in single-engine operations (refer to AFM for specific single-engine Limitations).



AT Modes and Status Display
Figure 09-12-1



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SECTION 2
NORMAL PROCEDURES & TECHNIQUES

AT ENGAGE AND DISENGAGE

The AT System is Armed/Engaged by the crew via the ENGAGE switch on the aft side of either Thrust Lever. Manual Disengagement of the AT by the crew is via the DISENGAGE button on the forward side of either Thrust Lever Knobs. When the AT is Manually Disengaged by the crew, the AT Mode(s) will clear, the AT Status will flash amber for 2 seconds and an “AUTOTHROTTLE” aural will be heard once.

If the AT detects a condition that does not meet the engage criteria, the AT will Automatically Disengage. An Auto Disengage will be noted by; all AT Modes will be removed from the FMA, the AT Status will continuously flash amber and an “AUTOTHROTTLE – AUTOTHROTTLE” aural will be continuously heard. The crew will need to acknowledge the Auto Disengage by pressing either AT DISENGAGE button on the Thrust Lever Knobs. This will cease the flashing amber AT Status and silence the associated aural.

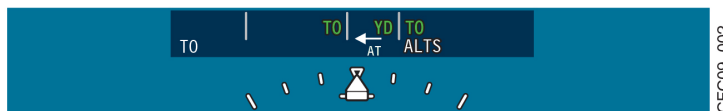
AT MODE AND STATUS INDICATIONS

The AT active modes are displayed in green on the top left-hand line of the FMA, and the AT armed modes are displayed in white on the bottom left-hand line. When an armed mode becomes active, it will flash for 5 seconds then becomes steady green.

Changes in AT Modes and Status should be confirmed by the crew by verifying the active Mode on the Flight Mode Annunciator (FMA) in the same manner as Flight Director and Autopilot statuses are confirmed.

TAXI

In order to conduct an AT assisted takeoff, the AT must be Armed prior to initiating the Takeoff roll. The AT can only be Armed after Takeoff Flaps are set, Vs speeds posted to the PFD and FD selected to TO/TO. The AT is Armed by pressing either AT ENGAGE switch. It is good practice to simultaneously press TOGA and arm the Autothrottle, when taxiing into takeoff position. Crews should confirm AT Mode displays TO (white) on the left side of the FMA and the AT Status displays AT (white) in the center of the FMA. Confirm proper FMA indications upon AT arming. (TO/TO/AT/YD//TO/ALTS).



AT Modes – TO Armed Mode
Figure 09–12–2

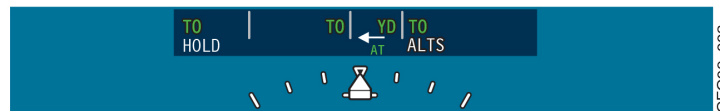
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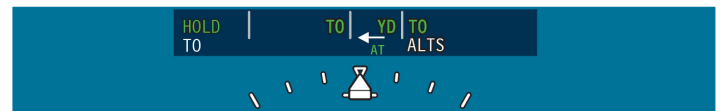
TAKEOFF

When the aircraft has been cleared for takeoff and aligned with the runway, the PF smoothly advances the thrust levers until the AT engages (approximately midpoint of thrust levers range). AT Engagement is confirmed by the AT Mode changing to TO (green) with HOLD (white) armed. AT Status also changes to AT (green) and the AT automatically advances the thrust levers to the TO detent (takeoff).



AT Modes – TO/HOLD Mode
Figure 09–12–3

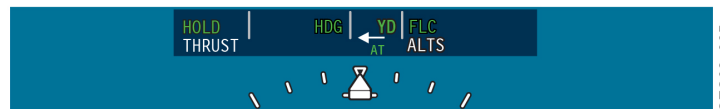
When the aircraft accelerates above 60 KIAS and the Thrust Levers are in the TO detent, the AT Mode will change to HOLD (green) with TO (white) as the Armed Mode. The crew must confirm that the AT Mode is HOLD (green) prior to 80 KIAS. When HOLD (green) is the active AT Mode, servo commands cease, and the Thrust Levers will be maintained in the TO Detent until reaching 400 ft Above Airport Elevation (AAE).



AT Modes – HOLD/TO Mode
Figure 09–12–4

INITIAL CLIMB

Once the aircraft is safely airborne, the crew will select a lateral and FLC mode and set the speed bug as required. Upon selection of FLC, the AT will arm THRUST (white) mode. When the aircraft passes 400 ft AAE, the AT will command the Thrust Levers back to the CLB Detent and will maintain that position until ALTS CAP or an AT SPD mode becomes active.



AT Modes – HOLD/THRUST Mode
Figure 09–12–5



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GENERAL PROTOCOLS

When flying in a technologically advanced flight deck, each pilot must understand basic protocols. When these protocols are followed, each crewmember should understand their responsibilities. This greatly enhances situational awareness. The following procedures promote efficiency and avoid confusion:

1. The FMS should never replace judgement or the ability to revert to non-FMS navigation within a moment's notice. Flight management systems have come a long way in accuracy and ability to find themselves, but they are only as good as the programmer.
2. One crewmember should always keep a heads-up discipline and actively monitor the aircraft. This cannot be overemphasized. It is not uncommon to occasionally find both pilots looking down (in the FMS) and no one looking outside. Avoid FMS programming in critical phases of flight or low level altitudes. If the flight crew is unsure of which approach will be assigned, wait until the assigned approach or the approach to expect is given.
3. Divide the cockpit in half. All switches to the left are the responsibility of the left-seat pilot. All switches to the right are the responsibility of the right-seat pilot. When making any switch selection, inform the other pilot.
4. Automatic Flight Control System (AFCS) — Communication regarding who is controlling the autopilot is essential between the pilots and should be confirmed. Confirmation by both pilots is necessary when there is a transfer of control. Additionally, the PF must inform the PM when the autopilot is turned on or off.
5. Flight Guidance Panel — The aircraft has a single flight Guidance Panel (FGP). When the autopilot is on the PF has control and makes selections. When the autopilot is off the PM makes the selections at the request of the PF.
6. All active FD mode changes shall be confirmed on the FMA and verbalized by the crewmember managing the FCP. Normally the PF announces the change with a confirmation from the PM. However, if the PM observes the change and no call is made by the PF, the PM will verbalize the change, expecting confirmation by the PF.
7. Landing Gear and Flap Handles: Should be moved by the PM but only at the command of the PF. The PM moving either handle on his own on an approach instead of at the direction of the PF, shows a break down of cockpit discipline.
8. Heading bug — When the autopilot is on, the PF manipulates the heading bug. When the autopilot is off, the PM may manipulate the heading bug at the instruction of the PF.

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9. Altitude selector — Altitude preselector is always operated by the PM. That said, some SOPs may require it to be set by the PF when the autopilot is on only.
10. Precision approach — When cleared for the approach and at the glide-slope (GS) intercept altitude, set the altitude preselect to the missed approach altitude but preferably once the GS is captured. If the missed approach altitude is below the GS intercept altitude, the aircraft flies through the altitude (rather than capturing it) provided the flight director (FD) captured the GS.
11. LPV approach/ (VGP)___ VNAV should be engaged. When cleared for the approach and at the vertical glide-path (VGP) intercept altitude, set the altitude preselector to the missed approach altitude but preferably once the VGP is captured. If the missed approach altitude is below the VGP intercept altitude, the aircraft flies through the altitude (rather than capturing it) provided the flight director (FD) captured the VGP.
12. Nonprecision approach — When cleared for the approach, select the next lower stepdown altitude at each intermediate altitude. Do not select the next lower altitude until a green ALTS illuminates. At the MDA, set the altitude preselect for the missed approach.
13. Nonprecision approach (VPATH) — When cleared for the approach, select the MDA (Minimum Descent Altitude). Monitor the vertical descent profile while respecting any approach altitude constraints. At the MDA, set the altitude preselector for the missed approach and continue to the MAP (Missed approach point).

Similarly, should this be a VMDA approach, prior to passing the FAF (Final Approach Fix) a technique is to deselect VNAV and select VS (Vertical speed) thereby respecting the AFM limitations and assuredly capturing the MDA while maintaining a constant descent rate which matches the original VPATH profile.

TRAINING AIRSPEEDS AND POWER SETTINGS

The following table is an example of power settings for a 34,000 lb airplane in standard (ISA) conditions. Power settings will vary due to aircraft weight, passengers, temperature, and pressure altitude and the following table is referenced for training targets only.

FLIGHT PHASE	AIRSPEED KNOTS/MACH	N ₁
Takeoff and Climb		
– Takeoff and Rotate	V _R	Takeoff detent
– Flaps 0	V ₂ + 15 (flaps 10) V ₂ + 25 (flaps 20)	CLB detent or power as required

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FLIGHT PHASE	AIRSPEED KNOTS/MACH	N ₁
– Climb (Class D)	200	CLB detent or power as required to hold speed with current pitch attitude
Normal Climb		
– 3,000 – 10,000 ft – Normal	250	CLB detent or power as required to hold speed with current pitch attitude
– 10,000 – Cruise – Normal	250/0.75 250/280/0.80 250/310/0.82	CLB detent or power as required to hold speed with current pitch attitude
Cruise		
– Below 10,000 ft	200	~52%
Miscellaneous Airspeeds		
– Below 10,000 ft	250	~59%
– 10,000 to FL250	250	~70%
– FL410 Cruise – Normal	0.80	~84%
Steep Turns		
– 45° Bank – 15,000 ft	250	Increase 2% before turn ~68%
Slow Flight		
– Flaps 0 – Gear Up	1.23 V _S .8 AOA	~48%
– Flaps 20 – Gear Up	1.23 V _S .8 AOA	~52%
– Flaps 20 – Gear Down	1.23 V _S .8 AOA	~56%

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FLIGHT PHASE	AIRSPEED KNOTS/MACH	N ₁
– Flaps 30 – Gear Down – Level	V _{REF}	~58%
Approach to Stalls		
– Clean	–1 kt per second	IDLE
– Takeoff and Approach	–1 kt per second	50% – 55%
– Landing	–1 kt per second	50% – 55%
Holding		
– 14,000 ft and Below (1 Minute Legs)	180	50%
– Above 14,000 ft (1.5 Minute Legs)	200	59%
Approaches		
– Flaps 0–Gear Up	200 – 180	~51%
– Flaps 10–Gear Up	160	~54%
– Flaps 20–Gear Down	140	~62%
– Flaps 30–Gear Down	V _{REF}	~59%
Normal Descent to Landing		
On GS	V _{REF}	~46%
Level Flight – MDA	V _{REF}	~59%
Level Flight – Circling	V _{REF} + 10	~60%
Landing		
Final for Landing	V _{REF} + ½ Gust Factor (max 10 kts)	

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FLIGHT PHASE	AIRSPEED KNOTS/MACH	N ₁
50 ft above Runway	V _{REF}	Idle

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NORMAL PROCEDURES & TECHNIQUES****PILOT TAKEOFF BRIEFING**

Action: It is recommended that the takeoff briefing be accomplished before requesting the STARTING ENGINES checklist assuming no delays for take off, so that it does not interfere with last minute takeoff preparations. A good takeoff briefing should include, but is not limited to, the following, as applicable:

- Takeoff runway and SID
- SID details, altitude/Speed restrictions, gradients, etc.
- Calculated Takeoff distance vs. runway available
- Taxi plan (when required) RVO/ LVO considerations, hotspots, etc.
- Takeoff FLAP setting
- Bleed / Anti-Ice requirements
- Takeoff weight (based on planned takeoff weight)
- N_1 Thrust setting value
- $V_1 / V_R / V_2 / V_{FTO}$
- Noise abatement procedures (if applicable)
- Acceleration altitude
- Standard takeoff callouts
- Transition altitude
- FGP Modes
- Non-Normal / emergency briefing (including rejected takeoff criteria)
- Emergency evacuation plan
- Weather
- Any deviations from standard
- Threats

Ask if any questions

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SAMPLE TAKEOFF BRIEFING T-S-R-E-D (EMERGENCY BRIEFING)

This sample takeoff briefing is based on a dry runway, 38,000 lbs (17,237 kg) airplane: A potentially useful Mnemonic, TSRED, may aid in the recall of required briefing items.

T — Type of takeoff with associated parameters

S — Standard calls

R — Reject items

E — Emergency plan

D — Departure

T	Type of Takeoff V-Speeds and Thrust	This will be a Flaps 10, rolling takeoff on runway 24 right, length 11,000 ft, takeoff distance required is 4,833 ft. (plus 100 ft for rolling takeoff = 4933 ft). V ₁ is 128 V _R is 132 V ₂ is 139 V _{FTO} is 157 N ₁ is 88.6
S	Standard Calls	Calls are "Airspeed alive", "N ₁ set", "80 kts crosscheck", "V ₁ ", "V _R ", and "Positive rate"
R	Reject Items	"Takeoff will be rejected prior to 80 kts for any abnormality. Between 80 kts and V ₁ , I will reject for: • Master warnings • Directional control problems • Safety of flight issues"
E	Emergency Plan	In the event of an engine failure after V ₁ , we will continue the takeoff. We will plan to remain VFR and return for a visual approach runway 24 right.
D	Departure	This will be a Montreal One departure using Noise Abatement Procedure NADP1/ NADP2. Runway heading to 5,000 ft.
	Ask for questions	

NOTE: Some companies also brief which Flight Guidance Panel modes will be selected for takeoff (Lateral and vertical modes) which is always a good idea.

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HOLDING SHORT OF RUNWAY

ABBREVIATED PILOT TAKEOFF BRIEFING

Action: This abbreviated pilot takeoff briefing could be used as a review briefing before entering the runway of key points. It should cover the essential items that could have changed during the taxi phase (i.e. change of a runway, flaps setting, fuel check, etc).

- Takeoff runway and SID review
- Calculated Takeoff distance vs. runway available
- Takeoff FLAP setting
- Takeoff minimum fuel quantity required vs. fuel on-board
- Cabin notified of imminent departure

Select TOGA to activate the Flight Director (FD) when taxiing into takeoff position. Additionally, to avoid AT deactivation during runway engagement while using differential thrust, it is suggested to arm the autothrottle once aligned with the runway under these conditions. The AT is armed by pressing either engage switch, located at the aft base of either thrust levers. The TO (white) should appear in the left-hand corner of the FMA as well as a AT (white) in the bottom center of the FMA indicator window.

Confirm proper FMA indications upon AT arming. (TO/TO/AT/YD/TO/ALTS)

NOTE: When the thrust levers are advanced past the 23 degrees travel (midpoint), the AT servo will engage and carry the levers to the TO detent (provided pre-conditions are met. See AT section & FCOM2 for further details).



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STANDARD CALLOUTS

PF	PM
TAKEOFF	
Cleared for takeoff	
Call: "Runway Lineup checklist" Arm AT if installed Action: Complete Runway Lineup checklist Call: "Runway Lineup checklist complete" Action: Place hand on thrust levers. Move up two clicks to the TO detent. If AT installed, advance past 23 degrees TLA (approx. mid-point travel) until servos engage. Call: "Set N₁" Action: Verify Thrust levers in the TO detent Call: "Check" Action: Move hand from thrust levers to control wheel Call: "Rotate" or "V_R" Action: Rotate to the takeoff attitude Action: When the VSI is showing positive climb and the indicated altitude is increasing Call: "Positive rate"	

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PF	PM
Call: "Gear up"	Call: "Gear up" Action: When all gear lights extinguished: Call: "Gear indicating up" Call: "V ₂ +15 (Flaps 10) V ₂ +25 (Flaps 20) Action: Above 400 ft AGL and clear of obstacles: Call: "Flaps up, After Takeoff Checklist"
	Call: "Flaps up" Action: Verify flap position indication up Call: "Indicating up" Above 700 ft "Autopilot is available"
"Autopilot On"	Action: After contacting departure control or the next radar center, do the After Takeoff checklist after the PF calls for it Call: "After Takeoff checklist complete" Action: Pressurization check every 10,000 ft
Call: "CLIMB Check"	Call: "Climb Check complete"
CLIMB	
Call: "Climb – Transition checklist"	Action: Complete Climb – Transition checklist Call: "Climb – Transition checklist complete" Call: "_____ (altitude) climbing _____ (altitude)" (e.g., "8,000 climbing 12,000")
Call: "_____ (altitude) climbing _____ (altitude)"	

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PF	PM
At all altitude changes, PF acknowledges the new altitude setting.	
Cruise altitude	
Call: "Cruise checklist"	Action: Complete the Cruise checklist Call: "Cruise Checklist complete"
DESCENT	
Call: "Descent checklist"	Action: Complete the Descent checklist Call: "Descent Checklist complete"
Call: "Descent – Transition checklist"	Action: Complete Descent – Transition checklist Call: "Descent – Transition checklist complete" Call: "_____ (altitude) descending _____ (altitude)" (e.g., "12,000 descending 8,000")
At 1,000 ft before assigned altitude	
Call: "_____ (altitude) descending _____ (altitude)"	Call: "_____ (altitude) descending _____ (altitude)" (e.g., "9,000 descending 8,000")
PRIOR TO BEGINNING THE PRECISION APPROACH (ILS or LPV)	
Prior to 31 nm from destination or below FL180	
Accomplish approach planning and briefing during the cruise or initial descent, if possible, or at the latest when called for in the Approach checklist. Entering the terminal area (31nm): Select within the FMS an approach. If performing an LPV approach, verify the PFD A1 line is showing "LPV ARM" and 1 nm scaling.	
Call: "Approach checklist"	Action: Initiate the Approach checklist Call: "Approach check complete"

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PF	PM
NOTE: Once on vectors, sequence the FMS. Recall the 3-2-1 rule: Within controlled airspace of 3 = 3000', 2 = maximum 200 kts, and 1 = within 10 nm. For LOC based approaches, if the PFD is selected to ROSE format a dotted cyan preview of the HSI inbound course is displayed and superimposed on the active Magenta HSI. Verification of the LOC frequency should also be done. Within the airport environment and the course deviation indicator of the approach captured, verify the PFD A1 line for "LPV ARM" and the FMA vertical GP is armed. This confirms VNAV is engaged if required.	
Call:"Flaps 10"/160 kts	Call:"Speed check; flaps 10" Call:"Indicating 10"
At initial convergence of course deviation indicator	
	Call:"Localizer alive/Course alive"
Call:" Localizer/Course alive"	
When course deviation indicates captured and tracking inbound	
	Call:"Localizer/Course captured"
Call:" Localizer/Course captured"	
At initial downward movement of the glideslope/glidepath	
Call:"glideslope/glidepath alive"	
	Call:"glideslope/glidepath alive"
2 dots prior glideslope/glidepath	
Call:"Flaps 20"/140 kts	Call:"Speed check" Call:"Flaps 20, indicating 20"
1 dot below glideslope/glidepath	
Call:"Gear down"	Call:"Gear down" Call:"Gear down, three green"
Call:"Gear down three green"	
At glideslope/glidepath capture	

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PF	PM
Call: "Flaps 30, before landing checklist"/ Vref	
Call: Speed check; flaps 30"	
Call: "Indicating 30"	
Call: "Glideslope/glidepath captured" "Set missed approach altitude"	
Call: "Check" "Missed approach altitude set"	
Action: If not already accomplished, complete the Before Landing checklist	
Call: "Before Landing Checklist complete"	
Verify the PFD A1 line for "LPV APPR" message and not "NO APPR"	
At the Final Approach (FAF)	
Action: Start timing, if needed Visually crosscheck that altimeters agree with crossing altitude Set missed approach altitude Call the tower Look for runway environment	
At 1,000 ft above DH	
Call: "1,000 above minimums"	
If IMC, should be stable at 1000' above minimums If VMC, should be stable at 500' above minimums	
Call: "Check/Stable" if IMC	
At 500 ft above DH	
Call: "500 above minimums"	
Call: "Check/Stable" if VMC "No flags"	
At 100 ft above DH	
Call: "Approaching minimums"	

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PF	PM
Call: "Check"	
At minimums or when the runway environment is in sight	
Call: "Visual Landing" Call: "Autopilot disconnect"	Call: "Minimums" or "Runway (or visual references) ____ o'clock (lead-in lights)"
	Call: "Check"
	After touchdown
Action: Brakes applied and thrust reversers as required	
NOTE: Spoilers automatically extend after touchdown. Monitor both the thrust reversers and spoilers.	
Call: "Spoilers extended, TRs deployed"	
Call: "Airspeeds during deceleration" (e.g.: 80, 60, 40 kt)	
After clearing the active runway	
Call: "After Landing/Clearing Runway checklist"	
Action: Complete After Landing/Clearing Runway checklist	
Call: "After Landing/Clearing Runway checklist complete"	
PRECISION MISSED APPROACH	
At minimums and no runway environment in sight	
Call: "Go-Around Set N1"	Call: "Minimums, Go-Around"
Action: Press the go-around TO/GA button, advance Thrust to Takeoff (TO) detent unless AT is engaged, Flight Spoilers retract (if extended), Pitch up to the command bars.	
Action: Verify the N ₁ setting for go-around	

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PF	PM
Call: "Flaps 10"	Call: "N1 Set" Call: "Flaps 10" Call: "Indicating 10" Action: When the VSI is showing positive climb and the indicated altitude is increasing Call: "Positive rate"
Call: "Gear up"	Call: "Gear up" Call: "Gear indicating up"
NOTE:	If an FMS approach was flown, the FMS will auto sequence into the missed approach and only a vertical mode on the FGP is required for navigation purposes. If a LOC based approach is flown, the NAV source must be changed from Green to Magenta source and then the appropriate FGP selections (NAV and Vertical mode) can be made to sequence into the missed approach.
Missed approach procedures	
Call: "Flaps 0"	Action: Announce initial heading and altitude for missed approach Clear of obstacles Call: "V _{GA} +15 KIAS" Call: "Flaps 0" Call: "Indicating 0"
Call: "Go-Around checklist"	When at safe altitude and time permitting, accomplish a Go-Around checklist Call: "Go-Around checklist complete"
NON PRECISION APPROACH	
Prior to 31 nm from destination or below FL180	

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PF	PM
Accomplish approach planning and briefing during the cruise or initial descent, if possible, or at the latest when called for in the Approach checklist. Within the terminal area (31nm) select an approach in the FMS. Verify the PDF A1 line is showing "RNP ARM" and 1 nm Scaling. Call:"Approach checklist" Action:Initiate the Approach checklist Call:"Approach checklist complete" NOTE: Once on vectors, sequence the FMS. Recall the 3 – 2 – 1 rule: Within controlled airspace of 3 = 3000', 2 = maximum 200 kts, 1 = within 10 nm. Within the airport environment and the course deviation indicator of the approach captured, verify the PFD A1 line for "RNP ARM" and the FMA vertical GP is armed. This confirms VNAV is engaged if required.	
After level-off intermediate approach segment	
Call:"Flaps 10"/160 kts Call:"Speed check; flaps 10" "Indicating 10"	
At initial convergence of course deviation indicator	
Call:"Course alive" Call:"Course alive"	
When course deviation indicates captured and tracking inbound	
Call:"Course captured" Call:"Course captured" NOTE: Verify the PFD A1 line for the "RNP APPR" message. Also verify the FMA vertical mode GP is armed. This confirms VNAV is engaged if required. Should only a path exist the altitude preselector will have to be set lower for the PATH (FMA) to appear and the PFD A1 line should display (REF APPR). If unfamiliar with these types of approaches VS mode may be the preferred method while deselecting VNAV.	
5 nm prior to final approach fix (FAF) or 2 dots below VGP	
Call:"Flaps 20"/140 kts Call:"Speed check; flaps 20"	

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PF	PM
At one DOT below VGP	Call: "Indicating 20"
Call: "Gear down"	Call: "Gear down"
	Call: "Gear down three green"
Call: "Gear down three green"	
Prior to the FAF, confirm the PFD A1 line is indicating "RNP APPR"	
1 nm prior to final approach fix (FAF) or VGP intercept	
Call: "Flaps 30""Before Landing Check", Vref	Call: "Speed check, flaps 30"
	Call: "Indicating 30" Complete the Landing Checklist
	Call: "Landing Checklist Complete"
At Final Approach Fix (FAF)	
	Action: Start timing Visually crosscheck that both altimeters agree Set MDA (to nearest 10 ft above) in Preselected Altitude
At 1,000 ft above MDA	
In IMC should be stable at 1000' above minimums In VMC should be stable at 500' above minimums	Call: "1,000 above minimums"
Call: "Check/Stable" if IMC	
At 500 ft above MDA	
	Call: "500 above minimums"
Call: "Check/Stable" if VMC	
At 100 ft above MDA	
	Call: "Approaching minimums"

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Call: "Checked"	
At minimum descent altitude (MDA)	
	Call: "Minimums, (time) or (remaining distance) to go"
Call: "Checked"	
At point where the runway or runway environment is in sight	
	Call: "Runway (or visual references) _____ o'clock (lead-in lights)"
Call: "Visual"	
Call: "Autopilot disconnect"	
	Call: "Check"
After touchdown	
Action: Maintain runway alignment. Brakes applied and thrust reversers as required	
	NOTE: Spoilers automatically extend after touchdown. Monitor the thrust reversers.
	Call: "Spoilers extended, TRs deployed"
	Call: "Airspeeds during deceleration" (i.e.: 80, 60, 40 kt)
After clearing the active runway	
Call: "After Landing/Clearing Runway checklist"	
	Action: Complete After Landing/Clearing Runway checklist
	Call: "After Landing/Clearing Runway checklist complete"
NON PRECISION MISSED APPROACH	
At MAP and no runway environment in sight	
Call: "Go-Around, set N1"	Call: "Minimums (or MAP), Go-Around"

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PF	PM
Action: Press the go-around TO/GA button. Advance Thrust to the Takeoff (TO) Detent unless AT engaged, Flight Spoilers Retract (if extended). Pitch up to the command bars. Call: "Flaps 10"	Action: Verify the N_1 setting for go-around Call: "N ₁ set" Call: "Flaps Selecting 10" Call: "Indicating 10" Action: When the VSI is showing positive climb and the indicated altitude is increasing Call: "Positive rate" Call: "Gear up" Call: "Gear up" Call: "Gear indicating up"
Missed approach procedures	
Call: "Flaps 0" Call: "Go-Around checklist"	Action: Announce initial heading and altitude for missed approach Clear of obstacles Call: "V _{GA} + 15 KIAS" Call: "Flaps 0" Call: "Indicating 0" Action: When at safe altitude and time permitting, accomplish the Go-Around checklist Call: "Go-Around check complete"

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SECTION 2 NORMAL PROCEDURES & TECHNIQUES

COCKPIT RECOMMENDED SET UP

PFD SETUP	PF	PM
FORMAT	ROSE*/PPOS	ROSE*/PPOS
NAV SOURCE	FMS 1	FMS 2
POINTERS	AS REQ'D	AS REQ'D
TRAFFIC (TCAS)	OVERLAY SELECTED	OVERLAY SELECTED
TERRAIN	SELECTED	SELECTED
WEATHER	NOT SELECTED	NOT SELECTED
RANGE	10 NM OR AS REQ'D	10 NM OR AS REQ'D

MFD SETUP	PF	PM
UPPER WINDOW	EICAS	SUMMARY
LOWER WINDOW	PPOS	PPOS
MFD DATA WINDOWS	VNAV	ON
POINTERS	AS REQ'D	AS REQ'D
TRAFFIC (TCAS)	OVERLAY SELECTED	OVERLAY SELECTED
TERRAIN	NOT SELECTED	NOT SELECTED
WEATHER	SELECTED	SELECTED

FMS SETUP	PF	PM
FMS PAGE	LEGS PAGE	TUNE PAGE

* means preferred

For departures typically the speed bug is set to 200kts based on the 3-2-1 rule of controlled airspace:

- 3 = within 3000'
- 2 = maximum 200 kts
- 1 = within 10 nm of an airport



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SECTION 2 NORMAL PROCEDURES & TECHNIQUES

PRETAKEOFF

The FD should be setup in the TO/TO mode complemented with any lateral mode armed (eg: LNAV) that may be required as per a departure procedure. Standard Instrument Departure (SID) procedures assume a standard rate turn and a 3.3 % (200 ft/nm) climb gradient, more if stated or depicted on the SID. Appropriate navigation modes should be set up at this time. Both pilots should be aware of which pilot is in command of the FD by verifying the position of the FD couple arrow on the top center of both PFDs.

Determine which navigation source (FMS or VHF) should be used and set up both PFDs accordingly. Tune appropriate frequencies, set courses, and select bearing pointers as desired.

Before entering the runway environment, the crew should scan the PFDs and EICAS, review displayed information, and ensure CAS messages are appropriate for the configuration. Confirm V-speeds are posted, Speed bug set to 200 kts or as required, HDG bug as required, FMA modes set for departure and pre-selected altitude as per clearance.

The PM is responsible for several areas of attention and some areas overlap with the PF. Throughout the takeoff, the PM monitors the EICAS. The normal flap setting for takeoff is flaps 10 due to the increased climb capability in the second segment. Flaps 20 can be used for short field considerations when obstacle clearance is not a factor.

Takeoff procedures, such as a Static takeoff versus a rolling takeoff should be discussed before departure. Runway length, runway conditions, and prevailing/anticipated weather are among the deciding factors.

Takeoff from a Static start must be accomplished when the computed takeoff distance is at or near actual runway length. Hold the brakes as thrust is advanced to the takeoff detent and takeoff power is achieved, and then release the brakes smoothly. Only by using this procedure can computed takeoff and climb performance figures be met.

A rolling takeoff may be accomplished when actual runway length is at least 300 ft longer than computed takeoff distance and obstacle clearance is not a factor. As the aircraft is aligned on the runway, advance the thrust levers smoothly to the takeoff detent. A rolling takeoff adds 100 ft to the takeoff field length.

Additionally, The extra runway required for a rolling takeoff depends on how long it takes to set the takeoff thrust and how far the airplane moves down the runway before takeoff thrust is set. Because of the numerous different CAS messages that could be displayed, an added safety feature is the CAS takeoff and landing inhibit mode. Distractions can complicate the critical phases of flight, mostly takeoff, final approach, and landing. For this reason, restrictions have been built into the CAS messaging logic to inhibit certain warning, caution, and advisory CAS messages until the takeoff or landing phase is completed. This mode also prevents the master caution or warning light and chime from activation should one of the selected CAS messages be detected.

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SECTION 2 NORMAL PROCEDURES & TECHNIQUES

TAKEOFF PROCEDURES

When cleared for takeoff (Fig. 2-1), the PF should call for "RUNWAY LINEUP checklist". The PM completes and calls "RUNWAY LINEUP checklist complete; cleared for takeoff". The PF smoothly advances thrust levers to the takeoff (TO) detent unless AT is armed and the travel occurs automatically past approximately 23 degrees TLA (midpoint) and tracks the runway centerline. The PM confirms the throttle levers are in the TO detent and the N_1 setting matches the N_1 bugs and calls, " N_1 set."

As airspeed becomes active, the PM verifies airspeed increasing on both PFDs and calls "airspeed alive". The PM calls "80 kts crosscheck" to which the PF responds "check". The purpose of the 80 kt cross check is for the PM to cross check both PFDs for airspeed indications matching, a general scan of MFD 1 and all 4 displays for anything abnormal. This call also serves as an incapacitation verification, denotes a marked transition for rejected take off criteria and CAS inhibit logic

NOTE: If autothrottle equipped, the crew must confirm that the AT has achieved the required takeoff thrust setting prior to 80 KIAS with the annunciation of "HOLD" on the FMA. At this point the "HOLD" will be indicated as active until 400 ft AAE and no further adjustments are made by the autothrottle, (AFM limitation).

At V_1 speed, the PM calls, " V_1 ". The PF releases the thrust levers and puts both hands on the control wheel. At V_R the PM calls, " V_R or Rotate". Under normal circumstances with two engines running, the PF rotates the aircraft at 3 to 4° per second to the command bars.

When a positive rate of climb is achieved, the PM calls, "Positive rate" to which the PF responds "gear up". The PM moves the gear handle to the up position and monitors the gear lights while the gear is retracting. The PF should then call for appropriate flight director modes (e.g.: HDG/NAV and FLC).

When clear of obstacles and accelerated, upon the PF's request, the PM initiates flap retraction. The PM positions the flap handle to the 0 position and monitors the flap indicator for the correct setting.

Flaps 0 can be initiated

$V_2 + 15$ for flaps 10 or

$V_2 + 25$ for flaps 20.

After contacting departure control, the PF calls for the After Takeoff checklist. The PM should then complete the After Takeoff checklist and announce "Flaps up, After Takeoff checklist complete". When able to continue the climb after takeoff, the PF will set the thrust levers to maximum climb power (CLB) and select the desired climb schedule or technique. Above 700 ft Autopilot may be engaged.



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SECTION 2 NORMAL PROCEDURES & TECHNIQUES

CLIMB AND CRUISE PROCEDURES

The PM announces all assigned altitudes and sets them in the altitude preselect window. The PM also calls out 1000 ft above or below all assigned altitudes and any altitude restrictions. For example:

“Through 9000 ft, climbing 10 000 ft,” or “Through FL 400, climbing FL 410”.

The PM also announces other significant altitudes, such as,

“10000 feet, 18000 feet and/or Transition Altitude”

Passing through 10 000 ft, the CLIMB check should be completed. This is also a reminder for those operators who subscribe to a sterile cockpit (no distractions or extraneous conversations) below 10 000 ft, that sterile cockpit procedures can be ended. Since the aircraft can climb to altitudes in excess of FL 410 in a very short time, it is recommended the crew check the pressurization system (pressure differential vs. cabin altitude) at each 10 000 ft interval throughout the climb.

FLC is the recommended vertical mode for any normal climbs. During climbs in FLC mode at higher altitudes (high FL 300s and above), it is possible that air mass variations may contribute to slight pitch variations. These variations are more noticeable in the flight compartment than in the cabin. If pitch variations are deemed to be excessive, an alternative vertical mode (Vs) may be used with caution. Another exception may occur where low level level offs are required after take off or multiple step climbs as seen in the London area or Teterboro NY. Of course this technique must consider minimum departure climb gradients, noise abatement procedures and so forth.

“When safe, practical, and in accordance with the carrier's approved operating procedures, pilots should limit vertical speeds to 1,500 fpm or less when within 2,000 feet of assigned altitudes. This procedure will reduce the frequency of unnecessary RAs and be in conformance with the ICAO guidance contained in PANS-OPS. In summary, there are certain incompatibilities between TCAS and ATC procedures or airspace design that exist today that will not change with TCAS Version 7.1. To mitigate their effects, improvements in airspace and procedure development as well as flight training and procedures will be needed.”

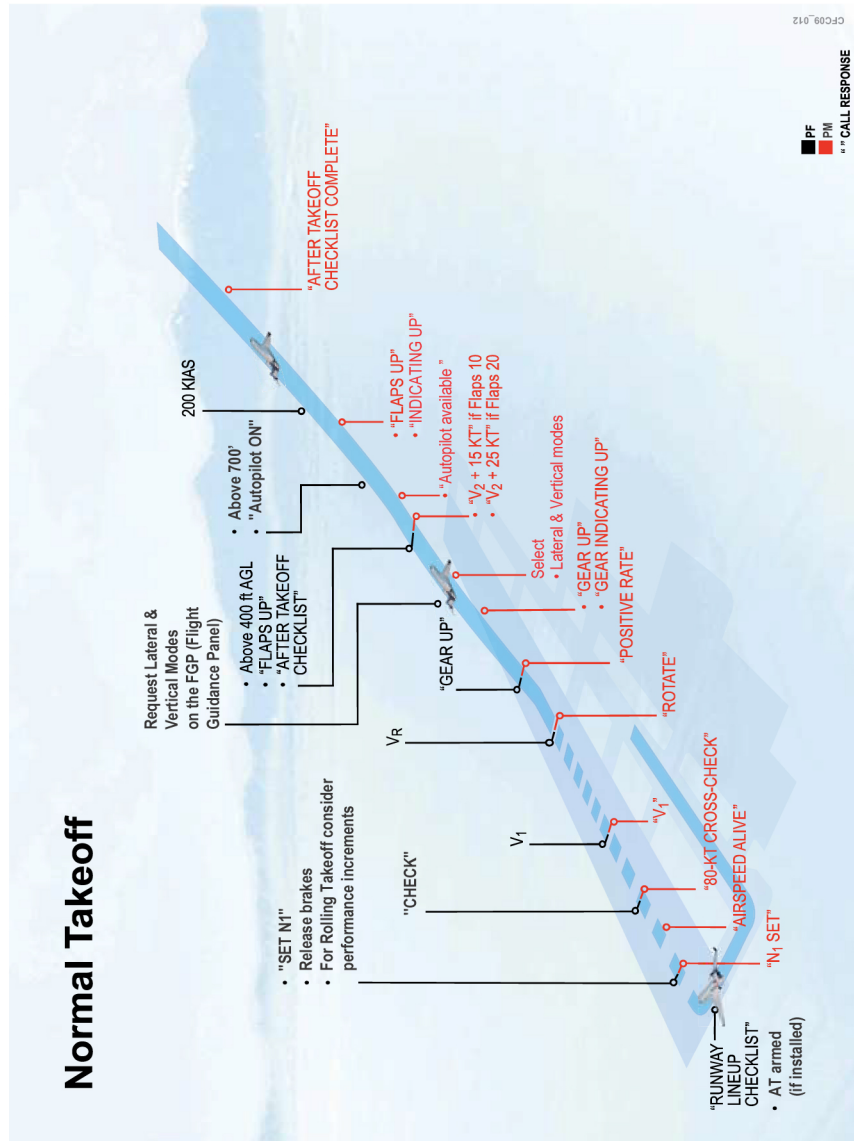
(Refer: Introduction to TCAS II Version 7.1, FAA HQ-111358, Feb28, 2011)

Additionally, when operationally viable, climbing in FLC mode may lead to high climb rates and may cause altitude capture deviations. To manage the energy in a climb for proper capture of an altitude, VS should be used to reduce the closure rate of capture. Typically, 2000 ft/min should be attained within 2000 ft of assigned capture altitude and 1000 ft/min attained within 1000 ft of capture altitude.

When balancing fuel from wing to wing, use a hands-on technique on the appropriate fuel panel switch as a reminder to prevent an imbalance from occurring to the opposite side. The Cruise checklist should be completed when the final cruising altitude is reached.

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SECTION 2
NORMAL PROCEDURES & TECHNIQUESNormal Takeoff – Standing or Rolling
Figure 09-12-9



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DESCENT PROCEDURES

STARS should be setup on the navigation equipment prior to beginning the letdown and then can be programmed into the FMS. This should be done above 10 000 ft. Below 10 000 ft, maintain a visual scan. For normal planning purposes, the aircraft should be down to 10 000 ft, 30 miles from the airport. Additionally, the 3 to 1 rule of thumb works very well. For every 3 nm calculate 1000 feet and that should give an approximate 3 degree glide path. In actuality the numbers are 320'/nm but 3/1 rule of thumb is just easier to calculate and is a good estimate.

The VNAV function in the FMS: See VNAV section.

When the descent is initiated, the PF calls for the "Descent checklist". The PM accomplishes the Descent checklist, as directed by the PF, and makes the appropriate altitude callouts. However, as with any other checklist, should the PF fail to call for the appropriate checklist, the PM should prompt the PF by calling, "Standing by for the.....checklist".

To ensure adequate obstacle clearance, temperature corrections shall be applied to the published procedure altitudes, including minimum sector altitudes, DME arcs, FAF crossing, MDA/DA and missed approach altitudes when operating in a non-radar environment. When operating under ATC control, altitudes inside the FAF shall be corrected to ensure adequate obstacle clearance.

Corrections apply with an OAT below ISA (or as required by your Authority), and must be calculated before commencing the approach brief.

For precision approaches with a published glidepath angle, such as ILS or LPV, the DA (H) shall be temperature compensated when temperature compensation is required.

Baro minimums shall be set to compensated altitudes when temperature compensation is used.

FMS altitude compensations are done via the TEMP COMP feature located in the FMS INDEX menu. The MDA/DA must be manually set to the temperature compensated altitude. There is a requirement to advise ATC when flying with temperature compensated altitudes.

APPROACH PLANNING AND BRIEFING

Approach planning and briefing should be accomplished during cruise or initial descent, if possible, or at the latest when called for in the Approach checklist. Review of hazardous Terrain, Minimum Enroute Altitudes (MEAs), and Minimum Sector Altitudes (MSAs) should be accomplished. During the early part of the descent, the PM should obtain destination weather.

The PF normally assumes ATC communications during this period. After checking the weather, the destination weather should be briefed, along with the expected approach and any other significant information. At this point, the type of approach can be selected and programmed into the FMS.

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The PF normally transfers aircraft control to the PM during the approach briefing. This does not necessarily mean to select the XFER button for such a short period of time. Complete and review performance data to include V_{REF}/V_{GA} speeds and landing distance. Once the briefing is complete, both pilots must ensure the AP/FD XFR arrow is pointing to the appropriate side. In addition to the above items, the following should also be addressed in the approach briefing:

- Approach to be flown and backup approach, if available
- AFCS modes to be used and expected FMA indications
- Special procedures during the approach, such as circling approach (Missed approach from different points), interception of a radial from an arc, VDP, etc.
- Altitudes of IAF, FAF, step-downs, sector altitudes, and obstacles
- BARO or RA Minimums set and select on temperature compensation requirements
- Missed approach point, procedures, and timing to MAP/VDP
- NAV aid setup desired to the side from which the approach is flown
- Anti-icing requirements
- Specific PM duties and callouts: standard 1000, 500, 100 above, minimums
- Procedure for transitioning to visual flight
- None essential information: Planned runway exit point and taxi routes/gate – Request for, “Any questions?” directed to the PM
- Threats

Some like to use acronyms to do their briefings and Transport Canada has provided one but there are many in the aviation world: AMORTS

A – Approach

M – Minima

O – Overshoot

R – Radios

T – Timing

S – Speeds and Supplementary Remarks & Threats

For those who use Jepp Charts, the flow of reading the approach plate generally covers the requirements. Coupled to a review of the FMS approach briefing page on the MFD, you are simply left with Remarks and Threats analysis.



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Either method is acceptable but the importance of a thorough and complete briefing can not be overemphasized especially during complex maneuvers such as circlings. Previous accident investigations have found the lack of proper briefings (especially Remarks and Threats) to be contributing factors to some accidents.

The remarks and threats can be related to possible windshear, icing conditions (accretion rates and effects), MELs. They could easily extend to pilots feeling fatigued after a long day and requiring extra meticulousness and diligence to details. All of these are merely some examples but the list could be much longer on what the PF determines relevant at the time.

ADDITIONALLY FOR VISUAL APPROACH

The PF should call the Transition and Approach checklists when descending out of FL 180 or when within 50 miles of the destination airport. The checklist is accomplished so as not to interfere with the visual scan for traffic.

Configuration changes during the approach should be accomplished using the same crew coordination techniques used after takeoff. The PF calls for a configuration change, and the PM acknowledges the change, selects the switch position, monitors, and reports when the configuration is in the selected position. The Approach checklist is completed and the airplane slowed to 200 kt or less and configured to flaps 10 when entering the terminal airspace.

Approximately seven miles from the runway, the PF should slow the airplane to Flaps 10/160 kts when deemed appropriate (typically 5 NM from the FAF) and then call, "Flaps 20, gear down". And slow to Flaps 20/140 kts. Both crew members should verify the gear down indications. Within two to three miles from the FAF for a straight-in two-engine approach, the PF calls for flaps 30/ Before Landing Checklist and slows the airplane to Flaps 30/ $V_{REF}+10$ then begins a descent and slows to V_{REF} . The PM also confirms the communication and navigation radios are set properly, checks the flight instruments, airspeed bugs, preselect altitude display, and displays on both PFDs. After confirmation that Flaps are set to 30, the PM subsequently reports "Before Landing checklist complete". While in the terminal airspace, a vigilant visual scan should be maintained by both crew members. During the approach, the PM should also make airspeed and vertical speed calls as requested by the PF.

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SECTION 2 NORMAL PROCEDURES & TECHNIQUES

NORMAL APPROACH FOR LANDING

The last mile (at least) of the final approach should approximate an ILS glideslope with a rate of descent of approximately 600 to 800 fpm. A widely recognized rule for computing an acceptable sink rate is $(GS \times 10)/2$ equals sink rate in feet per minute (i.e., add a zero to the end of the airspeed value and divide by 2):

$$\frac{130 \text{ kt} \times 10}{2} = 650$$

Maintaining V_{REF} on final approach is important to obtain the calculated landing distances. Each knot over the calculated V_{REF} can cause excessive runway usage and must be accounted for. Flying the final approach slower than V_{REF} causes extremely hard and/or premature touchdowns and is never recommended. V_{REF} must be incremented as per the AFM for gusty conditions but the required landing distance should be incremented as well to compensate for the higher approach speed.

Use of autothrottle is recommended to reduce crew workload during the approach and landing. Approaches in turbulent conditions may be treated similarly to gusty conditions. Adjust V_{REF} such that speed fluctuations occur from V_{REF} and up.

For example: if turbulence is causing the speed to dip 3 kts below V_{REF} then compensate by adding 3 kts to the approach speed to ensure adequate speed margin. It is highly likely that turbulence and gusts may be coincident.

Should the aircraft be in strong gusty conditions where the autothrottle begins chasing the speed (e.g.: continuously adjusting above and below the selected speed), disengage the AT system and manually set the power setting to avoid chasing or to stay above the required speed.

The previously mentioned practices are for an optimal approach to landing. If operating in a busy terminal airspace, the speeds and procedures should be adjusted accordingly. That being said, ATC may sometimes request higher approach speeds to accommodate their traffic volume but it is incumbent upon the pilot to refuse such requests late in the game when a stabilized approach profile is required especially past the FAF.



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LANDING

See Fig. 09-12-10. In a V_{REF} landing configuration, the aircraft is in a near landing attitude. V_{REF} should be achieved at 50 ft AAE for Landing performance numbers to be met. Refer to Normal Approach for Landing – Two Engines for V_{ref} adjustment considerations. Constantly trim pitch to neutral and maintain V_{REF} until within a few feet of the runway. Then reduce thrust smoothly to idle and raise the nose very slightly from the attitude maintained on final approach. With aft mounted engines, the nose tends to rise as thrust is reduced and very little back pressure is required. Maintain attitude and allow the aircraft to fly onto the runway surface. During this slight flare, do not continue to raise the nose as the airspeed decreases (known as holding it off) or the aircraft will float and the calculated performance numbers will not be obtained.

If the aircraft is in a normal landing configuration and is equipped with autothrottle, the AT RETARD Mode will arm when reaching 200 Feet AGL (RETARD in white). Upon descending through 50 ft AAE, the RETARD mode will activate (RETARD in green) and both Thrust levers will be reduced to IDLE. This sequence is consistent with the AFM Performance considerations for landing distance assessment.

Short field approaches and landings should also be made at V_{REF} as much as possible accounting for winds and increased distances as required. Do not attempt to grease it on or flare as much as normal landing. The wheel brakes are the primary means of stopping the aircraft and help achieve the calculated landing distance. Brakes efficiency is reduced if the tires are not firmly on the runway surface.

Upon touchdown, the spoilers will deploy automatically. The PM should verify and call, "Spoilers Deployed". Lower the nosewheel smoothly to the runway, apply brakes as necessary and deploy the Thrust Reversers (TRs). To achieve maximum braking, do not pump the brakes. Use a smooth application, steadily increasing pressure on the brake pedals until the airplane decelerates at an appropriate rate. Use sufficient braking action early in the landing roll, while keeping passenger comfort in mind.

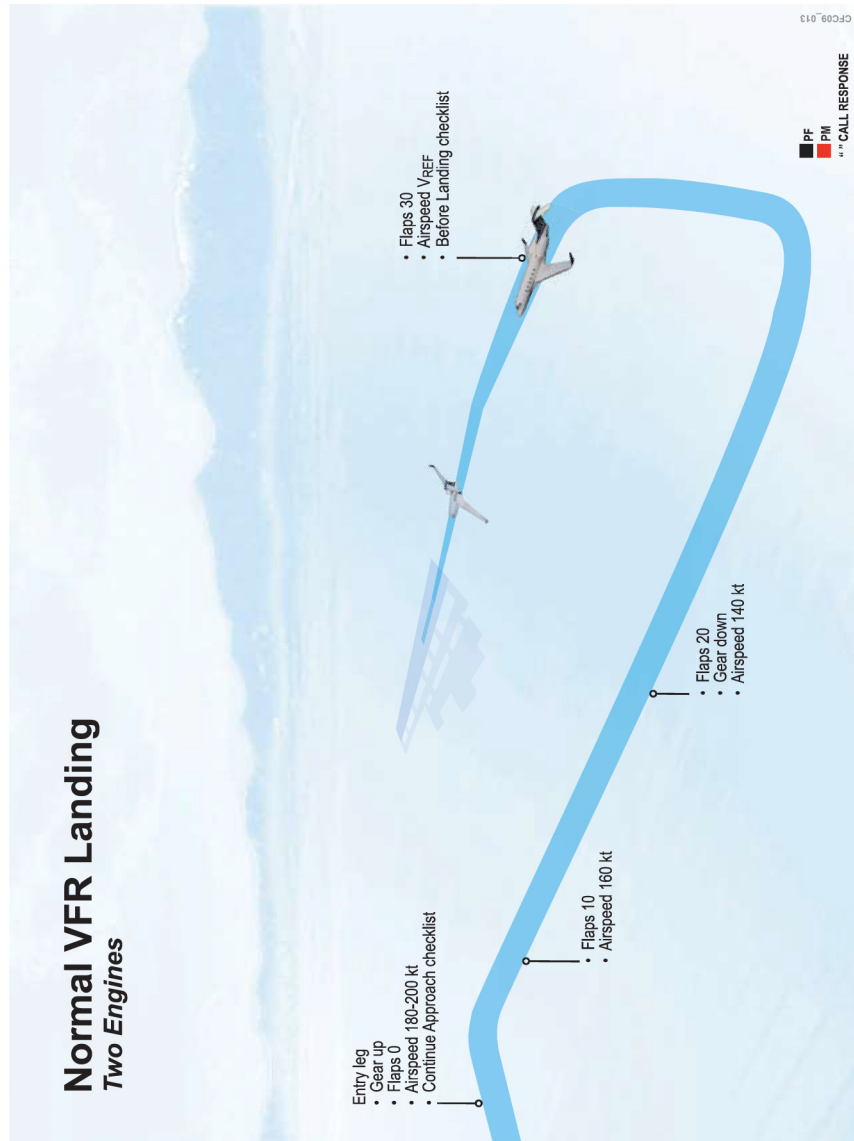
When the PM calls, "Two deployed", smoothly pull the TR levers to the desired reverse thrust. If the TR levers remain in the maximum reverse thrust position, the engines begin to schedule down as the aircraft decelerates through 85 KIAS. During deceleration, when appropriate, smoothly and deliberately return the TR levers to the IDLE position in order to be at Reverse IDLE when reaching 40 KIAS. Use brakes and rudder as necessary for directional control. Move the thrust levers to the STOW position when desired. The PM should confirm the green and white REV EI indication has extinguished and the reversers are stowed. Refer to the AFM limitations for operation of the thrust reversers. After clearing the runway, proceed with normal after landing procedures.

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NORMAL PROCEDURES & TECHNIQUES



Normal VFR Landing – Two Engines
Figure 09-12-10

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CROSSWIND LANDING

Crosswind landings are similar to those in other aircraft. Adequate aircraft control in a crosswind velocity (measured at a 10 m height) of 28 kt during takeoff and 24 kt during landing was demonstrated during certification tests. Use the crab approach, then transition to a wing low, slipped drift correction prior to touchdown. Hold the upwind aileron into the wind through touchdown and track the centerline on the rollout. The spoilers will deploy automatically, reducing lift, and making the brakes more effective. In extreme crosswind conditions, an airspeed slightly higher than V_{REF} is warranted. As a general rule, an increase of one-half the gust factor up to a maximum of 10 kt over V_{REF} may be appropriate on final approach. Do not allow the aircraft to float with power off prior to touchdown. Fly the aircraft to touchdown with a mild flare. Upon touchdown, keep the aircraft on the surface. As the spoilers deploy automatically, follow through the landing rollout with roll control into the wind.

SLIPPERY SURFACES

Landing on a slippery surface requires careful consideration of many factors, such as type of runway surface, approach hazards, temperature, ice, water, snow, and other crosswind scenarios. Normally, thrust reverser operation helps achieve the computed stopping distance with a greater margin of safety. Wet and contaminated runway data is published in the AFM and AFM Supplements.

ONE ENGINE INOPERATIVE LANDING

With one engine inoperative, TRs may not be as effective on a contaminated runway as on a dry runway. Full single-engine reverse is fine on a dry runway, from a directional control standpoint. However, do not attempt high power single-engine reverse on slippery runways. Differential reversing on a slippery runway may not yield satisfactory performance. Be prepared to stow thrust reversers immediately if the airplane begins to slide sideways. The effects may be substantially different in crosswind scenarios depending if the acting thrust reverser is upwind or downwind.

HYDROPLANING

If there is a possibility of hydroplaning, use aerodynamic braking to slow below hydroplaning speed. Hydroplaning speed is approximately 112 kt for accelerating aircraft (nine times the square root of tire pressure) and 100 kt for a decelerating aircraft (eight times the square root of tire pressure). The main gear tire pressure should be serviced to 167–175 psi and the nose gear tire pressure should be serviced to 113–119 psi. If brakes are applied while the tires are hydroplaning, the hydroplaning can continue to a much lower speed.

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GO-AROUND/MISSED APPROACH

A missed approach is accomplished when at DH/DA, the MDA when the time period is expired, the set distance is reached, sight of the intended landing runway is lost, or when in a position from which a normal visual landing approach cannot be accomplished. Other situations could also warrant the initiation of a missed approach.

If a go-around is necessary, either pilot can call for a go-around. The PF acknowledges by calling, "Going around". At this point, selecting FD go-around mode (GA) through either TOGA switches (located on both thrust levers) repositions the command bars to 8° nose up, and disengages the autopilot and activates the GA thrust mode if autothrottle was engaged. While pitching up to the command bars, if autothrottle was not engaged set power to the takeoff detent "Set N₁". The pitch attitude may have to be increased to more than 8° to attain V_{GA}.

The PF calls for flaps 10° when the speed trend is increasing and gear up (after a positive rate of climb is established). The PF climbs at V_{GA} and checks spoilers retracted. At relatively light gross weights, the aircraft quickly accelerates to V_{GA} with takeoff thrust. After climb and desired speed are established and when clear of all obstacles, reduce thrust as necessary to establish approximately 2000 fpm rate of climb. The trend vector is a helpful tool in accomplishing this.

The PM sets or confirms flaps 10°, calls out the direction of turn, if one is required, and the missed approach heading and altitude. The PM also notifies ATC of the missed approach, and retracts the flaps as per schedule. The Go-Around checklist is then accomplished.

The lateral mode is always GA at the start of the GA. If a ground-based approach (LOC, green needles) was being flown, the lateral command on the FD will be GA. To fly the missed approach sequenced in the FMS, this will require that the NAV source be selected to magenta and then engage NAV on the FGP. This is accomplished through the NAV SRC button located on the Display Control Panel (DCP). Once the magenta NAV source is selected (on-side FMS), NAV can be initiated to fly the published missed approach.

If an FMS-based approach (magenta needles) is flown, the lateral command bar is automatically selected to NAV and the only adjustment required in the missed approach would be for the vertical requirement (e.g.: FLC to GA speed).

NOTE: Prior to selecting a vertical navigation mode and engaging autothrottle, confirm MAA has been selected. If MDA remains, upon selection of FLC the AT will move the thrust levers to idle (THRUST MODE).

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SECTION 2 NORMAL PROCEDURES & TECHNIQUES

BALKED LANDING/LOW ENERGY GO-AROUND

According to Transport Canada AC 700-016, a Balked Landing is considered to be distinctly different from a "Low Energy Landing Regime".

A **Low-Energy** landing regime is defined as a condition where a rejected or balked landing is commenced after a commitment to a landing has been made. In a low-energy landing regime, the aeroplane is in a descent at a height of 50 feet or less above the runway, in the landing configuration with thrust stabilized in the idle range, and airspeed decreasing (up to $V_{ref}-10$). An attempt to conduct a rejected or balked landing from a low-energy landing regime may result in ground contact. Be prepared for a touchdown; airplane aligned with runway, bank angle minimized.

The engines are usually in, or close to, a low idle thrust setting and require several seconds to accelerate to MAX THRUST (TO). Missed approach obstacle clearance is often not considered from below the missed approach point. A mitigation strategy should be considered especially in obstacle rich environments. If there are any doubts regarding the probability of completing a safe landing, a Go-Around must be initiated.

A low Energy Go-Around should be addressed as follows:

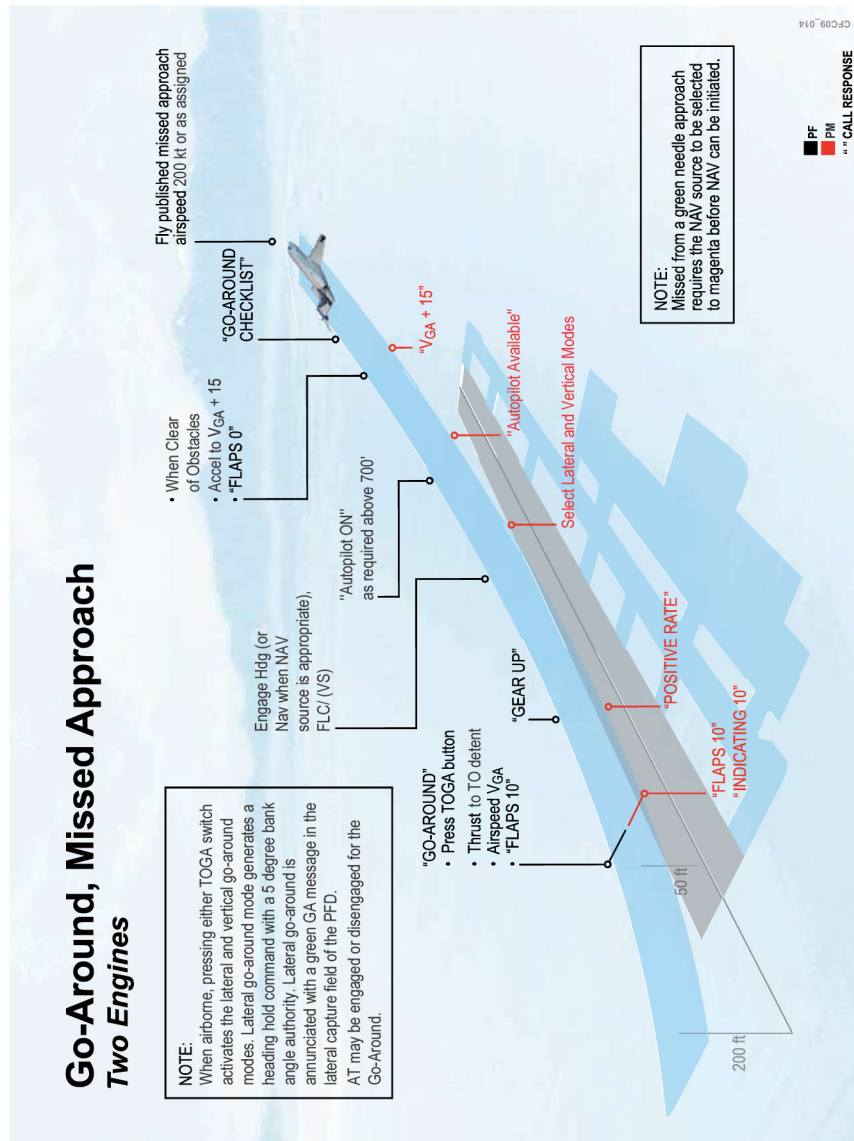
- Disengage AT
- Initiate a Go-around and simultaneously select TOGA and advance thrust levers to TO THRUST and confirm Spoilers retracted
- Maintain landing GEAR and FLAP configuration. (No configuration changes)
- Initially maintain or slightly increase pitch attitude (Similar to a flare)
- Be prepared for a touchdown; airplane aligned with runway, bank angle minimized

NOTE: During touchdown, autothrottle may disengage. Ensure that thrust levers have advanced to TO THRUST.

- When safely established in the go-around with no further risk of touchdown (speed at or above VAC and airplane climbing), set FLAP 20, raise the gear
- Continue with the GA profile
- Re-engage automation as desired

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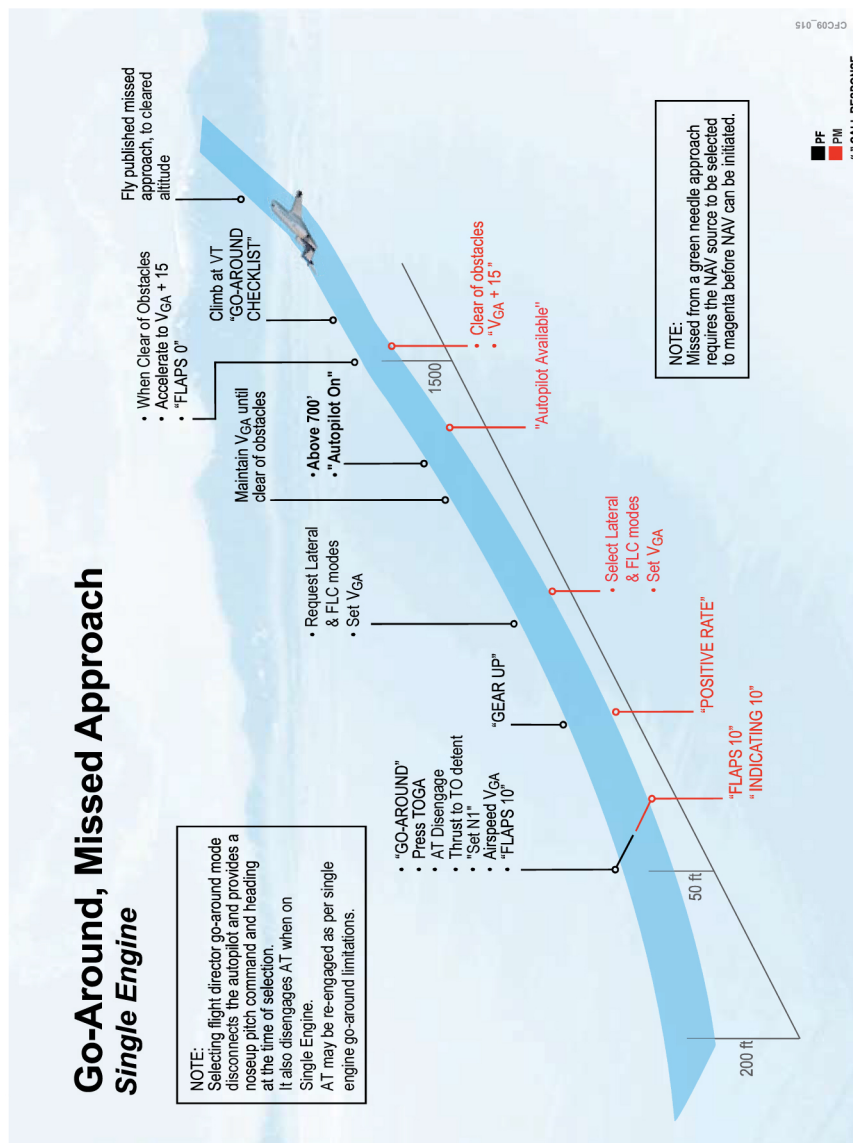
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SECTION 2
NORMAL PROCEDURES & TECHNIQUESGo-Around — Two Engines
Figure 09-12-11

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SECTION 2 NORMAL PROCEDURES & TECHNIQUES



Go-Around — Single Engine
Figure 09-12-12

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**SECTION 2
NORMAL PROCEDURES & TECHNIQUES****TOUCH-AND-GO LANDINGS**

Touch-and-go landings in conjunction with practicing non-normal procedures are not recommended. Full stop landings with a simulated inoperative engine are much safer. Simulated engine cuts during a touch-and-go landing can be hazardous in any aircraft. The PF may become confused concerning aborting or continuing the takeoff. These combinations are not recommended. Use of autothrottle during touch and go landings is prohibited.

All touch-and-go landings should be preplanned and cockpit procedures should be established Fig. 09-12-13. The PIC thoroughly briefs all aspects of the touch-and-go landing. Both crewmembers ensure the runway length is sufficient for touch-and-go maneuvers. Compute V_1 , V_R , V_2 , and required landing distance. These numbers do not vary much with succeeding touch-and-go landings. V_1 is difficult to positively call on every touch-and-go landing. Generally, V_R is reached at approximately the same time (or very shortly after) takeoff thrust is established.

Before commencing first Touch-and-Go ensure rudder trim is in the green band even if barely. This will avoid unnecessary EICAS messages during the maneuver on the ground.



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**SECTION 2
NORMAL PROCEDURES & TECHNIQUES**

After touchdown:

PF	PM
Lower the nosewheel to the surface	
Keep the airplane heading straight down the runway	Set wing flaps for takeoff while calling "Resetting Flaps" (flaps 20 is recommended for touch and go landings)
Keep the thrust levers just above idle to avoid spoiler deployment and do not rush the touch and go landing	Check elevator trim is within the green takeoff band Check rudder trim is within the green takeoff band
	Check EICAS (silent check)
	Call: "Go"
When the PM calls "Go", advance the thrust levers smartly and deliberately to the T/O detent	
"Set N ₁ "	
	Check thrust levers in the T/O detent
	Call: "N ₁ Set"
	Call: "V ₁ "
	Call: "Rotate" or "V _R "

Follow normal Flap 20 Takeoff profile. It is acceptable to leave the flaps set at 10 for transition to downwind. Reduce thrust to avoid an extremely nose-high attitude and high rate of climb. Use the trend vector as a helpful tool. Enter the downwind leg at approximately 160 KIAS or at the recommended minimum maneuvering speed per configuration. Complete the After Takeoff and Approach, checklists followed by the normal approach profile.

Challenger 350

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**SECTION 2
NORMAL PROCEDURES & TECHNIQUES**

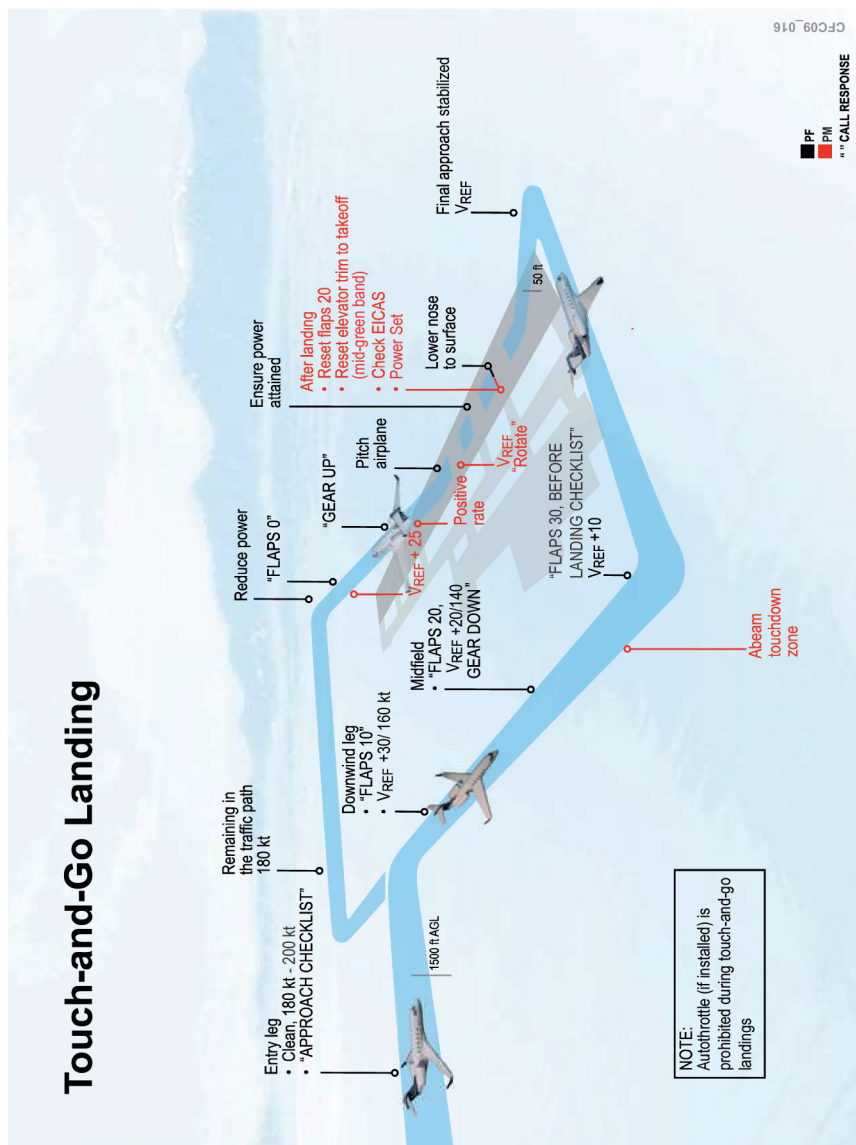
Be cognizant that these procedures are for touch and gos, not stop and goes. Any brake usage for stop and goes requires a thorough understanding and review of brake cooling AFM charts. Stop and goes without due diligence for brake cooling may result in adverse effects on brakes, tires, wheel assemblies and or structure.

- NOTE:**
1. A suggested minimum runway length is usually 10,000' at sea level.
 2. You always want to use your nearest flap setting; if you use flaps 10, you use up a tremendous amount of runway simply waiting for the flaps to retract and the airplane is very ready to fly much earlier. Make sure that the rudder trim is in the T/O band; otherwise you will get a config warning. As much as the rudder trim is moved on this airplane, it is common to get a rudder trim config warning on a Touch & Go.
 3. You should also be aware of the elevator trim being in the green band may not necessarily be the same as when setting a specific number per the Center of Gravity. The Pilot Flying should make judicious use of the control column when rotating for a touch and go.



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SECTION 2
NORMAL PROCEDURES & TECHNIQUESTouch-and-Go Landing
Figure 09-12-13

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**SECTION 2
NORMAL PROCEDURES & TECHNIQUES****AFTER LANDING AND CLEARING RUNWAY**

After clearing the runway, the After Landing/Clearing Runway checklist is initiated. The engines should idle for at least one minute prior to shutdown. Upon shutting down an engine, the master caution lights flash, a single chime sounds and new CAS messages appear. Confirm all indications are appropriate for the configuration before canceling the flashing master caution lights. Monitor hydraulic pressure when taxiing to the ramp area.

Before shutting down an engine while taxiing to the parking area, some factors need to be considered. The runway and taxiway may be clear of ice, snow or slush, but the parking area might still be contaminated. Do not shutdown an engine until the condition of the parking area is known. With one engine operating on a slippery surface, the aircraft may turn in one direction easily and be difficult to taxi straight. If this situation is encountered, consider shutting down completely and towing the aircraft or restarting the other engine and resuming taxiing.

Chock the main gear when the aircraft is parked. If strong winds are expected, all wheels should be chocked. Install the gust lock, even for short periods. High winds may suddenly develop or jetblast/helicopter rotorwash may damage the controls. Before securing the aircraft, ensure all hot bus items are off, particularly the emergency, baggage, and entrance lights. Set all switches to off, remove all power from the airplane, and close the access doors.



Challenger 350

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SECTION 3 INSTRUMENT PROCEDURES

This section focuses on operations with the Challenger 350 in instrument conditions. More specifically, precision, non-precision, circling approach procedures and techniques are reviewed. Procedure turns, missed approach, and holding procedures are also discussed.

INSTRUMENT APPROACH CONSIDERATIONS

Several factors must be considered prior to commencing an approach. In addition to basic knowledge required for a flight (departure and destination weather, airport information, runway conditions, NOTAMS, etc.), the crew must also have a thorough understanding of the aircraft. More specifically, the crew should know what resources are available in the aircraft avionics package and how to effectively use them. The enroute and initial descent phases of flight are where flight crews should prepare, brief, and make decisions on what instrument approach procedures to execute. Study the respective approaches and procedures carefully.

Published approaches for Category C aircraft have a height above touchdown (HAT) in excess of 600 ft requiring only one mile of visibility. For example, in moderate or heavy rain there would be much less than a mile before the runway is seen if the aircraft is much higher than it should be (approximately 300 ft) to make a normal landing with normal maneuvers. Additionally, consider a normal straight-in approach with 500 ft HAT and 1 mi visibility required. If the approach speed is 115 KIAS the aircraft is moving along at 1.9 NM per minute. Optimally, the runway comes into sight 1 NM out, requiring an average descent rate of 1000 fpm to make the touchdown point. Any delay in establishing visual contact and/or starting a descent worsens the problem. If the aircraft is not in a position to make a normal descent to landing, execute a missed approach or visual pattern, if possible. Consider going to the filed alternate.

The visibility reporting system can sometimes work against the crew. If the visibility is reported as 1 mile, it is 1 statute mile which equates to 0.87 NM. This is enough of a difference to increase the descent required for the approach to more than 1100 fpm. If the ceiling and visibility is less than published minimums, the approach should not be attempted.

In different conditions, it may be advantageous to plan a circling approach. If so, ensure published circling approach minimums are being reported. Refer to the Airman's Information Manual (AIM) for visibility and radius distance minimums for Category C aircraft. If the airplane is to remain within this radius, precise airspeed and bank control are essential. Lower airspeeds result in a decreased turn radius. It is also easy to lose sight of the airport if circling approach speed is too high or bank is too shallow. Circling approaches are discussed later in this section.

After evaluating all the weather factors, flight crews may find the destination approach situation to be marginal. If so, seriously consider proceeding to a suitable alternate before descending out of the high altitude structure.

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SECTION 3 INSTRUMENT PROCEDURES

When descending out of 18,000 ft or when within 50 NM of the terminal area for landing, call for and complete the Descent and Approach checklists. Compute V_{REF} and V_{GA} and set the airspeed bug to help anticipate approach speeds. Slow the aircraft early to avoid requiring rapid configuration changes and increasing the risk of falling behind the aircraft.

For perspective, if 10 NM is flown at 250 kt ground speed, it takes 2 minutes and 24 seconds to cover the distance. If 10 NM is flown at 200 kt ground speed, it takes 3 minutes to cover. If the ground speed is 150 kt, it takes 4 minutes.

Note how many miles are allowed for each published procedure turn. Two hundred knots keep the aircraft within 10 NM provided the wind is calm, the timing outbound is no more than 60 seconds, and a 30° bank is promptly initiated for 180° turns. In this case, the aircraft flies approximately 8 NM at the furthestmost point in the procedure turn.

At major airports with busy terminal environments with a lot of airline traffic, flying a final approach at V_{REF} (unless minimum conditions exist or instructed to do so by ATC) would be unrealistic. The aircraft offers flexibility to change speeds and configurations easily. However, this manual makes recommendations on how to fly the aircraft in optimal speeds and configurations and/or instrument approach procedures for the lowest published instrument conditions combined with a short runway.

Fly the aircraft at minimum maneuvering speeds for each approach and landing configuration. Flying the recommended minimum maneuvering speeds allows more time to plan ahead. Course intercepts are smoother and cleaner. Crews also have more time on final approach, allowing slower descents and enabling the aircraft to remain within the confines of circling approach areas. Recommended maneuvering speeds are shown in Table 09–13–1:

FLAP SETTING	AIRSPEED
Flaps 0	$V_{REF} + 40$ kt (180 kt)
Flaps 10	$V_{REF} + 30$ kt (160 kt)
Flaps 20	$V_{REF} + 20$ kt (140 kt)
Flaps 30	$V_{REF} + 10$ kt

Recommended Maneuvering Speed

Table 09–13–1

NOTE: Maneuvering speeds based on max gross weight landing. V_{REF} varies with weight.



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SECTION 3
INSTRUMENT PROCEDURES

ADDITIONAL INSTRUMENT SYSTEMS

Additional instrument systems, such as a radio altimeter and an altitude alerter function, are navigational safety devices installed on the aircraft. These systems contribute to a safe instrument approach if used properly. However, becoming so involved in setting and resetting these devices compromises safety. The following is a brief review of some of these aids:

- **Min Alert** – In addition to setting BARO and RA minimums, the MIN ALERT should be set as appropriate. This is usually BARO.
- **Altitude Select Knob**– Before takeoff, the initial leveloff altitude should be set. When climbing or descending, the altitude preselect should be set to the next leveloff altitude. Once established on the final approach fix (FAF) inbound, the missed approach altitude should be set in the altitude preselect, unless there are stepdown altitudes inside the FAF. Generally, since the PM accomplishes the radio communications, the PM also has responsibility for resetting the ASEL knob. Whether the ASEL knob is a function of the PF or the PM is up to the crew, as long as it is clear who is responsible so that an altitude assignment is not missed.
- **Navigation Radios**– Navigation and communication radios should be assigned to one crewmember. Ensure there is an understanding as to who changes and identifies frequencies, as well as who sets the approach headings. Neither pilot should change a navigation or communication frequency or bearing without informing the other pilot of their intentions.

HOLDING

Whether holding is accomplished enroute for ATC delays or as part of an approach procedure, the techniques are similar. If holding takes place in the enroute phase of the flight, holding speeds should be in compliance with the AIM (Table 09–13–2) below and the Computerized In-Flight Performance Software (CIFP) speeds.

When holding as part of an instrument approach, hold at speeds published in the pilots manual. In icing conditions, the crew should consider higher holding speeds and higher power settings. Slow the aircraft to holding speed within three minutes prior to reaching the holding fix. Do not hold in icing conditions with the flaps down. The initial outbound leg should be flown for 1 minute, or 1.5 minutes, whichever is appropriate for altitude. Timing of subsequent outbound legs should be adjusted as necessary to achieve proper inbound leg time (Table 09–13–3). Regulator authorities may be different on holding procedures such as EASA and FAA. Always adhere to your airspace's governing authorities regulations.

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SECTION 3 INSTRUMENT PROCEDURES

If the holding procedure is used as a procedure turn for an instrument approach, start slowing the aircraft 3 minutes prior to the IAF to arrive over the IAF at $V_{REF} + 30$ and flaps 10° . When crossing the IAF, initiate the holding procedure, start timing when abeam the IAF, start descent to procedure turn altitude (if cleared), and maintain $V_{REF} + 30$. At 60 seconds, turn back toward the inbound course and intercept the course inbound. When on course inbound, follow the same procedures as stated in the applicable precision or non-precision approach procedures.

CIVIL TURBOJET	MAXIMUM AIRSPEED
6,000 ft or below	200 KIAS
6,001 ft – 14,000 ft	230 KIAS
Above 14,000 ft	265 KIAS

Maximum Holding Airspeeds

Table 09-13-2

AT OR BELOW 14,000 FT MSL	ABOVE 14,000 FT MSL
1 minute	1.5 minutes

Holding – Inbound Leg Timing

Table 09-13-3

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SECTION 3 INSTRUMENT PROCEDURES

NADP PROCEDURES

Noise abatement departure procedures are developed to reduce the noise signature of an aircraft in certain noise sensitive areas. Of the two Standard NADP 1 and 2 procedures, both require Takeoff thrust be maintained until a minimum of 800 AAE.

On Autothrottle equipped aircraft, any change to the FD mode selection after takeoff will change the active vertical FD out of TO, ie.: HDG, NAV or FLC. If the active FD vertical mode is not maintained in TO, when the autothrottle exits HOLD mode passing 400 AAE the Autothrottle will reduce the thrust to below Takeoff Rating. Both NADP profiles assume TO thrust until a minimum of 800 AAE.

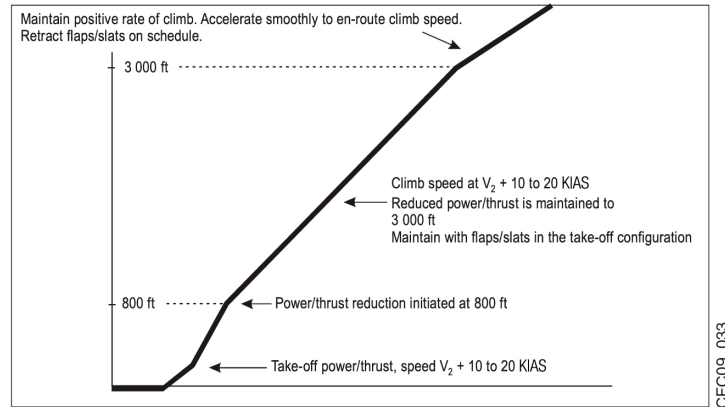
For this reason, Autothrottle equipped aircraft should conduct a NON-Autothrottle takeoff when a noise abatement procedure is being flown and delay Autothrottle engagement until stabilized above 800 AAE and/ or takeoff power is no longer required.

- Refer to Airplane Flight Manual, Chapter 6 – Certificated Noise Levels for Aircraft configuration guidance to achieve noise level compliance guidance.
- Additional guidance can be found in the Airplane Flight Manual, Chapter 8 – Restrictions on Performance Penalty (Takeoff and Landing) regarding noise abatement.

NOTE: The following tables are extracted from Transport Canada AIM guidance for NADP1 and 2 and are used as examples only.

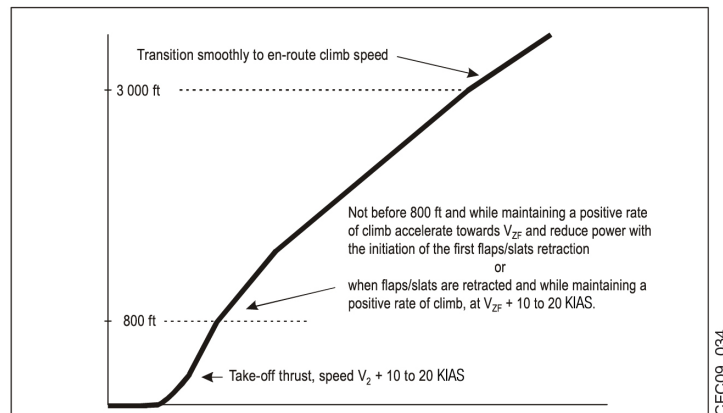
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INSTRUMENT PROCEDURES

Noise abatement take-off climb — Example of a procedure alleviating noise close to the aerodrome (NADP 1)

Figure 09-13-1



Noise abatement take-off climb — Example of a procedure alleviating noise distant from the aerodrome (NADP 2)

Figure 09-13-2



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SECTION 3
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COLD WEATHER TEMPERATURE CORRECTIONS

Temperature has an effect on altimeter accuracy as it relates to true altitude. When the air is warmer than standard, the airplane is higher than the altimeter indicates. Conversely, when the air is colder than standard, the airplane is lower than indicated. When flying into a colder air mass while maintaining a constant indicated altitude, true altitude is decreasing. The colder the temperature, the greater the difference between true altitude and indicated altitude. In extreme cold conditions, especially in mountainous areas, pilots should exercise caution in flight planning both in regard to route and altitude to ensure adequate enroute and terminal area clearance.

The table below, derived from ICAO formulas, indicates how much error can exist when the temperature is extremely cold. To use the table, find the reported temperature in the left column, and then read across the top row to locate the height above the airport/reporting station (subtract the airport/reporting station elevation from the intended flight altitude). The intersection of the column and row indicates how much lower the airplane may actually be as a result of the possible cold temperature induced error:

ICAO COLD TEMPERATURE ERROR TABLE

°C	HEIGHT ABOVE AIRPORT IN FEET														
	200	300	400	500	600	700	800	900	1000	1500	2000	3000	4000	5000	
+10	10	10	10	10	20	20	20	20	20	30	40	60	80	90	
0	20	20	30	30	40	40	50	50	60	90	120	170	230	280	
-10	20	30	40	50	60	70	90	90	100	150	200	290	390	490	
-20	30	50	60	70	90	100	130	130	140	210	260	420	570	710	
-30	40	60	80	100	120	140	170	170	190	280	380	570	760	950	
-40	50	80	100	120	150	170	220	220	240	360	480	720	970	1210	
-50	60	90	120	150	180	210	270	270	300	450	590	890	1190	1500	

BFC01_008

IFC01_008

Example

Temperature -30°C (-22°F), and the airplane altitude is 3,000 ft above the airport elevation during a procedure turn. The chart shows that the reported current altimeter setting may place the airplane as much as 570 ft below the altitude indicated on the altimeter. When operating in a non-controlled environment, the procedure turn should be flown at 3,600 ft to ensure obstacle clearance. ATC radar vectoring altitudes are normally compensated for temperature.

The altitude correction should be applied to the other published altitudes, specifically minimum altitude (DA / MDA). The FMS INDEX Menu has a TEMP COMP feature. It is basically a calculator that can be used to find the corrected barometric altitude.

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STABILIZED APPROACH PHILOSOPHY

Unstabilized approaches are a key contributor to CFIT events and RUNWAY OVERRUNS. This generic information is as per FAA and Flight Safety Foundation guidance. Please refer to your respective authorities for differences and additional guidance. Efforts should be made to use a continuous descent profile, more specifically during Non-Precision approaches (NPAs). Level-offs due to ATC, or procedural constraints may occur but they should not affect the technique significantly.

Approach slopes are normally intercepted at altitudes greater than 1,500 ft Above Airport Elevation (AAE) and guidelines are given for a standard 3° flight path angle.

The importance of a stabilized approach cannot be overemphasized. It ensures a safe approach and landing and reduces crew workload. Operators are encouraged to promote the use of the stabilized approach concepts to help mitigate CFIT.

The stabilized approach concept is characterized by maintaining a stable:

- Approach speed
- Vertical flight path
- Configuration to the landing touchdown point
- Descent rate: Typically characterized by a maximum of 1000'/min for a 3° glide slope.

Depart the FAF configured for landing and on the proper approach speed, power setting and flightpath before descending below the minimum stabilized approach height.

- 1,000 ft AAE (**IMC**), call "Stable"
- 500 ft AAE (**VMC**), call "Stable"
- Descent rate no greater than 1000 fpm unless specifically briefed.

STABILIZED CONSTANT DESCENT ANGLE (SCDA)// CONTINUOUS DESCENT FINAL APPROACH (CDFA)

SCDA/CDFA are techniques consistent with the stabilized approach concept for flying the final approach segment of a non-precision approach procedure (NPA) as a continuous descent profile, in opposition to the traditional Step down type approach. This is accomplished without level-off from an altitude at or above the final approach fix altitude to a point approximately 50 ft. above the landing runway threshold or the point when the flare maneuver should begin.

SCDA/CDFA approaches consider the minimum descent altitude (MDA) as a decision altitude (DA) and, if the runway is not in sight when the airplane reaches the MDA, a go-around must be initiated.



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Pilots must not descend below the MDA contrary to a DA when executing a missed approach from an SCDA/CDFA profile. This is why most operators require that a margin be added to the MDA to preclude MDA excursion during the Go-Around procedure. This revised MDA altitude (MDA + altitude additive/ margin) is called a Derived Decision Altitude (DDA). For the Challenger 350 an altitude additive of 50 ft is recommended for normal approaches.

Regulating authorities may also require Flight Crew to follow an accredited SCDA/CDFA training program with established operator SOPs.

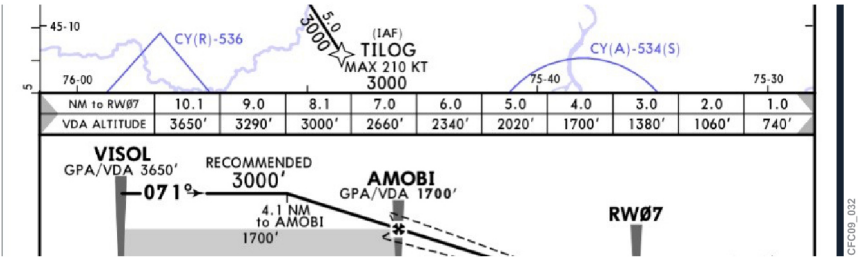
Compliance with these instructions does not constitute operational approval for the use of SCDA/CDFA procedures. Refer to your state authority publications for any further guidance. Also be advised that certain authorities have given operators through OpSpec/MSpec/LOA's the privilege to treat an MDA as a DA, hence no additive is required. Again, consult your regulator for more information on that topic. A good reference document on the topic is FAA AC 120-108.

EASA and TC have developed their approach plates to support these kinds of approaches. They provide scalable guidance of distance versus altitude tables at every NM (Nautical Mile). Although not necessary to pursue this type of approach, it is a nice addition and facilitates the application that can be manually calculate with the 3 to 1 rule or 320 ft per NM for a 3 degree approach. Good communication via SOP call outs developed for this purpose will simplify greatly the resultant procedure. A key call should be done at every NM by the PM stating any deviations from calculated profile. Simply saying the PF is a little high/ low is insufficient. A specific number like 7 NM, 150 ft high, will provide the quantitative information necessary to the PF for an appropriate correction while maintaining a stabilized approach. Additionally, once acknowledged by the PF, another technique is for the PM to call the next distance and altitude constraint.

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INSTRUMENT PROCEDURES



CDFA/SCDA
Figure 09-13-3



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CLIMB/DESCENT TABLE 10042

INSTRUMENT TAKEOFF OR APPROACH PROCEDURE CHARTS RATE OF CLIMB/DESCENT TABLE (ft. per min)												
A rate of climb/descent table is provided for use in planning and executing climbs or descents under known or approximate ground speed conditions. It will be especially useful for approaches when the localizer only is used for course guidance. A best speed, power, altitude combination can be programmed which will result in a stable glide rate and altitude favorable for executing a landing if minimums exist upon breakout. Care should always be exercised so that minimum descent altitude and missed approach point are not exceeded.												
CLIMB/ DESCENT ANGLE (degrees and tenths)	ft./NM	GROUND SPEED (knots)										
		60	90	120	150	180	210	240	270	300	330	360
2.0	210	210	320	425	530	635	743	850	955	1060	1165	1275
2.5	265	265	400	530	665	795	930	1060	1195	1325	1460	1590
2.7	287	287	430	574	717	860	1003	1147	1290	1433	1576	1720
2.8	297	297	446	595	743	892	1041	1189	1338	1486	1635	1783
2.9	308	308	462	616	770	924	1078	1232	1386	1539	1693	1847
3.0	318	318	478	637	797	956	1115	1274	1433	1593	1752	1911
3.1	329	329	494	659	823	988	1152	1317	1481	1646	1810	1975
3.2	340	340	510	680	850	1020	1189	1359	1529	1699	1869	2039
3.3	350	350	526	701	876	1052	1227	1402	1577	1752	1927	2103
3.4	361	361	542	722	903	1083	1264	1444	1625	1805	1986	2166
3.5	370	370	555	745	930	1115	1300	1485	1670	1860	2045	2230
4.0	425	425	640	850	1065	1275	1490	1700	1915	2125	2340	2550
4.5	480	480	715	955	1195	1435	1675	1915	2150	2390	2630	2870
5.0	530	530	795	1065	1330	1595	1860	2125	2390	2660	2925	3190
5.5	585	585	880	1170	1465	1755	2050	2340	2635	2925	3220	3510
6.0	640	640	960	1275	1595	1915	2235	2555	2875	3195	3510	3830
6.5	690	690	1040	1385	1730	2075	2425	2770	3115	3460	3805	4155
7.0	745	745	1120	1490	1865	2240	2610	2985	3355	3730	4105	4475
7.5	800	800	1200	1600	2000	2400	2800	3200	3600	4000	4400	4800
8.0	855	855	1280	1710	2135	2560	2990	3415	3845	4270	4695	5125
8.5	910	910	1360	1815	2270	2725	3180	3630	4085	4540	4995	5450
9.0	960	960	1445	1925	2405	2885	3370	3850	4330	4810	5295	5775
9.5	1015	1015	1525	2035	2540	3050	3560	4065	4575	5085	5590	6100
10.0	1070	1070	1605	2145	2680	3215	3750	4285	4820	5355	5890	6430

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CFC09_031

CLIMB/DESCENT TABLE 10042

NOTE: For circling approaches, if the aircraft is not stabilized at the end of the circling maneuver for a stabilized descent to the landing runway or if the aircraft overshoots the landing runway, initiate a go-around and do not try to salvage the approach by excessive bank angle or excessive descent rates.

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VERTICAL NAVIGATION (VNAV): DESCENT AND APPROACH PROCEDURES

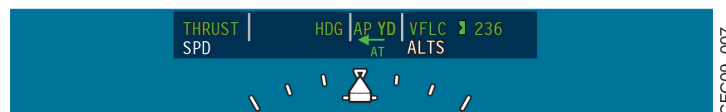
The use of the vertical navigation (VNAV) functionality of the Challenger 350 AFCS and FMS is an excellent tool for reducing pilot workload and increasing passenger comfort. Provided below are procedures that permit the safe and efficient operation of the Challenger 350 in VNAV from top of descent until touchdown and/or missed approach. For expanded information See Collins Manual (Challenger 300–350 Proline21 Advanced FMS, Chapter 19, Principals of VNAV).

ENROUTE VNAV CLIMB

The VNAV function could also be used for any climb profiles. This will assist the crew to comply with altitude and speed constraints at waypoints, and speed limits at altitudes. It will additionally help in following the vertical flight profile entered in the active flight plan. The VNAV climb target airspeed can be set using either the VNAV SETUP in the FMS (default value) or specific VNAV airspeeds from the LEGS page. Before initiating a VNAV climb, the crew must confirm that waypoints are programmed with VNAV altitudes (and airspeeds if non-default airspeeds are desired), altitude preselector is set to the ATC cleared altitude, which should be above the current altitude and VNAV is selected on the FGP.

If a higher altitude is selected prior initiating the climb, the aircraft remains level until the Bottom Of Climb (BOC). At the BOC, the aircraft captures the vertical track (VFLC displayed as the active vertical mode) and the autothrottle (if installed) activates the THRUST Mode to initiate the climb.

NOTE: The use of VFLC (FLC with VNAV) is prohibited during climb when the airspeed reference is displayed as Mach.



AT Modes – THRUST/SPD Mode
Figure 09–13–4

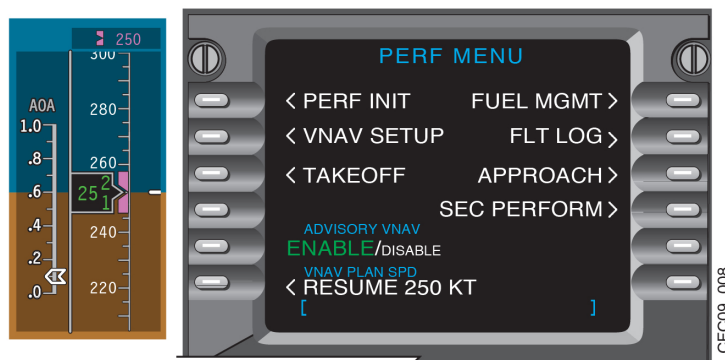
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VFLC VNAV CLIMB AND DESCENTS

For VFLC VNAV climb and descents profiles with speed constraints (where the speed bug is managed by the FMS), the crew must set and confirm the VNAV target speeds on either the FMS LEGS page or under the FMS – PERF MENU/VNAV SETUP pages. The crew can activate the VNAV planned speed through the FMS –PERF MENU – <RESUME xxx KT function>.



VNAV Climb Speed

Figure 09-13-5

NOTE: Under VNAV PLAN SPD, the speed bug and its analog value are controlled by the FMS and will be displayed in magenta color (FMS speeds) in lieu of cyan (SPEED bug input).

NOTE: The crew must also be aware that upon VFLC activation from VALT mode, the speed bug will switch from VNAV target speed (magenta) to the current aircraft speed (cyan). The crew should reactivate the VNAV planned speed through the FMS –PERF MENU – RESUME xxx KT function or manually reset the speed bug to the desired value (non-VNAV).

ENROUTE VNAV DESCENT

The VNAV descent airspeeds and angle can be set using VNAV SETUP in the FMS. The Challenger 350 has a high wing sweep and is considered to be of clean design. If descent angles of greater than 3° are required in the clean configuration, the use of flight spoilers may be required to maintain the required vertical path and/or airspeed.

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SECTION 3 INSTRUMENT PROCEDURES

In order to fly the descent profile, the STAR, TRANSITION, APPROACH, and RWY should have been programmed correctly and all crossing speeds and altitude limits verified. Before top of descent (TOD), VNAV is selected on the FGP. When cleared for descent, the PM sets the ATC cleared altitude on the altitude preselector.

If a lower altitude is selected prior to the TOD, the aircraft remains level until the TOD. At the TOD the aircraft captures the path (VPATH as the active vertical mode) and the autothrottle (if installed) retards/modulates (SPD as the active AT mode) to maintain the airspeed. If the lower altitude was selected after passing the TOD, the crew must initiate the descent using FLC, VS, or PTCH modes, and may intercept the descent path downrange of the TOD.

The FMS VERTICAL DIRECT function is useful when a low descent angle or a short descent is required. The FMS descent angle limits are 1° to 6°, however, if an angle greater than 3° is directed, crews will probably require flight spoilers for airspeed control. Another option is to use the VFCL, VVS or VPITCH modes to fly the aircraft back to the path, as mentioned previously, using flight spoilers if required.

VNAV APPROACH – GENERAL

VNAV is a viable option in numerous approach situations. It can add to situational awareness and allow a constant descent angle to landing. VNAV is available anytime FMS is the selected NAV source, although the crew may not always elect to use it. Once the approach has been selected in the FMS, a thorough approach chart study is the key to a successful VNAV approach. You must confirm that all the information contained in the FMS database is accurate — this includes waypoints, altitudes and descent path angles.

- The approach annunciation (RNP APPR/RNP AR APPR/LPV APPR on the PFD) must be displayed prior to the FAF indicating that the CDI sensitivity requirements have been met. Normally between IAF and FAF depending on approach type.
- The temperature restrictions in the notes section of the approach chart must be observed. Temperatures that are well below standard cause a reduction in true altitude, therefore, at very low temperatures this may infringe the obstacle clearance criteria. Crew should use the TEMP COMP function of the FMS to carry on approaches in cold weather (usually below 0°C).
- The altitudes and vertical path must not be changed from that contained within the FMS database. The descent path stored in the FMS ensures all altitude restrictions from the FAF to the missed approach point are met and must not be modified manually.
- An RNAV(GNSS) approach is classified as a non-precision approach therefore the autopilot must be disengaged by 200 ft AGL.
- An LPV approach is classified as a precision approach (FAA) therefore the autopilot must be disengaged by 80 ft AGL (If GP<3.5°).



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SECTION 3 INSTRUMENT PROCEDURES

RWY VERSUS V-MDA APPROACHES

The FMS will code non-localizer approaches one of two ways. RWY (runway) or V-MDA (vertical navigation with no runway associated). The reason for this is some approaches do not allow for a constant descent angle to the runway or that there is no runway associated with the approach (circling only) (i.e. VOR-A, GPS-D).

RWY APPROACHES

A RWY approach will be indicated in the FMS by threshold altitude + 50 ft (green) abeam the RWY fix on the LEGS page. In this case the glidepath is calculated from 50 ft above the runway threshold to the FAF at the published approach angle (usually 3°). This angle will guarantee obstacle clearance from the FAF altitude to the MAP. A RWY approach may have minimums based on LNAV/VNAV (DA) or just LNAV (MDA). In either case a VNAV approach may be conducted to minimums.

V-MDA APPROACHES

A V-MDA approach will be indicated in the FMS by the letters V-MDA abeam the missed approach point and will not show a runway on the legs page. The reason V-MDA approaches exist is that there is not a runway associated with the procedure (circling only) because it is not straight in (>30° final course alignment to the runway) or the descent angle from the FAF to the MAP is more than 400 ft per NM. V-MDA APPROACHES MAY NOT BE CONDUCTED IN VNAV INSIDE THE FAF. The reason is that there is no guarantee of obstacle clearance to the runway.

A suggested technique is to deselect VNAV prior to the FAF crossing and engage VS for the rest of the approach.

USING VNAV FOR APPROACHES

When conducting an approach in VNAV, approach mode (APPR) and VNAV must be selected to ensure VNAV glide path (VGP) will be the active vertical mode on the FMA. VGP mode will not capture the altitude preselector (similar to an ILS glideslope), therefore, the altitude preselector should be set to the missed approach altitude after VGP capture.

Before conducting a VNAV approach, first ensure that the approach is a RWY approach. Then look at the minimums on the approach plate. There are two types of minimums associated with these approaches: MDA and DA.

VNAV WITH MDA MINIMUMS

With MDA minimums published, the aircraft must not descend below this altitude unless visual conditions are met as per regulation. Therefore if this approach is conducted in VNAV (VGP mode) then caution should be used to ensure the aircraft will not descend below the MDA.

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SECTION 3 INSTRUMENT PROCEDURES

Some countries require SCDA approaches. Under these circumstances some provide OpSpecs/MSpec/LOA to treat MDA as a DA. For those who do not, a suggested technique is to add 50' to the MDA and treat it like a DA. Most define this new altitude as a DDA (Derived Decision Altitude). Refer to the section on SCDA (Stabilized Constant Descent Approach) for details.

VNAV/LNAV WITH DA MINIMUMS

With DA minimums published, the aircraft may descend below this altitude during the transition to the missed approach. In this case when minimums are reached and the runway or approach lights are not in sight, the missed approach must be commenced and the aircraft will descend below minimums during the transition to the missed approach segment.

RNAV (GNSS) VS VOR, NDB APPROACHES

All approaches that are not localizer-based are treated the same way by the FMS. These approaches should normally be conducted in FMS (magenta) NAV source. In certain situations it may be necessary to conduct VOR approaches in green needles or NDB approaches with the bearing pointer. Lack of GPS RAIM, operations in a non-WGS-84 country, or the procedure not included in the FMS database are some reasons to conduct these approaches in "raw data".

Another reason worth mention is that some Approaches may be listed as VOR or NDB stand alone approaches without GNSS/GPS indicated on the approach plate. These approaches can mostly be retrieved from the FMS and flown in Magenta (FMS) source but are recognized as a secondary source of information. Green needles and/of bearing pointers are the primary source of information and must be overlaid or single source at all times.

PRECISION APPROACH

The PM confirms the COM/NAV radios are set properly, checks the flight instruments, airspeed bugs, preselect altitude display, BARO (DH – displayed on the PFs and PMs PFD). If possible, the aircraft should be slowed to 160 KIAS within 10 NM of the outer marker (Fig. 3 – 6). Within 3 to 5 miles of the FAF or 2 DOTS below Glide Slope, the PF calls "Flaps 20, gear down, Before Landing checklist" and slows the airplane to $V_{REF} + 20$ (140 KIAS). The PM completes the Before Landing check– list to the flaps 30 item. Just prior to glideslope intercept (approximately one dot), for a two-engine approach, the PF calls for flaps 30 and slows the air– plane to V_{REF} , and begins a descent at the glideslope intercept. It is good practice to call for "Set missed approach altitude" when intercepting the glideslope. Upon confirmation that Flaps are 30, the PM then reports "Before Landing checklist complete", and repeats the last ATC clearance. After passing the outer marker, the PM begins looking for visual references outside the airplane. The PM also monitors the instruments and calls out significant deviations such as one dot or more deflection on the localizer or glideslope and/or airspeed variations greater than ± 5 kt of V_{REF} .



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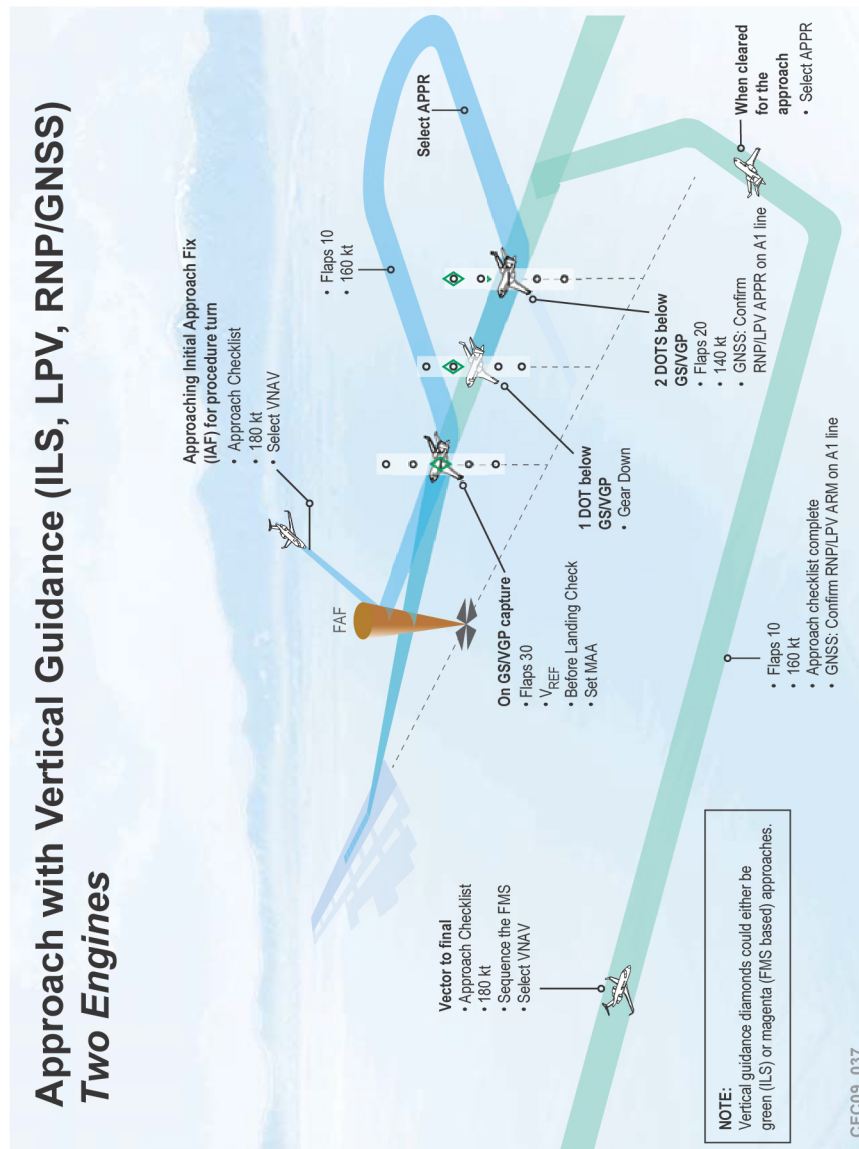
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The PM makes altitude callouts at 1000, 500, and 100 ft above Minimums. The PM reports any visual contact with the ground or when the runway environment is in sight. Approaching minimums or missed approach point (DA), the PF continues cross-checking outside the aircraft for visual references. When satisfied visual references are adequate for landing, the PF announces "Visual". At this point, the PM transfers attention inside the airplane, while cross-checking outside, and calls airspeeds, descent rates, and altitudes. The purpose is to verbally provide the PF, the same information as if still flying instruments. A missed approach should be initiated, if the aircraft becomes unstable along the approach or if a condition that could not warrant a safe landing occurs.

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SECTION 3
INSTRUMENT PROCEDURESApproach with Vertical Guidance
Figure 09–13–6Volume 1
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NON-PRECISION APPROACH

If the weather is close to or at published minimums, it is sometimes impractical or impossible to complete a non-precision approach successfully. This is due to the mathematical relationship of the minimum descent altitude (MDA) versus the minimum visibility combined with the approach speed.

These items occasionally combine to require an intolerable descent for landing. To continue the approach to landing after arrival at MDA, the runway environment must be in sight and the aircraft must be in a position from which a normal landing can be accomplished. A 3° approach calls for being at the following approximate altitudes:

- 600 ft at 1.8 NM
- 500 ft at 1.5 NM
- 400 ft at 1.23 NM
- 300 ft at .9 NM.

For non-precision approaches with no published visual descent point (VDP), it is recommended that a time to see (the runway) point be calculated. Divide the HAT or HAA by 10. The result is the number of seconds the runway should be seen before arriving at the missed approach point (MAP). For example, if the HAT/HAA is 400 ft, divide by 10 ($400/10 = 40$). Forty seconds prior to the expiration of the time from FAF to MAP, the crew should be at MDA and have the runway environment in sight to accomplish a normal visual approach. Consequently, it is desirable to descend to the MDA before arriving over the VDP. A descent rate to accomplish this should be calculated accordingly.

The PM also confirms the COM/NAV radios set properly, checks the flight instruments, airspeed bugs, preselect altitude display, and MDA displays on both PFDs. If possible, the aircraft should be slowed to 160 KIAS within 10 miles of the FAF (Fig. 09-13-7 and Fig. 09-13-8). Within 3 to 5 miles of the FAF, the PF slows the airplane to $V_{REF} + 20/140$ KIAS and calls "Flaps 20, gear down, Before Landing checklist". The PM completes the Before Landing checklist down to the flaps 30 item. Just prior to the FAF, the PF slows the airplane to V_{REF} for straight-in approaches or $V_{REF} + 10$ for circling approaches and calls for Flaps 30. Descent is started at the FAF (at 1,000 fpm) and the approach timing initiated. The PM then reports "Before Landing checklist complete," and repeats the last ATC clearance. After passing the FAF, the PM begins looking for visual references outside the airplane, while monitoring the instruments and calling out significant deviations such as one dot or more deflection on the CDI and airspeed variations greater than ± 5 kt of V_{REF} . A missed approach should be initiated at the missed approach point, if necessary.

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**SECTION 3
INSTRUMENT PROCEDURES**

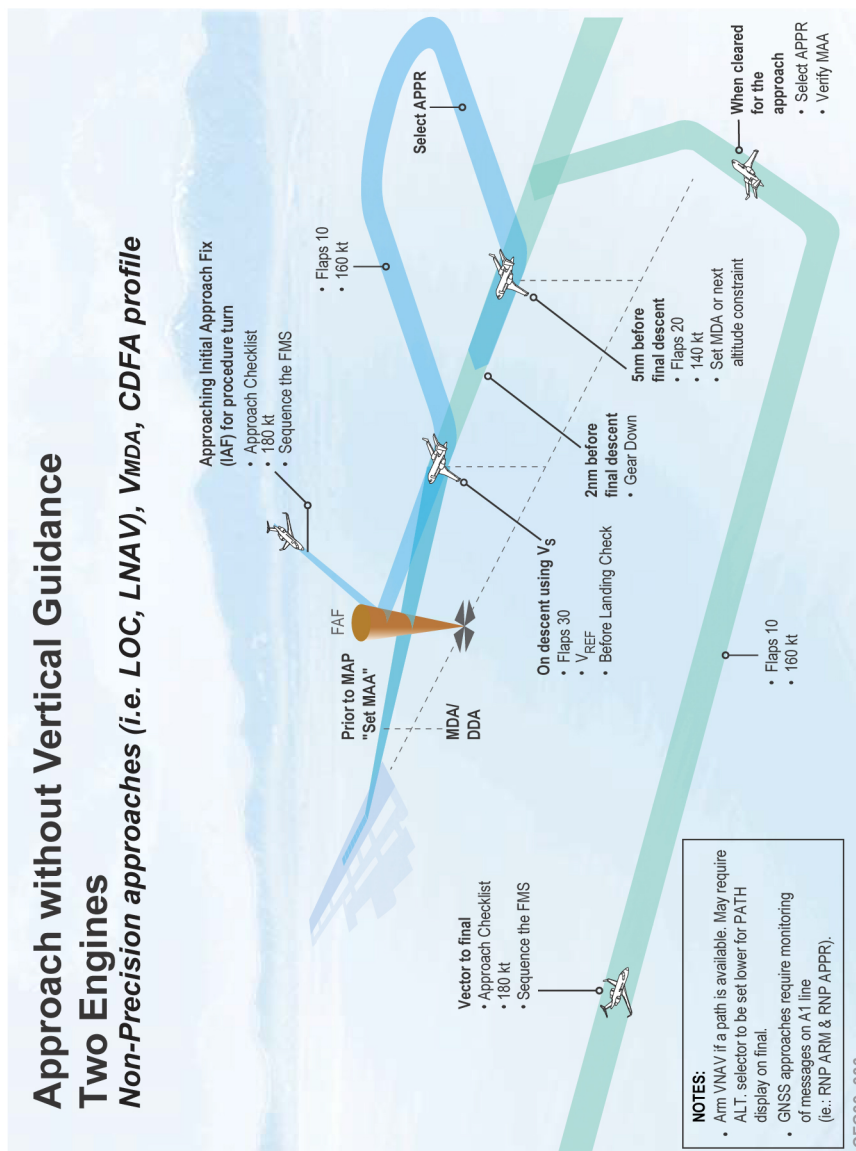
Upon commencing the descent profile, set the altitude pre-selector to minimums in order to capture the MDA (like in a circling procedure). Once the MDA is captured the missed approach altitude should be set without delay.

The PM makes altitude callouts at 1000, 500, and 100 ft above MDA and also gives approach timing updates in reference to the VDP. The PM also reports any visual contact with the ground or when the runway environment is in sight. Approaching minimums or the missed approach point, the PF continues cross-checking outside the aircraft for visual references. When satisfied visual references are adequate for landing, the PF announces, "Visual". At this point, the PM transfers attention inside the airplane, while cross-checking outside. The PM calls airspeeds, descent rates, and altitudes. The purpose is to verbally provide the PF the same information as if still on instruments.

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SECTION 3 INSTRUMENT PROCEDURES



Approach without Vertical Guidance
Figure 09-13-7

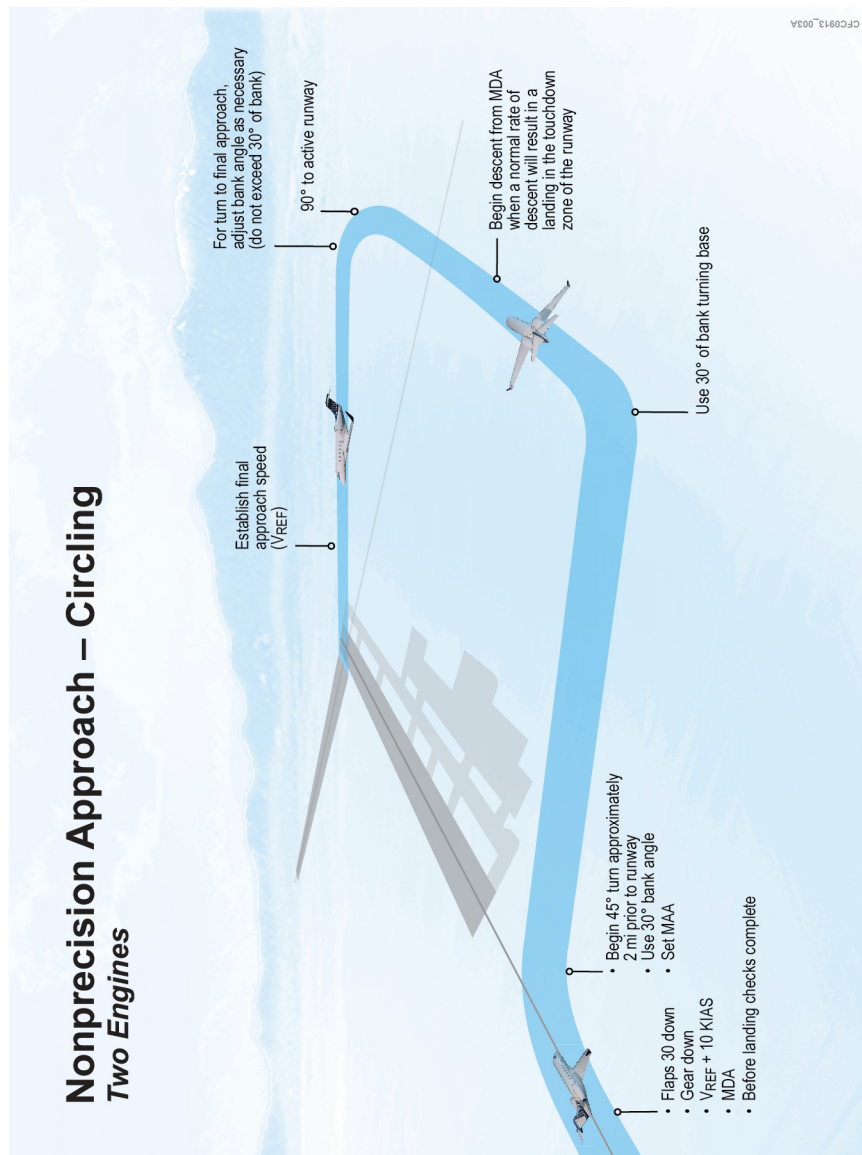
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SECTION 3
INSTRUMENT PROCEDURESNonprecision Approach
Figure 09-13-8Volume 1
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SECTION 3
INSTRUMENT PROCEDURES

PROCEDURE TURNS

When a procedure turn is required, the instrument approach procedure specifies the outbound and inbound courses, the distance within which the procedure turn shall be completed, and the side of the inbound course on which the turn should be made. Unless otherwise specified or restricted, the type, rate of turn, and the point at which the turn is begun is left to the discretion of the crew. When a holding pattern is depicted in lieu of a procedure turn, it must be executed within the one-minute limitation or published leg length.

A teardrop procedure/penetration turn may be specified. Its purpose is to permit an aircraft to reverse direction and lose considerable altitude within a reasonably limited airspace. This procedure works best when approaching the IAF from a direction requiring less than a 45° turn to the selected (or depicted) teardrop course. When depicted, this type turn must be executed. In some cases, the approach is made directly or via an Arc procedure from a specified intermediate fix to the final approach fix. If a procedure turn is desired when "No PT" is specified, special arrangements must be made with ATC. Other notes, symbols or ATC restrictions which limit a procedure turn, are listed on the approach charts.

For published instrument approaches with no procedure turn restrictions, most pilots elect the Jeppesen depicted 45°-type procedure turn. Other acceptable types of procedure turns are teardrop, 90°/270°, and racetrack (holding pattern type). Abiding by the following guidelines assures the aircraft stays within the procedure turn maneuvering airspace:

- **45° -Type Procedure Turn**— Within 3 minutes of the initial approach fix (IAF), slow the aircraft to arrive over the IAF at 160 KIAS and flaps 10. When crossing the IAF outbound, start timing and intercept the outbound course. Also, start descent to procedure turn altitude (if cleared) and maintain 160 KIAS. At 60 seconds (on course outbound), turn 45° as depicted and start timing for 45 seconds. If 160 KIAS is not maintained, the timing outbound should be adjusted accordingly. At expiration of 45 seconds or 20°-track change, turn 180° and level off at procedure turn altitude as required. Intercept the inbound course with FD and/or raw data as required. Lead the turn as necessary to roll out on the inbound course. When on course inbound, follow the same procedures as stated in the applicable precision or non-precision approach procedures addressed earlier in this chapter.

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SECTION 3 INSTRUMENT PROCEDURES

- **Teardrop –Type Procedure Turn—** Within 3 minutes of the initial approach fix, slow to arrive over the fix at flaps 10 and 160 KIAS. When crossing the initial approach fix outbound, start timing (one minute for a 30° teardrop), turn to a heading to intercept the course outbound, and start descent to procedure turn altitude (if cleared). At expiration of time, turn toward the inbound course and maintain procedure turn altitude (if applicable). Intercept the inbound course with the FD and/or raw data, as required. Lead the turn as necessary to roll out on the inbound course. Ideally, completion of the teardrop turn places the aircraft on course inbound. When on course inbound, follow the same procedures as in the applicable precision or non-precision approach procedures.
- **90°/270° –Type Procedure Turn—** Within 3 minutes of the initial approach fix, slow to arrive over the fix at flaps 10 and 160 KIAS. When crossing the initial approach fix outbound, start timing over or abeam the IAF, turn to a heading to intercept the outbound course within 60 seconds, maintain 160 KIAS, and start descent to procedure turn altitude (if cleared). At expiration of 60 seconds and on course outbound, turn 90° to the maneuvering side and immediately reverse the direction of turn for another 270° and maintain procedure turn altitude (if applicable). Intercept the inbound course with the FD and/or raw data, as required. Lead the turn as necessary to roll out on the inbound course. When on course inbound, follow the same procedures as stated in the applicable precision or non-precision approach procedures addressed earlier in this chapter.

CIRCLING APPROACH

A circling approach can be one of the most challenging of the instrument approach procedures (Fig. 09–13–9,). Turbulence, strong winds, poor visibility, and low maneuvering altitude can add to the challenge. Maintain proficiency and skills practice to minimize the high-risk maneuvering required for executing a circling approach. Advanced approach planning and briefing also add to the success of a circling maneuver. Airspeed control is extremely important and the handling characteristics and stability of the aircraft at slower speeds help flight crews reduce the high risks of these procedures even more. Anticipate the level-off at MDA and set sufficient thrust to maintain altitude and safe maneuvering speed throughout the procedure. During the circling, use available automation, including autopilot and autothrottle (if installed) to help reduce pilot workload.

A circling procedure itself is not difficult. The key is to stay within the prescribed distance from the airport. Under normal circumstances, the aircraft falls into Category C for circling approaches, thus having a circling radius of 1.7 NM from the runway end.



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SECTION 3
INSTRUMENT PROCEDURES

TERPS 8260.3B Change 21 has recently modified the criteria for circling approaches. A black diamond with a white C in the circle-to-land minimums box of the approach plate indicates the revised criteria.



For category C aircraft, the new maneuvering radius has increased to 2.7 nm for an airport elevation of sea level to 1000 ft and increases 0.1 nm for every 1000 ft elevation change up to 9001 ft and above.

NOTE: Additional guidance for circling distances does not apply to PANS OPS.

Whenever possible, the circling approach is made to the PF side to ease maintaining visual contact with the intended runway. The PM then monitors the flight instruments calling out excessive deviations in airspeed (+10/-5 kt), altitude (+100 ft, -0 ft), and bank angle (30° maximum). If the situation calls for executing the circle to the opposite side of the PF, the PM is better able to maintain visual contact with the intended runway. The PF should fly the airplane primarily on instruments and follow the timing and heading directions as the PM calls them out. It is imperative that a thorough briefing be completed prior to performing a circling approach, clearly defining who is inside watching the instruments and who is scanning outside.

An alternative is to have control of the aircraft transferred to the other pilot.

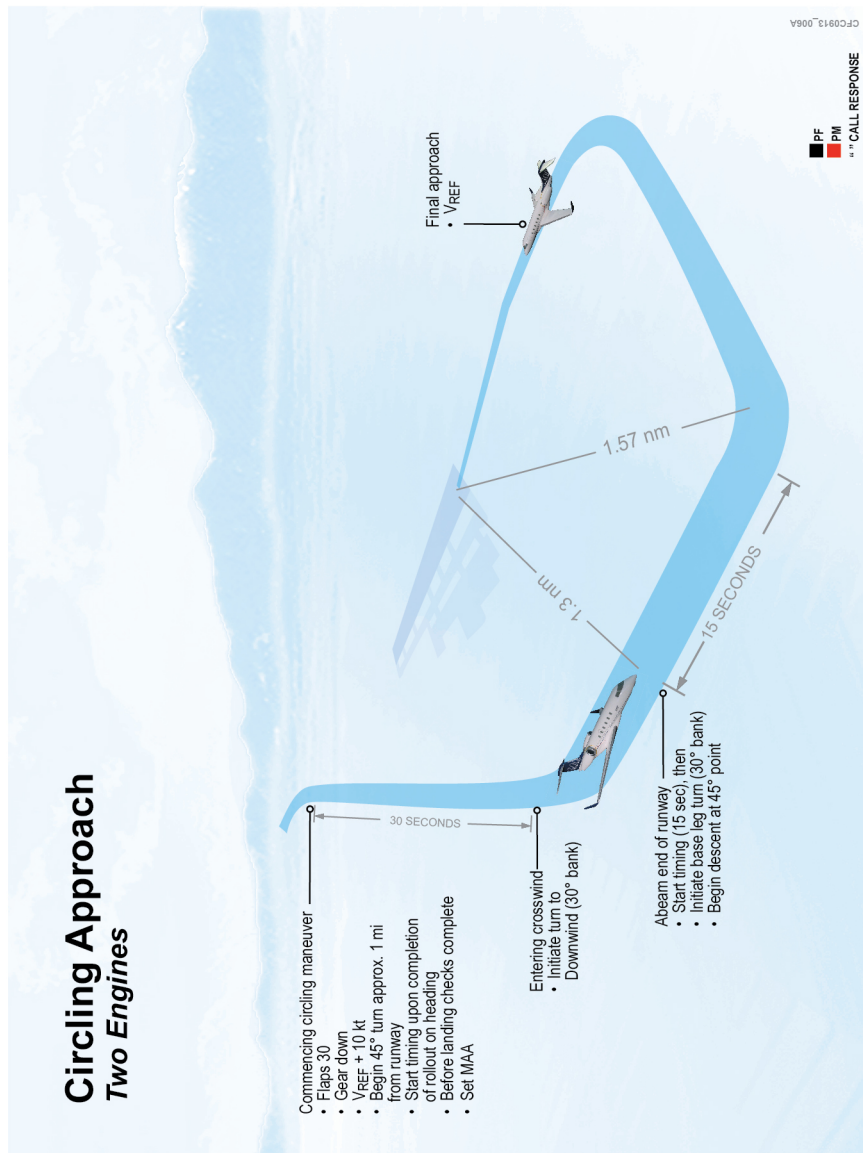
A consideration for when planning a descent from a circling altitude is the 3 to 1 profile. Calculate 320 ft per nm for a stabilized 3° path. So if you are at 640' circling MDA, your descent profile should commence 2 track miles (nm) from the runway for a 3° path.

Refer to your regulating authority from where it is appropriate to descend from a circling altitude. In the past, there has been disagreement on the topic among regulators. Some believe it is on final only, others within 10° of final and some written guidance only says "when landing is assured". Which ever position is deemed to be the proper position to start from, a stabilized descent profile should be the goal.

NOTE: If the aircraft is not stabilized at the end of the circling maneuver for a stabilized descent to the landing runway or if the aircraft overshoots the landing runway, initiate a go-around and do not try to salvage the approach by excessive bank angle or excessive descent rates.

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SECTION 3
INSTRUMENT PROCEDURESCircling Approach
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SECTION 4 NON-NORMAL PROCEDURES

The key to handling non-normal/emergency procedures is to apply the basic principles of crew resource management (CRM). As always, the overriding consideration in any unusual situation must be to maintain aircraft control, analyze the situation, and take proper action.

CAS INHIBITING SYSTEM

The CAS is a tremendous asset for keeping the crew informed about the overall health of the aircraft. As mentioned in Section 2, there are phases of the flight where distraction needs to be minimized. The CAS inhibit mode prevents many CAS messages from being displayed until after takeoff and after landing. Once the inhibit mode is deactivated, a CAS message displays immediately if the condition is still valid.

The takeoff inhibit feature is automatically entered when the aircraft accelerates through 80 kt and ends when the aircraft climbs above 400 ft AGL or 60 seconds after the inhibit time started.

The landing inhibit feature is automatically entered when all the following conditions are met as the aircraft descends through 400 ft AGL and ends as the aircraft decelerates through 40 kt or 60 seconds after the inhibit time started.

TAKEOFF EMERGENCIES

The takeoff is a very critical phase of any flight. The crew takeoff briefing should leave no questions as to crew actions during the takeoff sequence (see section 2: Pretakeoff for the suggested crew takeoff briefing). Although there can be no clearly defined briefing to cover every contingency, there should be no question as to what each crewmember expects. The pilot monitoring (PM) should have full abort/reject/stop authority up to a given point, generally 80 kt. Takeoff aborts should normally not be attempted after the V_1 call. Balanced field length (BFL) versus runway available is a large part in the takeoff decision process. Takeoff abort scenarios basically fall into two different decision scenarios:

- Runway available > BFL
- Runway available = BFL.

Prior to takeoff, the flight crew should discuss go versus abort scenarios. For example, a go decision may be the better decision at V_1 minus 10 kt for a main gear blown tire. Remember the calculated BFL is based on four properly inflated main tires. If a tire is blown on takeoff, the calculated BFL lengthens considerably and is no longer valid. If takeoff is aborted due to a blown tire, most likely the other tire will blow and the brakes will be damaged by tire FOD, in addition to other areas of the aircraft that may receive FOD damage. Should the decision to go or stop be influenced by a critical BFL for a fire indication at V_1 minus 5 kt? These are questions the flight crews and flight department need to consider for crew takeoff briefings.

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SECTION 4 NON-NORMAL PROCEDURES

Directional control is the primary goal. If directional control is lost, then there are no decisions to be made; the takeoff should be aborted. Nothing replaces good judgment and the final decision rests with the pilot in command (PIC). But knowing what to expect, what the parameters are, and the expected reaction makes everything much easier.

The toe brake system is the primary means of stopping the aircraft if a takeoff abort is initiated. The aircraft brakes are very effective. Upon initiating the takeoff abort, the procedure calls for maximum braking immediately. This brake application should be even and firm while simultaneously retarding the thrust levers to idle. If the aircraft starts to deviate from the centerline, apply rudder and differential braking to compensate. During training, flight crews should not execute consecutive multiple rejected takeoffs. The brakes should be allowed to cool between rejected takeoffs.

Typically, AFM brake cooling charts are based on the premise of ONE rejected take off or landing followed by ONE take off or rejected take off only. Allowances and procedures exist for multi-segment legs or crew training. Refer to AFM brake cooling performance section for additional guidance.

When experiencing any Flight control or AFCS related issues, AFM and QRH guidance must always be followed. Additionally, unless specifically mentioned in the AFM/QRH checklist, consider aircraft configuration / airspeed changes when dealing with abnormal situations.

i.e.: Should an AP STAB TRIM FAIL (C) message be posted during initial climb, keep in mind that changing aircraft configuration (retracting flaps for example) and/or increasing the airspeed could have adverse effects on the yoke residual forces. In those cases, consider delaying (if possible) the aircraft configuration and speed changes until the checklist is performed.

The Autopilot and the Stab Trim system work closely to achieve a smooth and efficient flight path. Proper stab trim positioning is very important for performance and passenger comfort. Although capable of handling out-of-trim situations, it is considered good airmanship to trim the aircraft properly before engaging the autopilot. This will prevent unnecessary trim clacker events, messages and will greatly facilitate aircraft handling should the autopilot inadvertently disconnect before reaching the required trim position. Much like you would not transfer control to another pilot without properly trimming the aircraft first, the autopilot should be given the same consideration.



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SECTION 4
NON-NORMAL PROCEDURESREJECTED TAKEOFF/ENGINE FAILURE BELOW V₁ SPEED

A rejected takeoff (RTO) is a profile initiated during a takeoff roll to expeditiously stop the airplane on the runway. As the airplane accelerates, energy increases rapidly. At low speeds, up to approximately 80 KIAS, the energy developed is not sufficient to cause difficulty in stopping the airplane. As the speed approaches V₁, on a balanced field, the effort to stop the airplane in the event of a reject takeoff approaches maximum. The decision to reject the takeoff must therefore be made so that the RTO can be initiated no later than V₁.

- During the takeoff run, making a decision to reject takeoff after V₁ may result in the airplane not being able to stop safely on the remaining runway.
- Takeoff performance is based on a stopping distance that may or may not account for use of reverse thrust. On a dry runway reverse thrust is not factored. Use of maximum reverse thrust is factored on wet or contaminated runways.

Takeoff will be rejected prior to 80 kts for any abnormality. Between 80 kts and V₁, reject only for the following:

- Master warnings
- Directional control problems
- safety of flight issues.

REJECTED TAKEOFF PROFILE

When triggered by circumstances (briefed or otherwise) warranting a discontinuance of the takeoff, a Rejected Takeoff (RTO) is to be initiated immediately and without reference to a checklist procedure. When the decision is made to reject a takeoff, either pilot may announce "Stop, Stop, Stop", "Reject, Reject, Reject" or "Abort, Abort, Abort".

NOTE: These are three widely used terms to call for an abort.

1. Abort, Abort, Abort
2. Reject, Reject, Reject
3. Stop, Stop, Stop

Any of these terms are acceptable as long as all crew members are clear on the call, its meaning and consistent with the SOPs. As a caveat the word STOP is becoming more widely used especially with ATC notifications for international procedures because it is more recognizable globally.

The PF must then immediately reduce thrust to idle and perform the rejected takeoff maneuver using maximum braking and thrust reversers as needed.

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SECTION 4
NON-NORMAL PROCEDURES

The rejected takeoff profile is summarized as follows:

- 1. Autothrottle (if installed) Disengage
- 2. Thrust levers IDLE
- 3. Brakes Maximum or as required
- 4. Thrust reverser(s) Max rev or as required

————— **END** —————

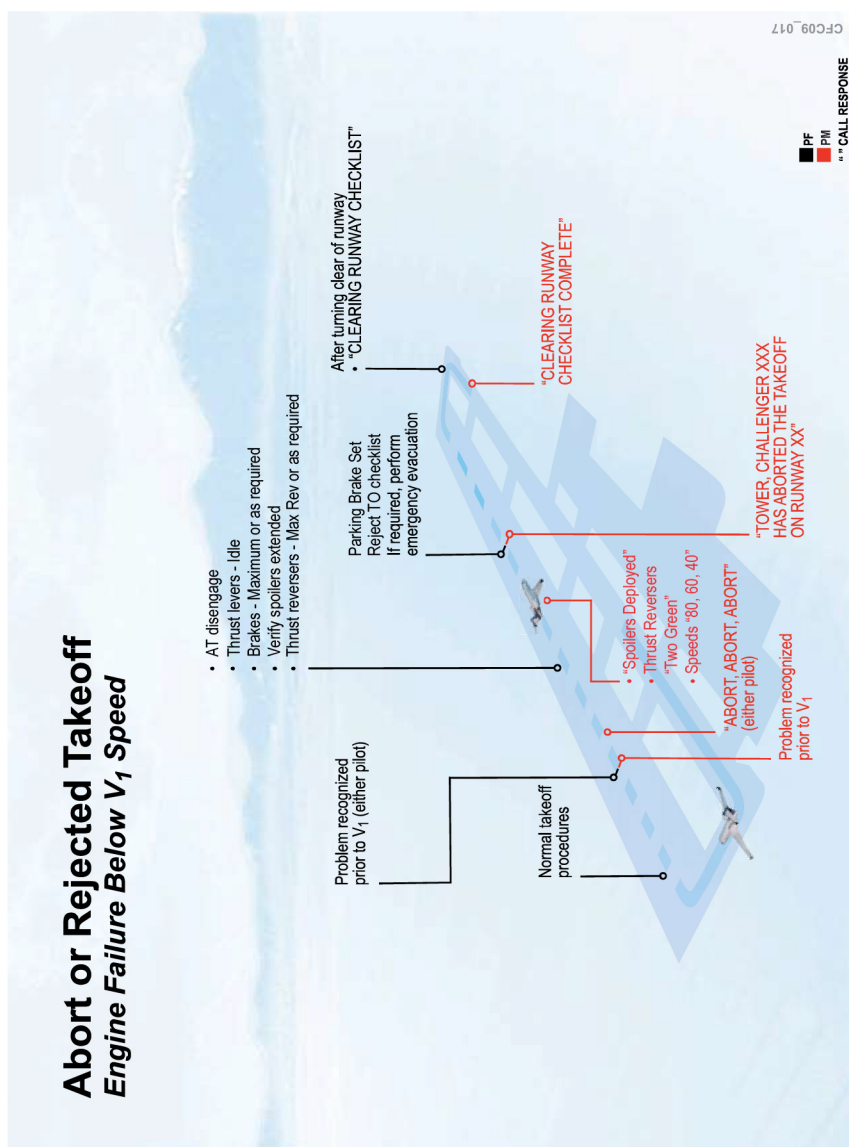
NOTE: It may take a few seconds to deploy the thrust reversers. Do not delay braking while thrust reverser deployment takes place.

The PM should be monitoring TR deployment, Spoiler deployment and Speeds as per rejected take off guidance.

When the airplane has rolled to a full stop and the park brake is ON, the PM will commence the Rejected Takeoff/Engine Failure below V₁ or appropriate checklist, as commanded by the PF.

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SECTION 4
NON-NORMAL PROCEDURESEngine Failure Below V_1 Speed
Figure 09-14-1

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SECTION 4

NON-NORMAL PROCEDURES

ENGINE FAILURE ABOVE V₁ SPEED

If an engine fails at or above V₁ and the TLA is in the TO Detent, APR thrust will be commanded by the FADEC. Keep the nosewheel on the runway until V_R and track the centerline. At V_R, rotate the aircraft and continue to apply rudder to maintain track and bank into the good engine. The slip-skid indicator above each PFD should be centered. With a positive rate of climb, select the gear up, and pitch the aircraft to the command bar noseup attitude to establish V₂. Once V₂ is established, the PF should maintain V₂ until obstacle clearance altitude or 1500 ft AGL, whichever is higher, and accelerate, to V₂ + 15 for flaps 10 or V₂ + 25 for flaps 20, and retract the flaps. Call for the checklist.

Use the following procedures to continue the takeoff (Fig. 09-14-2). When the airplane starts to yaw due to engine failure or other causes, apply a small amount of forward pressure on the control wheel. This keeps the nosewheel on the runway. Use rudder for directional control. Do not attempt to return to centerline; maintain parallel motion.

When the V_R or "Rotate" call is made, smoothly rotate to the command bars nose up pitch and maintain airplane control. When a positive rate of climb is established, call for "Gear up" and increase pitch to maintain V₂. Flight Level Change (FLC) selected to V₂ speed can be used for airspeed control. If turns are anticipated, it might be preferable to maintain up to a maximum of V₂ + 10 for stall margin considerations if half bank is unavailable or inappropriate. Once the airplane is stable and in trim, the autopilot may be engaged at 700 ft to relieve pilot workload. It is prohibited to re-engage the autothrottle following an engine failure on takeoff until the flaps are retracted and the aircraft has accelerated to enroute climb.

When airborne and stable, a good CRM technique is for the PF to ask the question "What happened?". At this point, it allows the crew to come together, briefly discuss the issue to be sure that both are on the same page and action any appropriate immediate action items.

Both pilots ensure climb speed is attained and pitch attitude maintained so the airplane satisfies all obstacle clearance requirements. When the airplane is stable, the rudder trim may reduce rudder pedal pressure. When the airplane is clear of obstacles or 1500 ft AGL, whichever is higher, accelerate to V₂ + 15 for flaps 10 or V₂ + 25 for flaps 20, call for flaps up, and then call for the Engine Failure (Above V₁) checklist. Increase the airspeed to (V_{fto}) and continue the enroute climb if necessary. As airspeed increases, the need for rudder deflection decreases. APR thrust is limited to 10 minutes. Reduce the thrust levers to CLB within 10 minutes of takeoff as per AFM limitations.



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SECTION 4 NON-NORMAL PROCEDURES

Both pilots positively identify which engine is not operating. The PF should guard the operating engine with one hand, while the PM confirms the proper throttle lever and then slowly retards the non-operating engine to IDLE. The PM then selects and confirms the non-operating engine run switch to OFF as per checklist instructions.

There are three critical items that need confirmation prior to selection to a different state at the same time:

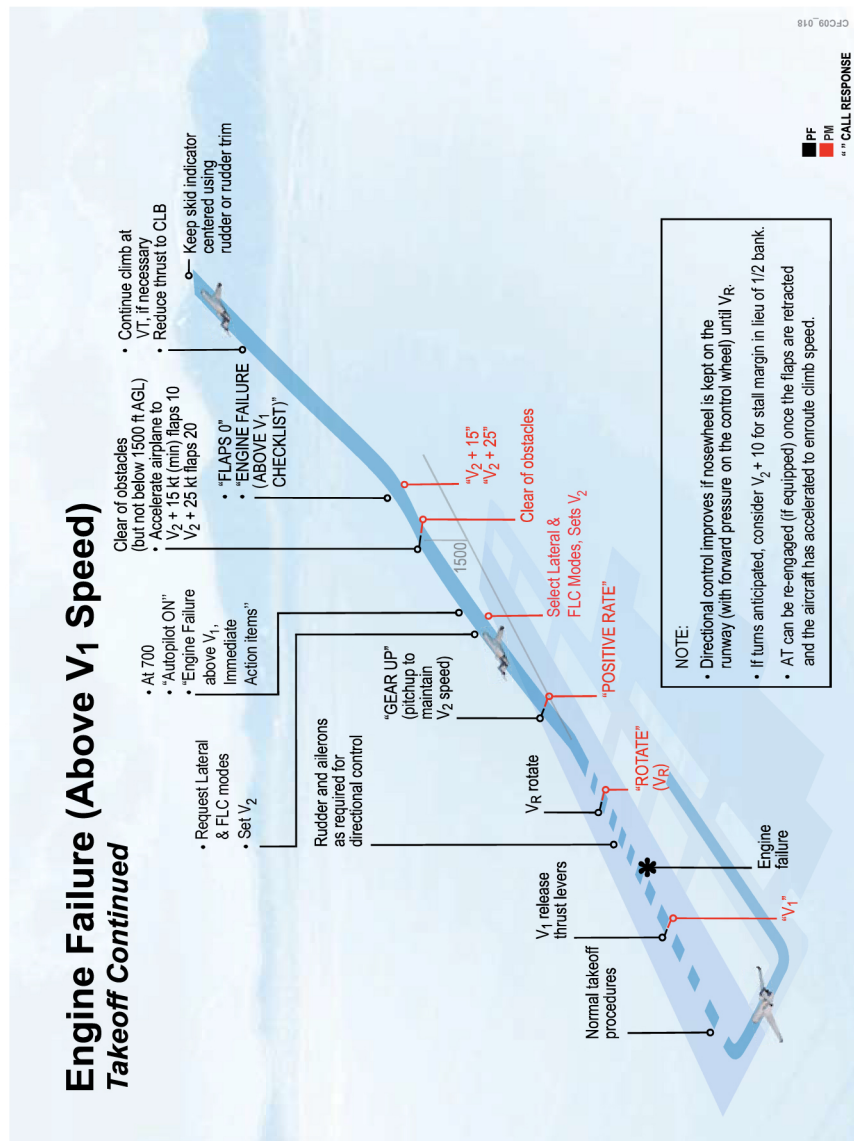
1. Engine Run Switches
2. Generators
3. Engine Fire Switches

The person making the selection should have their hand over the Switch/Button/Lever when making the request for confirmation which not only addresses the system but confirms the L/R side. Any one of these wrongly selected could have dire consequences and must be done at the request and confirmation of the PF. Upon completing all checklist items, select a suitable airport for a single-engine landing. An engine restart may be attempted if conditions warrant.

During takeoff roll, the PM devotes his attention primarily to the engine instruments, EICAS, and airspeed indicator. This should allow any malfunction to be recognized and confirmed in the shortest amount of time. Callouts to the PF should be exactly as briefed. The PF should have primary focus on the aircraft, using peripheral vision to backup the PM inside. Late takeoff abort decisions after V_1 are notoriously unsuccessful for all turbojet aircraft. Know what is critical and stick with the decision made in the crew takeoff briefing. There should be no doubt by either crewmember as to what is expected during takeoff.

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SECTION 4
NON-NORMAL PROCEDURESEngine Failure Above V_1 Speed
Figure 09-14-2



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SECTION 4 NON-NORMAL PROCEDURES

CRUISE EMERGENCIES

Malfunctions at altitude require the same thought process as those on takeoff. Maintaining aircraft control is the number one priority. Someone should always be flying the aircraft. For example, if an emergency descent is necessary due to rapid decompression, the primary crew concern should be to don the oxygen masks, and establish communications. At altitudes above FL 410, the time of useful consciousness (TUC) decreases significantly without supplemental oxygen.

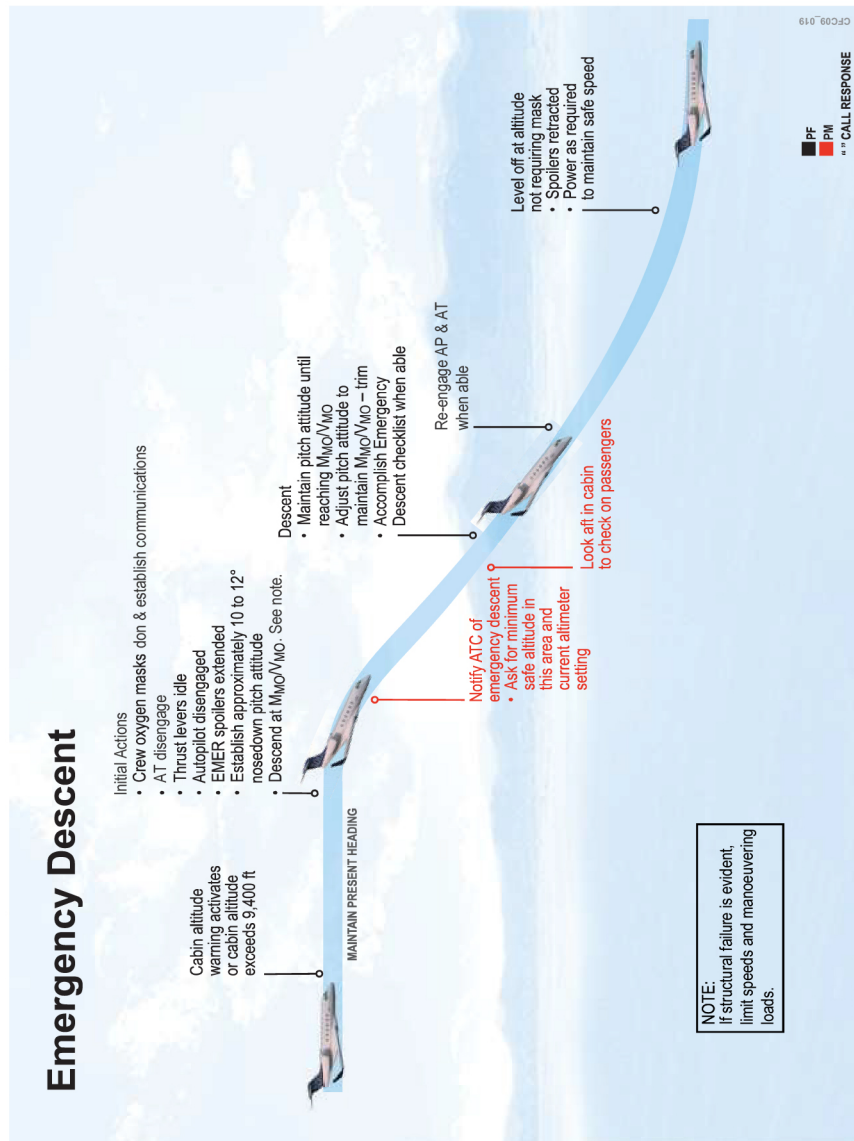
Pilots always put on their oxygen masks first, before ensuring that the passengers' masks have dropped. The emergency descent Immediate Action Items on the checklist are necessary to learn and accomplish. See Fig. 09-14-3

Emergency Descent

Of special note to the profile, to get the spoilers out to the EMER detent requires pushing the button on top of the handle which you normally never do. Also, if you have aft pressure on the handle as you try to push the button, it may hang up. Relax the pressure on the handle momentarily to be able to engage it. Once established in the descent, it may be wise to re-establish the automation.

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SECTION 4
NON-NORMAL PROCEDURESEmergency Descent
Figure 09–14–3Volume 1
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APPROACH/LANDING EMERGENCIES

For a single-engine approach, the procedure is the same as with both engines running (Fig. 09-14-4). The single-engine landing distance need only be increased by the associated factors in the AFM over the distance required for normal landing.

Knowledge of the emergency checklists (especially the Immediate Action Items) and aircraft limitations is important in successfully navigating an emergency situation. Also, keep the passengers informed on the progress of the emergency. Overall, good CRM is one of the best tools in an emergency situation. The objective in any emergency is to protect the passengers and safely land the aircraft. Depending on the type of emergency, there are situations when it is better to enter a holding pattern, sort things out, and then proceed with the approach and landing (Fig. 09-14-5).

WINDSHEAR

If extreme windshear is encountered, recommendations are the FAA technique of flying the attitude indicator, using APR thrust, and climbing at just above stick shaker (Target low speed cue + 10kts initially) until a safe altitude is reached. Do not rely on pressure instruments until after exiting windshear conditions, reference the radio altimeter.

Be alert for windshear reports and conditions. Study approach weather and wind conditions carefully. Be prepared to use thrust if a sudden sustained airspeed loss on final approach is encountered. Conversely, if the aircraft suddenly picks up too much speed, deliberately and carefully decrease thrust. If the increase in airspeed was caused by a sudden increase in headwind component, the ground speed may not significantly change immediately.

During the approach, be cognizant of increased performance windshear and how likely it may be followed by decreased performance windshear. Under these conditions, it may be favorable to GA at the earliest possible moment of the onset of increased performance windshear.

WINDSHEAR ALERTS AND WARNINGS

Mode 7 of the TAWS of the Challenger 350 provides alerts and warnings if significant windshear is detected below 1500 ft AGL.

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SECTION 4 NON-NORMAL PROCEDURES

WINDSHEAR RECOGNITION AND ESCAPE

Windshear escape should be performed whenever the TAWS has given a WINDSHEAR aural warning or whenever aircraft control becomes marginal below 1000 ft AGL. Marginal aircraft control may be recognized by uncommanded changes in the flight path in excess of (Refer to FAA AC 00-54, Appendix 1, Pilot Windshear Guide).

These values are guidelines only:

- 15 KIAS
- 500 ft/min vertical speed
- 5° pitch attitude
- Rapid one dot displacement from the glideslope
- Unusual throttle position for a significant period of time

At first indication of a windshear encounter the PF should simultaneously, disengage AT and AP and advance the thrust levers to the APR detent while ensuring spoilers are retracted and call WINDSHEAR RECOVERY, CHECK N_1 . The PM responds with N_1 SET when APR N_1 is reached. The PF should roll wings-level and apply back pressure on the yoke at a normal rotation rate. The objective is to initiate a climb with 10–15 degrees initial pitch up. Increase pitch attitude smoothly and in small increments, trading airspeed for altitude as necessary to stop descent. The target airspeed (if possible) should be 10 kt above the low speed cue initially. Apart from retracting the flight spoilers (if extended), no other aircraft configuration changes should be made until safely clear of the ground and with a suitable climb rate. Maximum aircraft performance is achieved with maximum N_1 and a pitch attitude that tickles the stick shaker; however, care must be given to avoid overcontrolling and inducing stick pusher activation. Once clear of the windshear, the aircraft accelerates rapidly with APR set. Pitch attitude control and configuration changes should be conducted with close attention to the airspeed trend vector and the VSI/altimeter. The PM should closely monitor all indications on the VSI/altimeter and call out speeds to the PF. Advise ATC of the windshear and any excursions from cleared altitude or heading.

The following procedure should be employed for a windshear escape maneuver:

1. Autothrottle (if installed) Disengage
2. Autopilot Disconnect
3. Thrust Levers APR
4. Flight Spoilers Retract
5. Rotate smoothly to the takeoff/go around pitch attitude, allowing airspeed to decrease if necessary. Maintain wings level. Do not retract flaps or landing gear.



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**SECTION 4
NON-NORMAL PROCEDURES**

6. If the airplane continues to descend, increase pitch attitude smoothly and in small increments, bleeding airspeed as necessary to stop descent. Use stall warning onset (stick shaker) as the upper limit of pitch attitude. A good target would be Low Speed cue plus 10 KIAS initially.
7. Maintain escape attitude and thrust and delay retracting flaps or landing gear until safe climb out is assured and positive energy to the airplane has returned.

NOTE: Refer to AFM & QRH for official exact guidelines.

8. Once clear of obstacles or terrain and "WINDSHEAR" removed from PFD, resume normal flight.
9. Check airspeed and adjust thrust/configuration as required.

————— **END** —————

TAWS RECOVERY

The terrain awareness warning system (TAWS) of the Challenger 350 has seven modes. Modes 1 through 6 are basic TAWS functions while mode 7 includes windshear alerting. TAWS terrain alerting can be split into two areas — Caution and Warning. Refer to FCOM 2 for details of these modes.

CAUTION AREA

Penetration into a caution area generates a CAUTION TERRAIN aural warning and a GND PROX annunciation on the PFD. This occurs at approximately 60 seconds prior to predicted ground impact.

WARNING AREA

Penetration into a warning area generates a PULL UP aural warning and a PULL UP annunciation on the PFD. This occurs at approximately 30 seconds prior to predicted ground impact.

Should either area be penetrated, the PF should simultaneously disengage AT and AP, advance the thrust levers to the APR detent, ensure spoilers are retracted if used and call "TERRAIN RECOVERY, CHECK THRUST". The PM responds with "APR SET" when APR is reached. The PF should roll wings level and apply back pressure to initiate a wings level climb at a normal rotation rate. The objective is to initiate a climb with 10–15 degrees initial pitch up. Increase pitch attitude smoothly and in small increments, trading airspeed for altitude as necessary towards the low speed cue (Target low speed cue +10 kts initially), back pressure must be reduced to maintain this speed. If altitude for recovery is critical, maximum aircraft performance can be achieved by applying enough back pressure on the yoke to maintain the edge of (tickle) stick shaker until clear of obstacles or terrain.

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TAWS – PULL UP – ESCAPE:

1. Autothrottle (if installed) Disengage
2. Autopilot Disconnect
3. Thrust Levers APR
4. Flight Spoilers Retract
5. Climb at maximum practical rate.
6. Landing Gear switch UP
7. Maintain climb until the warning ceases.
8. Once clear of obstacles or terrain, resume normal flight.
9. Check airspeed and adjust thrust/configuration as required.

————— **END** —————

Your PFD terrain indications are a good source indicating peaks in the general area if not visual.

Approach Call outs

A TAWS alert is pre-programmed to sound at “1000 AGL and 500 AGL” it may be pre-programmed to advise other optional calls but it is important to understand that this is a RADALT call and not an indication above minimums. They are simply to advise of proximity to ground and relative position to the approach. The PF may acknowledge it by simply stating Check.

TCAS

Either pilot can call TCAS traffic as it is noticed on the MFD. The PF should immediately optimize the scale of the MFD so that the traffic is on the outer edge of the display. The PF should then direct the PM to look outside for the traffic and turn on all exterior lights (See and be Seen). The PF continues to optimize the scale of the MFD, continues to direct the PM where to look for the traffic, and monitors the MFD for any changes in traffic flight path or new traffic. Should the PM become visual with the traffic, the PM should inform the PF and continue to monitor this traffic as well as look for others.

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SECTION 4 NON-NORMAL PROCEDURES

The PF should continue to monitor the MFD for any changes in traffic flight path or new traffic. The PM should also request/advise ATC of any flight path changes requested by the PF in order to avoid the traffic. The PF should take whatever Resolution Advisory (RA) attitude is directed by the TCAS. The PM should continue to look for the traffic and ensure the PF has met the Resolution Advisory (RA) directed by TCAS.

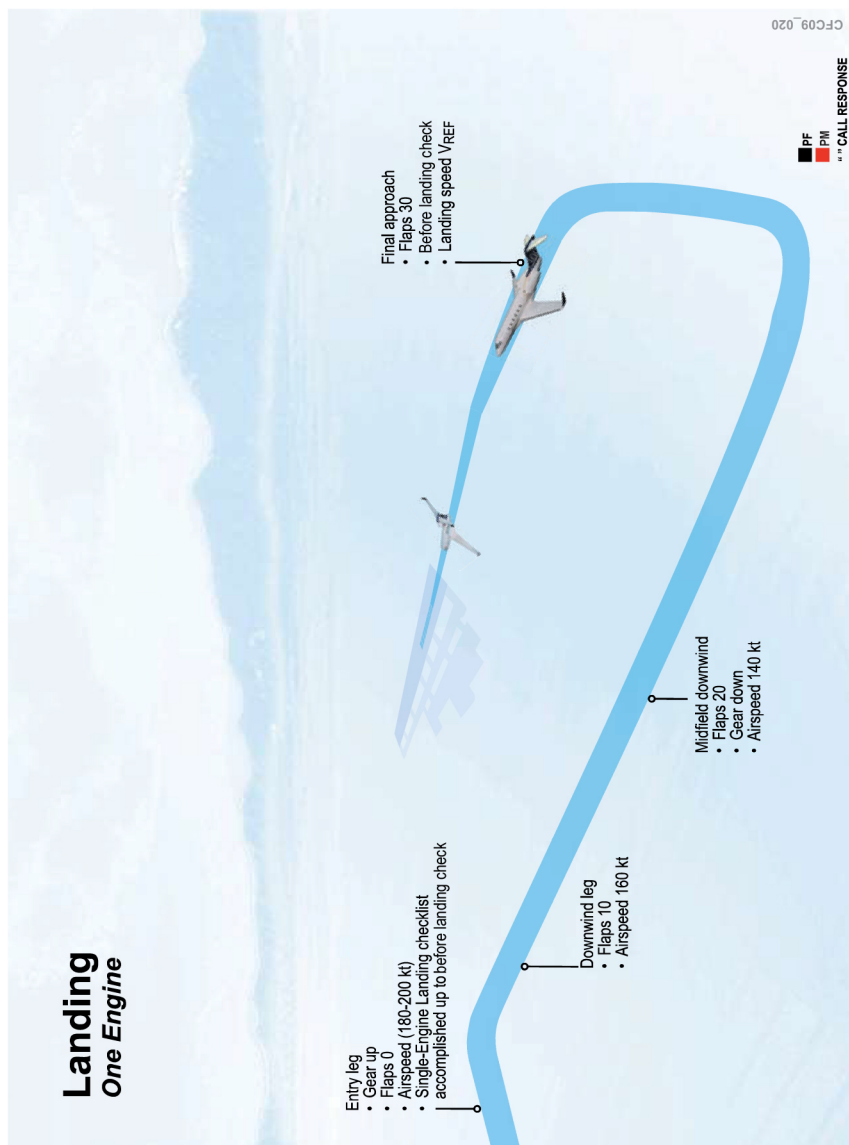
Resolution Advisory (RA) Actions:

1. Autothrottle (if installed)..... Disengage
2. Autopilot Disconnect
3. Follow VSI indications as indicated by green band
4. PM to advise ATC "TCAS RA"
5. After "CLEAR OF CONFLICT", resume normal navigation
6. Advise ATC

————— **END** —————

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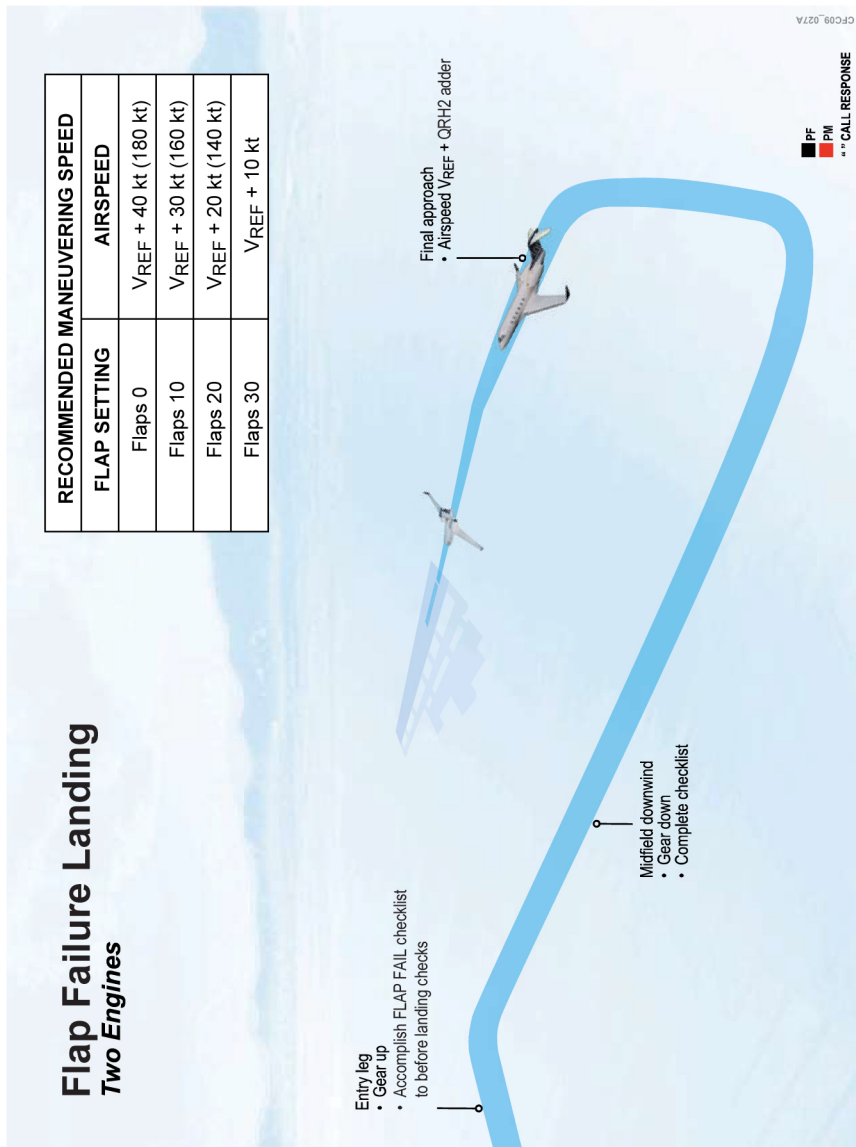
ROPAT

SECTION 4
NON-NORMAL PROCEDURESSingle-Engine Landing
Figure 09-14-4



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NON-NORMAL PROCEDURESNo-Flap Landing
Figure 09-14-5

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NON-NORMAL PROCEDURES

RUNWAY OVERRUN AWARENESS AND ALERTING SYSTEM (ROAAS)

ROAAS is a feature of the TAWS unit that compliments flight crews' situational awareness to the possibility of exceeding the runway end during approach and landing. It is designed to be an added safety net for runway overrun hazards. ROAAS provides alerts to the flight crew when a real-time calculation of landing distance exceeds the remaining available distance to the end of the runway. It has two automatic modes of operations: In-Air and On-Ground Alerting.

ROAAS landing distance is representative of the Factored Operational Landing Distance (FOLD), not the AFM Actual Landing Distance (ALD).

IN-AIR MODE

During approach, should the ROAAS predicted landing distance exceed the available runway length, the system will generate a "RUNWAY LENGTH" aural alert and a RWY LENGTH annunciation on the PFD. There are two levels of In-Air alerts: Caution and Warning.

ROAAS In-Air CAUTION

RWY LENGTH (Amber annunciation on PFD)



"RUNWAY LENGTH" (Single Aural)

ROAAS In-Air CAUTION can occur during final approach between 450 and 200 feet above runway elevation:

1. Current predicted landing distance exceeds runway length available.
2. Consider a go-around.
3. If condition persists at 200 feet above runway elevation, a ROAAS warning will be issued.

NOTE: Small corrections can sometimes stop the ROAAS CAUTION message, but large corrections can lead to Unstabilized Approaches. Refer to: FCOM1, ROPAT Chapter 9, STABILIZED APPROACH PHILOSOPHY .

— END —



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SECTION 4 NON-NORMAL PROCEDURES

ROAAS In-Air Warning



**“RUNWAY LENGTH,
RUNWAY LENGTH”
(Continuous Aural)**

1. Execute a go-around.

NOTE: Contact with the ground may be unavoidable if go-around is initiated from a low altitude or high sink rate. If the airplane contacts the ground during the Go-Around, maintain the normal landing attitude or slightly higher. The airplane configuration (landing gear/flaps) should not be changed until the airplane is climbing if ground contact is made or not. Refer to FCOM 1 ROPAT, Balked Landing / Low Energy Go-Around procedure.

————— **END** —————

ON-GROUND MODE

After landing/touchdown, should the ROAAS predicted landing distance exceed the remaining runway length, the system will generate a “DECELERATE” or “DECELERATE NOW” aural alert and a DECELERATE annunciation on the PFD. There are two levels of On-Ground alerts: Caution and Warning.

ROAAS On-Ground Caution

ROAAS On-Ground Caution can occur during the landing rollout:

**DECELERATE (Amber
annunciation on PFD)**



**“DECELERATE” (Single
Aural)**

1. Current predicted stopping point is approaching the end of the runway.
2. Increase deceleration to avoid a ROAAS Warning.

————— **END** —————

ROAAS On-Ground Warning

**DECELERATE (Red
annunciation on PFD)**



**“DECELERATE NOW”
(Continuous Aural)**

1. Brakes Maximum
2. Thrust reversers MAX REV

————— **END** —————

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SECTION 4 NON-NORMAL PROCEDURES

OPERATIONAL CONSIDERATIONS

ROAAS is only available for landing.

If landing on wet or contaminated runways, select RCC5. ROAAS (if installed) may not provide timely alerts to reduce the risk of overrun on contaminated runways with braking reports less than RCC 5.

The ROAAS Model Distance (RMD) can be conservatively approximated by FOLD. As a result, ROAAS must be selected OFF for operations on runways shorter than FOLD or divert to a longer runway. With ROAAS on, to avoid ROAAS alerts, the landing distance available must be equal to or greater than FOLD. (See Flight Crew Operating Manual, Volume 1, Chapter 6 – PERFORMANCE for FOLD information or QRH 1 P-43).

NON-NORMAL AND EMERGENCY PROCEDURES

There are three possible impacts to ROAAS operation due to system malfunctions:

1. ROAAS alerting becomes unreliable due to signal failure (e.g. **WOW FAIL**). In this case, the crew will be directed to select ROAAS OFF, as alerting and landing distance calculations may be unreliable or inaccurate.
2. RMD under-predicts the landing distance due to reduced deceleration capability (e.g. **INBD BRAKES FAIL**). In this case, ROAAS alerts will assume full system functionality and may not be timely enough to completely prevent an overrun. Crews are not directed to select ROAAS OFF, because any alerts will still be valid and can reduce the severity of an overrun.
3. The AFM non-normal/emergency landing distance could be shorter than the calculated ROAAS landing distance. ROAAS calculations are closely approximated by FOLD, and AFM non-normal/emergency landing distance factors are based on ALD. As a result, for non-normal/emergency procedures with a relatively low ALD factor and/or increased approach speed, the resulting minimum runway distance will fall below the ROAAS calculated landing distance. These non-normal/emergency procedures are identified with the following note:

- NOTE:**
- For aircraft with ROAAS installed, ROAAS should be selected OFF when landing on an RCC 6 runway with a length shorter than the increased ALD plus 2,000 feet (600 m).
 - ROAAS should be selected OFF when landing on a runway with RCC less than 6.
 - If the above note(s) do not apply, ROAAS should be kept on.



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SECTION 5 TRAINING MANEUVERS

Bombardier has collaborated with other Manufacturers and ICAO to create Revision 03 of the Airplane Upset Prevention and Recovery Training Aid (AUPRTA). This is free courseware available online and in the APP store that targets in depth knowledge for upset recovery.

Refer to Advisory Wire: AW000-02-0003 for more detailed information.

NOTE: If there is any disagreements between AUPRTA or ROPAT guidance with the AFM, the AFM guidance prevails.

In addition to evaluating normal operational skills and procedures, certain training and testing maneuvers are required to pass ATP, Type Rating, and Part 135 practical tests. The following section focuses on a few of the maneuvers required by the FAA ACS (Airman Certification Standards).

When conducting maneuvers, altitudes are at the discretion of the instructor/examiner. They should be chosen based on aircraft performance and safe clearance from terrain, obstacles, and other traffic. At the same time, entry altitudes for approach to stall maneuvers (Stall to Shaker) should be realistic and consistent with the maneuver configuration. Typically, from relatively flat terrain at approximately sea level, training is conducted at 14000 ft but can vary.

Training maneuvers are intended to be done in a simulator. Most but not all could be done in the airplane. Stalls to pusher in the actual airplane are not authorized, and are in fact prohibited by AFM limitation (min speed authorized being shaker).

All in-aircraft training maneuvers should be conducted in VMC with appropriate cloud clearance to ensure the aircraft is clear of all traffic for the full duration of the maneuver. When conducting training maneuvers in a flight simulator or training device, minimum altitude and cloud clearance do not apply and are based on the training objective. For example, landing configuration stall demonstrations and recoveries may be conducted at the MDA, departure configuration stalls may be conducted immediately after takeoff, etc.

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TRAINING MANEUVERS

The use of the flight director and/or autopilot and autothrottle remains at the discretion of the instructor/examiner. The decision to use aircraft automation is based on the objective of the maneuver and skills of the customer trainee. For example, a steep turn exercise is an instrument-skills maneuver, so the flight director, autopilot and autothrottle should be off. A stall-recovery maneuver used to demonstrate aircraft low-speed handling characteristics should be flown without the use of the flight director, autopilot or autothrottle. However, when demonstrating a stall recovery, allowing the autopilot trim to the stall warning is beneficial. In the course of training, a pilot should see stall recovery maneuvers both with and without the use of the aircraft automation.

- Steep bank turns
- Approach to stall – clean configuration
- Approach to stall – takeoff/approach configuration
- Approach to stall – landing configuration
- Unusual attitude recovery.

STEEP BANK TURNS

The flight director will be off for this maneuver. Altitude and speed selection is at the discretion of the instructor/examiner. The normal maneuvering speed for this exercise is 250 KIAS and 14000 ft. This maneuver is usually accomplished at 45° of bank, turning in both directions with heading changes of 180°. A constant speed and altitude is maintained throughout the maneuver (Fig. 09-15-1).

Stabilize the airplane at the assigned speed and altitude. While rolling into the turn, increase power (Approx. increase 2%–4% N_1) to maintain the assigned airspeed at 45° of bank. While rolling into the turn, adjust pitch to maintain altitude. Trim, if desired, to reduce yoke pressure.

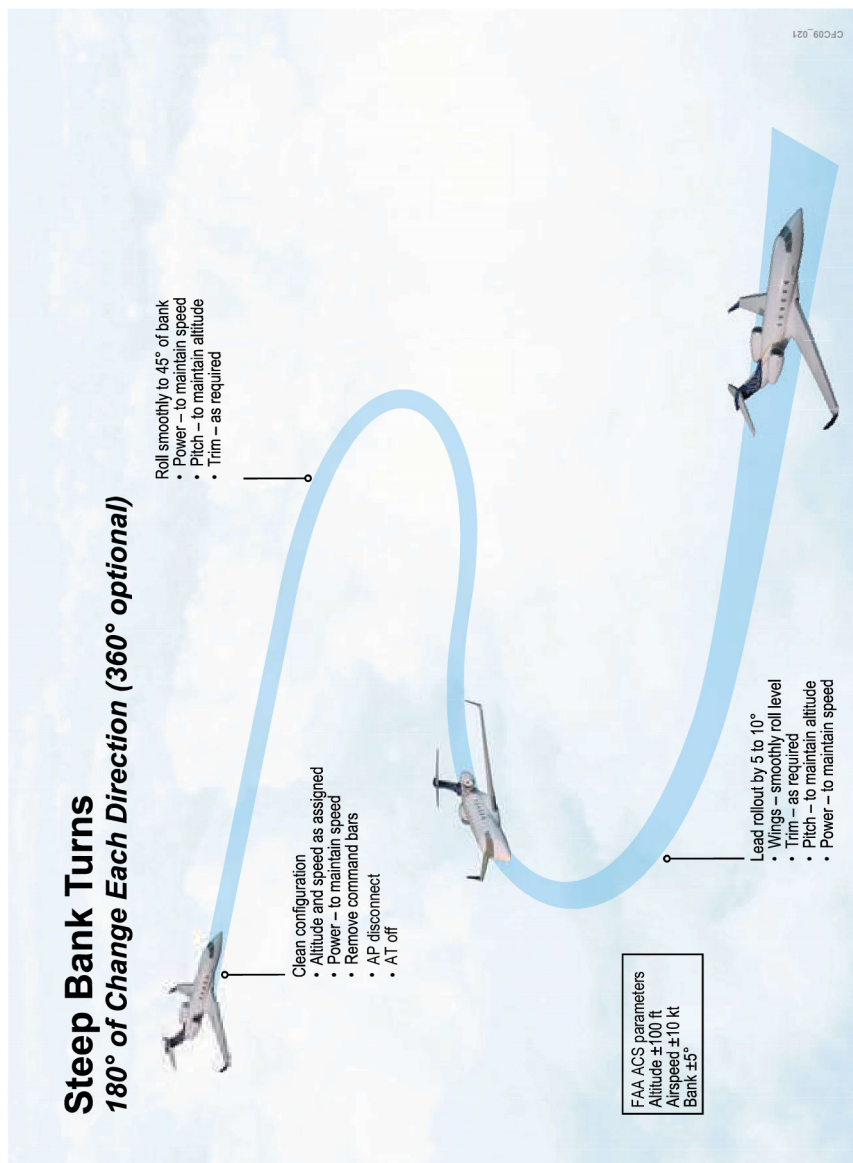
Start the rollout approximately 10° prior to the desired heading. The actual lead time is dependent on the pilot's roll rate. No pause is necessary or desired when changing the direction of turn. Continue the turn, rolling into the opposite direction 45° of bank. Very little trim correction is required when transitioning quickly from one direction to the other.

During the maneuver, the PM can be used, as briefed by the PF, to monitor and announce deviations from altitude, bank, airspeed, and heading. For coordination, PM heading calls of 30, 20, and 10 can be used to increase the accuracy of the rollout heading. The PM can adjust power as directed by the PF (Approx. increase 2% N_1). In recent times, some authorities no longer allow that practice for check rides hoping to sharpen your skills so it may be good practice to do on your own. In the real world however it would be considered good CRM.



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SECTION 5
TRAINING MANEUVERSSteep Bank Turns
Figure 09–15–1

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SECTION 5
TRAINING MANEUVERS

APPROACH TO STALL AND RECOVERY PROCEDURES

With smooth technique, the pilot can easily control the aircraft flight path and rate of change in speed during the maneuver entry and recovery from stall warning regime. Recovery is normally initiated at the first indication of low speed / Stall. The warning system indications include but not limited to Nose high attitude, slow speed, rapidly decreasing speed trend vector, sloppiness of flight controls, **stick shaker**, pusher, or aural warnings. When training in a flight simulator or training device, recovery may be delayed to demonstrate additional stall warning indications and aircraft flight characteristics at lower than normal flight speeds. If autothrottle equipped, typically the system not used until recovered.

The AFM recovery procedures must be used. The AFM recovery should be maintained until the aircraft is above the minimum safe speed for the current condition. Normally, the aircraft is recovered to 180 KIAS at the same altitude the maneuver began.

While altitude loss is a consideration, it is not the primary point of focus. Reducing the angle of attack by reducing the pitch attitude should be the pilot's main goal, not maintaining an arbitrary cleared altitude. The emphasis must be on recovering the airplane from the stall, regardless of the altitude loss; maintaining your cleared altitude is irrelevant in stall recovery. That is not a license to lose an unreasonable amount of altitude however and principles of good airmanship apply.

At low altitude (past the FAF on approach), terrain proximity is definitely a factor which must be considered. Proper balance between altitude loss and stall recovery technique should be exercised with proper judgement. A trade off must occur from what is required versus what is acceptable but you may wish to use all you can.

The autopilot and/or flight director may be used on any of the three approach-to-stall maneuvers. If the autopilot is used, a distraction may be used, making the stall warning activation and aircraft recovery more realistic.

Appropriate horizontal cloud clearance must be maintained to ensure the maneuver will be completed in VMC and so clearance from other traffic is maintained. Stall warning activation speeds V_S should be calculated for specific altitude, weight, and configuration before the maneuver begins. V_{REF}/V_2 will be calculated for the specific weight and manually set on the speed tape. If the stall warning system does not activate at the determined speed, an immediate recovery to normal flight speeds will be made and no further low-speed training may be conducted until the sources of the error is corrected.



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SECTION 5
TRAINING MANEUVERS

When training is conducted in a flight simulator or training device, altitude and cloud clearance requirements do not apply. The instructor will determine the maneuver conditions based on the training needs at the time. Stall warning speeds do not need to be calculated. If a stall recovery maneuver based on a departure is conducted, a V_2 and flap retract speed should be posted on the airspeed tape. If a stall recovery maneuver based on an approach situation is conducted, V_{REF} and V_{ga} should be posted on the airspeed tape.

The following approach-to-stall profiles are examples and strict adherence to their choreography is not required as long as all three profiles (clean, approach/takeoff, and landing) are performed. Proper recoveries per AFM procedures **must** be followed.

APPROACH TO STALL — CLEAN (FLAPS 0)

The approach to stall – clean configuration is accomplished with flaps and landing gear retracted. Normally, there would not be V-speeds selected for this phase of flight, therefore it is not appropriate to select anything other than what would be available for normal cruise flight.

Maintain heading and altitude entering the maneuver. Initially, stabilize the airplane at 180 kt using about 65% N_1 . Retard the thrust levers to IDLE. As airspeed decreases, the pitch attitude will increase in order to maintain altitude. At the first indication of an impending stall, perform the AFM stall recovery procedure. Some altitude loss will result.

1. Autopilot..... Off
2. Lower the pitch attitude to reduce angle-of-attack.
3. Autothrottle (if installed) Off
4. Thrust Levers APR
5. Flight Spoiler lever Retract
6. Level the wings.

After airspeed increases and stall warning is extinguished:

7. Pitch attitude Adjust to minimize loss of altitude.
8. Advise ATC and proceed as cleared.

————— **END** —————

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SECTION 5
TRAINING MANEUVERS

For training purposes, stall recognition can be considered as stick shaker but as mentioned above there are many indications prior to stick shaker activation that should prompt the Stall recovery technique. Good airmanship requires us to keep an active watch on aircraft performance, which should keep the aircraft outside of an impending stall regime. It is also important to note that a stick shaker event is not yet a stall but it should still prompt an immediate stall recovery procedure

**APPROACH TO STALL — TAKEOFF OR APPROACH
CONFIGURATION FLAPS 20**

The approach to stall-takeoff configuration is accomplished with flaps at 20° (Fig. 09-15-2). Prior to approaches to stalls, compute and set the airspeed bug to V_2 for the applicable weight. While slowing the aircraft, use the pitch trim to reduce control forces; however discontinue trim when reaching the computed V_2 . This may be accomplished by displaying the FMS takeoff speeds.

Initially, stabilize the airplane at 180 kt. Configure the airplane with flaps 20°. Fly at 15° – 30° of bank. Power should be set to approximately 50% N1 to cause a slow deceleration to low-speed warning.

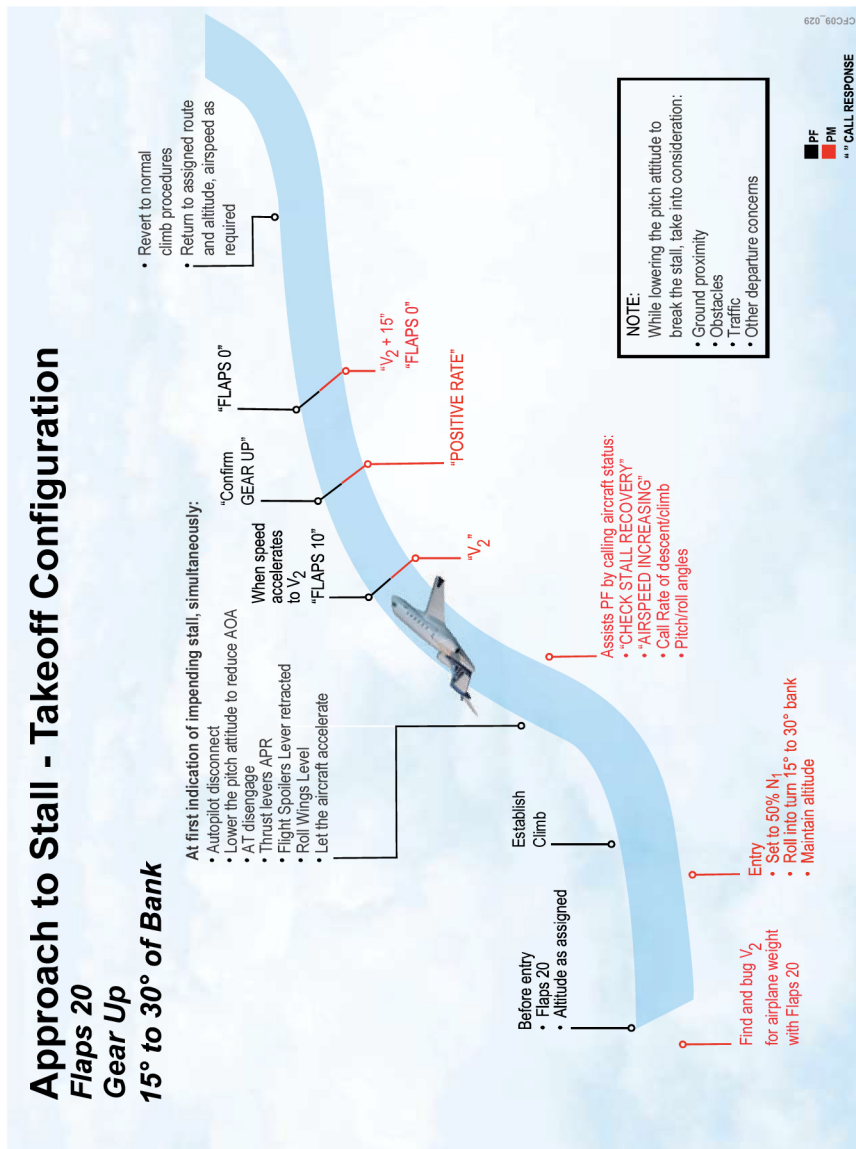
At the first indication of the low-speed warning or impending stall, perform the AFM stall recovery procedure. Altitude loss will occur and is expected. Emphasis must be on reducing the AOA to recover from the stalled condition. Do not change configuration when airspeed is below V_2 . Once the airplane accelerates above V_2 , flaps may be retracted to 10°. When a positive rate of climb is indicated, and when selected airspeed increases above V_2+15 , then flaps 0 selected. Return to the original altitude and maintain present heading. Reduce thrust to recover to 180 kt or previously assigned speed. Once stabilized and recovery is underway, advise ATC and proceed as cleared.

As this profile addresses flaps 20 be certain to select proper V_2 if attempting an approach to stall Flaps 10. The V_2 speed is a factor of V_{SR} which changes with flap settings.

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SECTION 5 TRAINING MANEUVERS



Approach to Stall – Takeoff or Approach Configuration
Figure 09–15–2

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**SECTION 5
TRAINING MANEUVERS****APPROACH TO STALL — LANDING CONFIGURATION**

The approach to stall – landing configuration is accomplished fully configured and preferably in association with a published procedure (Fig. 09–15–3). Prior to accomplishing this approach-to-stall maneuver, compute and set the landing airspeed bugs for weight. This should be accomplished by displaying the FMS-based approach speeds (V_{REF} and V_{ga}).

Configure the aircraft for landing in level flight. Set power to 55% N1. Slow to V_{REF} .

At the first indication of the low-speed warning or impending stall, perform the AFM stall recovery procedure. Altitude loss will occur and is expected. Emphasis must be on reducing the AOA to recover from the stalled condition.

Once the aircraft accelerates to a least V_{REF} , the flaps may be retracted to 10°. After a positive rate is attained, the gear may be retracted. When clear of obstacles, accelerate to $V_{GA} + 15$ and retract flaps to 0. Once stabilized and recovered advise ATC and return to previously assigned altitude and heading or newly issued clearance.

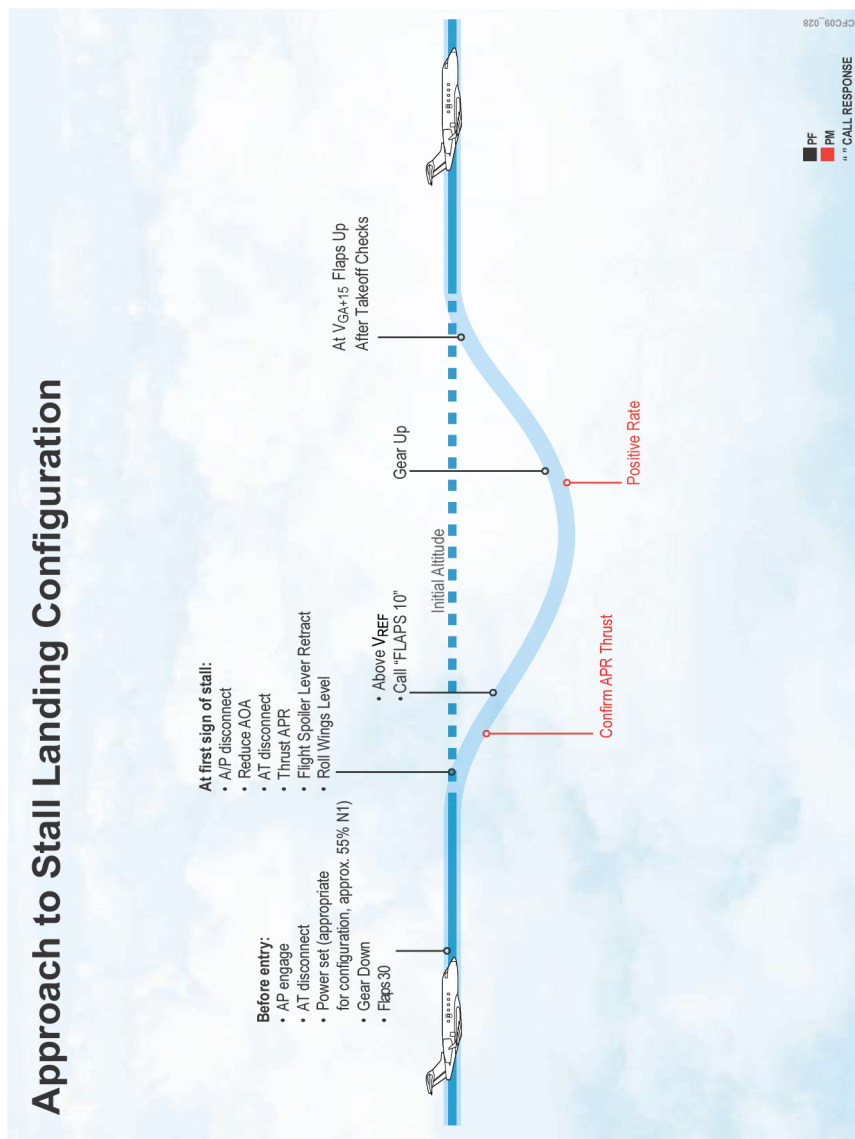
When established on the appropriate heading and altitude, reduce the thrust to maintain 180 kt.

If accomplishing this maneuver in a flight simulator or training device, it is beneficial to conduct this maneuver in conjunction with a non-precision approach. The aircraft should be fully configured at the FAF. Allow the aircraft to descend at a rate sufficient to level off at the MDA prior to the VDP. Maintain V_{REF} during the descent. At level off, do not increase power. Allow the aircraft to activate the low-speed warning.



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SECTION 5
TRAINING MANEUVERSApproach to Stall – Landing Configuration
Figure 09–15–3

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TRAINING MANEUVERS

DEMONSTRATION OF THE STICK PUSHER

This maneuver is conducted in a **flight simulator or training device only**, not in the aircraft. This maneuver will be briefed in advance. It must be made clear to the customer trainee that this maneuver is to demonstrate the operation of the stick pusher.

This maneuver may be conducted in conjunction with any of the low-speed recovery maneuvers described previously. As the aircraft slows through the low-speed warning cue, the stick shaker will activate and the autopilot will disconnect. The customer trainee must hand fly the (simulator) while continuing to reduce speed. The stick pusher will activate. Allow the customer trainee to experience a full pusher recovery to normal flight.

Once pusher is activated allow the pusher to take the yoke out of your hands, at a normal AOA it shall release and you must be prepared to maintain a forward pressure. It must be clear to the pilot that a forward pressure must be maintained during initial "STALL RECOVERY" as it will tend to nose up and may cause secondary shaker and or pusher activation. Then the AFM stall recovery procedure can be completed as normal.

The low energy regime must be exited completely before resuming normal flight, much like any other stall.

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SECTION 5 TRAINING MANEUVERS

HIGH ALTITUDE STALLS

This maneuver is conducted in a **flight simulator or training device only**, not in the aircraft, as it is a training requirement for certain authorities.

At higher altitudes, less power is available from the engines and an exchange of altitude for speed is required because the spool up time of the engines and speed/energy increase can be very slow from idle. Typically, a high altitude stall recovery is handled in what may seem as a counter intuitive method. Should the aircraft stall in cruise at 38000 ft, in addition to the normal stall recovery technique, you may be required to maintain a lower pitch attitude of minus 5 degrees below the horizon until the aircraft can recover a minimum energy of .72 Mach. Any recovery to level flight before these parameters are attained can leave you struggling on the wrong side of the power curve and may lead to secondary stalls. This may lead to a large altitude loss which can be as much as 5000 ft. ATC and crew communications can not be over emphasized.

Stall Recovery Procedure:

1. Autothrottle (if installed)..... Disengage
2. Autopilot Disconnect
3. Lower Pitch Attitude (target – 5 degrees below horizon)
4. Thrust Levers APR
5. Spoilers Retract
6. Roll Wings Level

— END —

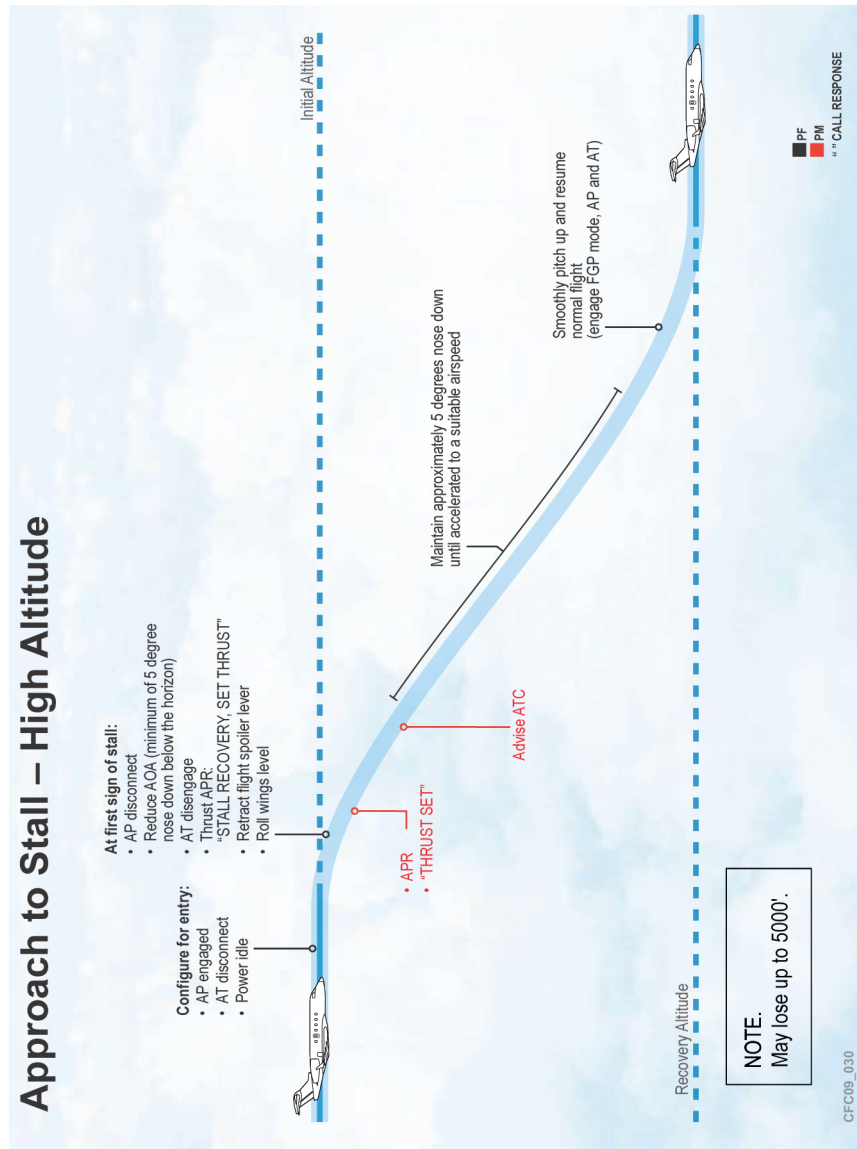
Calls:

PF	PM
"Stall Recovery, Set N ₁ "	
	"N ₁ Set"

The PM should advise ATC, monitor performance and voice energy (speed) returning and altitudes losses progressively until recovered.

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SECTION 5
TRAINING MANEUVERS

Approach to Stall – High Altitude Stall
Figure 09–15–4



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SECTION 5 TRAINING MANEUVERS

UNUSUAL ATTITUDE RECOVERY

It is important to maintain positive control of the aircraft by recognizing the airplane flight condition.

During a sudden or unknown change to an unusual attitude, verify the aircraft attitude using all available indicators. Use these references to make the proper recovery.

Aircraft upsets and unusual attitudes (UAs) can be caused by a number of factors including failure of attitude information, clear air turbulence, windshear, wake turbulence, engine failure, flight control problems, aircraft mishandling, or pilot inattention.

The first step in any upset recovery is to centralize the controls to avoid exacerbating the situation. Then an expeditious analysis of the aircraft pitch attitude, angle of bank, current airspeed, airspeed trend, rate of descent, and altitude. Make use of primary flight and performance instruments (PFD) when analyzing the situation; however, should their reliability be in doubt immediate reference must be made to the standby instruments. Except for the most minor upsets, it is generally advisable to disconnect both the autopilot and the autothrottle until the aircraft is recovered to normal conditions.

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SECTION 5
TRAINING MANEUVERS**Immediate Actions**

1. Centralize controls.
2. Analyze the situation: cross-check both primary and secondary attitude instruments.
3. Disengage the autopilot and autothrottle.
4. The pilot with the reliable attitude information assumes control and flies the recovery.
5. Check Airspeed:
 - Airspeed decreasing PF announces “NOSE HIGH RECOVERY”.
 - Airspeed increasing PF announces “NOSE LOW RECOVERY”.

————— **END** —————

NOSE HIGH — AIRSPEED SLOWING

Once the nose high, airspeed slowing, increasing altitude indications are confirmed (cross check instruments), Disengage AT and AP. Roll the wings toward the nearest horizon to unload the wing (Target 60 degrees bank), while simultaneously applying full power and retract flight spoilers if used to counter the decreasing airspeed (Fig. 09-15-5). Allow the nose of the airplane to fall to the horizon. Roll wings level and return the airplane to level flight. Then adjust power to maintain the desired airspeed.

By targeting 60 degrees and releasing the back pressure on the yoke, the nose will have a natural tendency to drop rapidly, therefore achieving the primary objective – bring the nose down – without applying or exceeding any negative g loading. Once stable, re-engage automation and advise ATC. Resume normal flight and clearance if appropriate.

NOSE LOW — AIRSPEED INCREASING

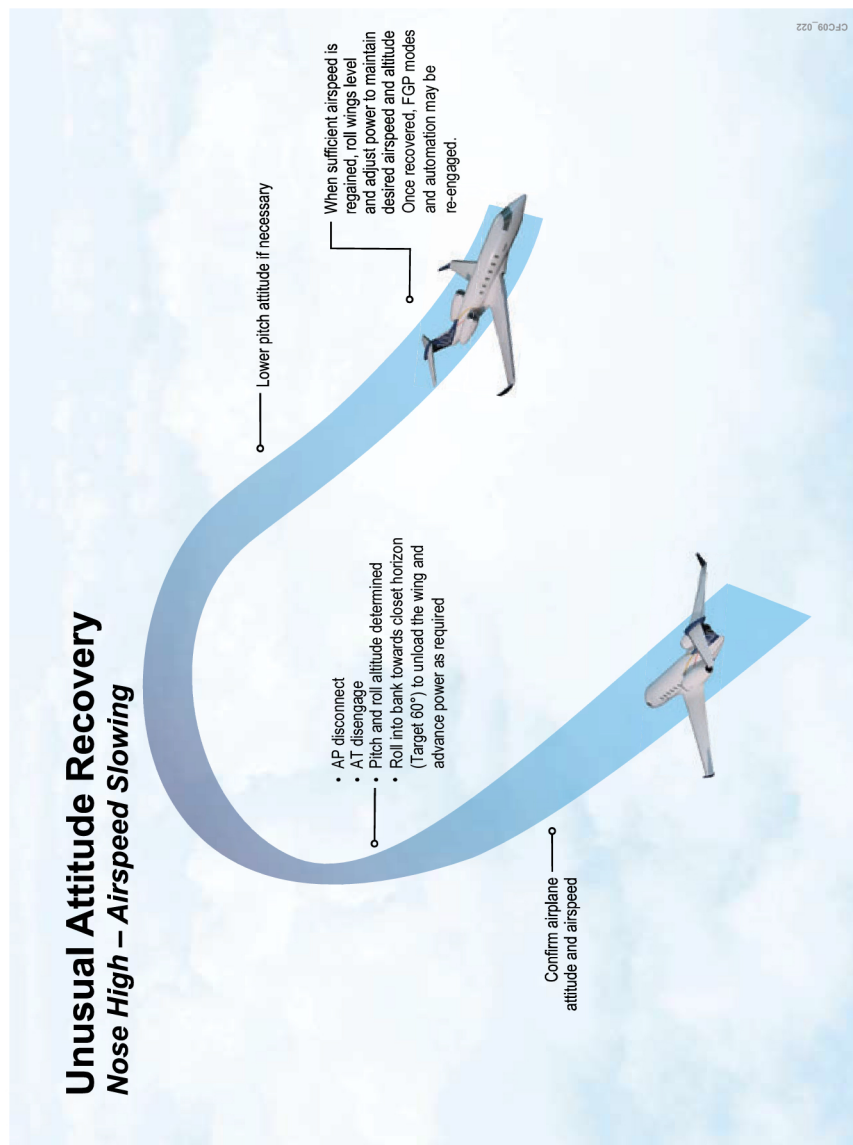
Once the nose low, airspeed rapidly increasing and altitude decreasing condition is confirmed (cross check instruments), Disengage AT and AP. Rapidly place the thrust levers to idle and roll wings level to the horizon (Fig. 09-15-6). Spoilers usage may be necessary to prevent overspeed. Before adding elevator pressure, make sure the wings are level. Use elevator pressure to return the airplane to level flight, adjust the power and retract flight spoilers (if used) to maintain the desired indicated airspeed. Be careful not to over stress the aircraft while applying back pressure from nose down attitude (wing loading).

Once stable, re-engage automation and advise ATC. Resume normal flight and clearance if appropriate



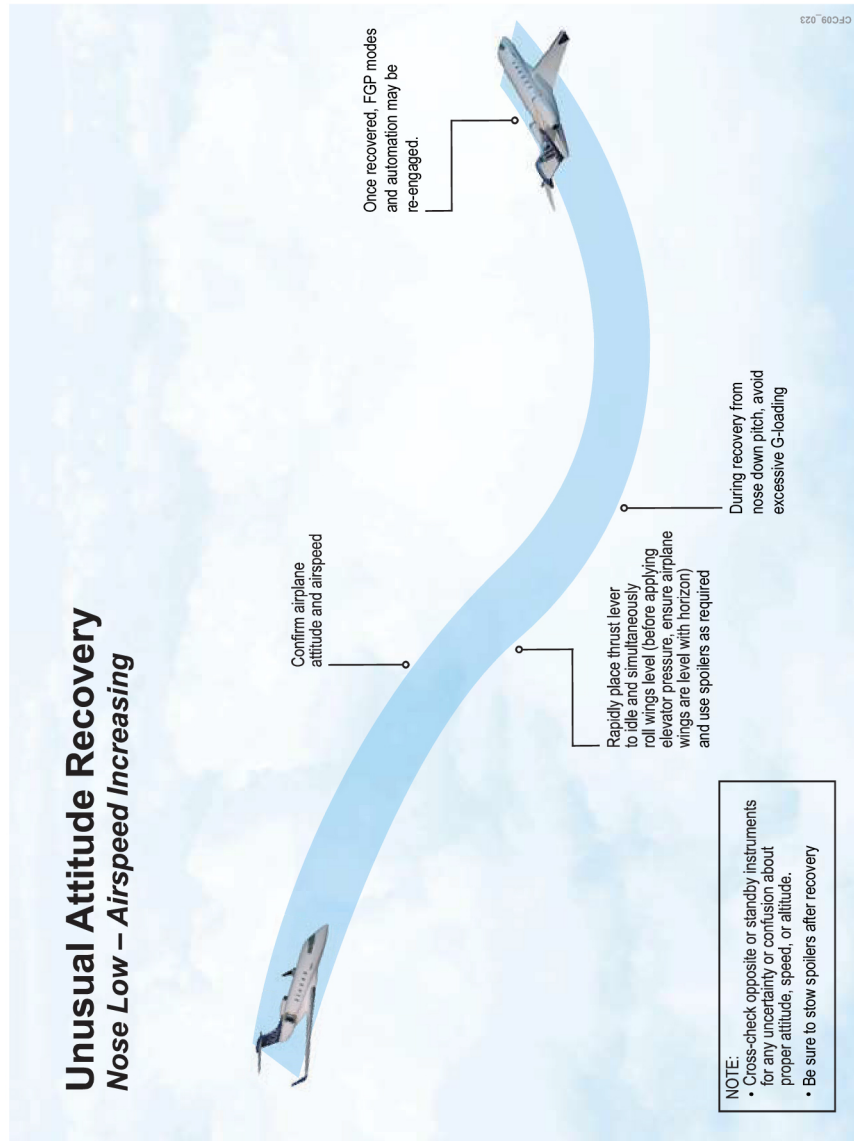
Challenger 350

ROPAT

SECTION 5
TRAINING MANEUVERSNose High – Airspeed Slowing
Figure 09-15-5

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SECTION 5
TRAINING MANEUVERS

Nose Low – Airspeed Increasing
Figure 09–15–6



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ROPAT

SECTION 6
SUPPLEMENTAL GUIDANCE

NOSEWHEEL STEERING (NWS) INOPERATIVE (INOP)

DISPATCH WITH NWS INOP/ NWS FAIL

Dispatch with NWS INOP, if authorized, must be in accordance with the approved MEL.

- NOTE:**
1. Takeoff with nosewheel steering (NWS) inoperative (INOP) must be performed in accordance with DDG/M MEL specific variant guidance. Included with the guidance is AFM Supplement 2 (Supplemental information for the MEL) performance guidance.
 2. For FAA-registered Challenger 350 airplanes, takeoff with NWS INOP is not authorized.
 3. From a stopped position on the centerline of the runway, the Rolling Takeoff technique is recommended as described in the Flight Crew Operating Manual (FCOM) Chapter 9 (ROPAT) section 2 (NORMAL PROCEDURES & TECHNIQUES) with the takeoff distance impact per Airplane Flight Manual (AFM) Chapter 6 (Standard Performance Procedures).

When takeoff with NWS INOP is planned, the runway should be chosen to minimize crosswinds if possible. Maximum crosswind component for takeoff and landing is 15 knots.

Takeoff distance available should be greater than the calculated takeoff distance. As per the AFM Supplement 2 and MEL/DDG guidance, the Dry and Wet Takeoff Field Length obtained from the applicable basic CAFM data must be increased by 1.0% (1.01 factor) when dispatching with NWS INOP.

In addition to this MEL correction, the recommended rolling takeoff technique adds an extra 100 feet to the Takeoff Distance. Both corrections are cumulative. The CAFM calculator allows selection for the Nosewheel Steering Inoperative and Rolling Takeoff considerations.

The nosewheel steering system must be selected OFF. The nosewheel will be free casting.

Dispatch with NWS INOP is prohibited for the following conditions:

- Contaminated Runways
- Operations with Steep Approaches up to 5.5 degrees (AFM Supplement 10)

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SECTION 6
SUPPLEMENTAL GUIDANCE

NWS INOP TAXI TECHNIQUE

When nosewheel steering (NWS) is inoperative (INOP), the nosewheel is free casting and taxi can be accomplished using differential braking. Application of differential braking will turn the airplane while it is moving. Differential thrust can be used in moderation to facilitate turns and to prevent slowing down excessively as a result of braking.

Anticipate turns and turn reversals or termination of turns because smooth opposite direction differential braking must be anticipated to facilitate tracking the desired route and to avoid jerky braking and associated discomfort for passengers. Above all, brake temperature management can be largely controlled by anticipating long in advance taxi needs through rudder and differential thrust. Sharp turns should be avoided as they require more braking action either to enter, exit or both.

Minimize prolonged use of sustained brake applications to not cause excessive increase of brake temperatures. This is especially important for NWS INOP taxi following a landing or RTO with aggressive braking.

Care must be exercised when making tight turns. Avoid casting the nosewheel to high angles approaching 90 degrees. Larger angles beyond 55 degrees up to 90 should be avoided. At extreme nosewheel angles, forward progress may no longer be possible and excessive lateral forces could be placed on nosewheel tires, potentially causing tire damage, tire coming off the wheel, deflation or damage to the nose gear. A tow bar may be required to straighten the nosewheel. If there is any doubt, the airplane should be stopped until a tow can be arranged.

NWS INOP TAKEOFF TECHNIQUE

NOTE: NWS failure could occur during the takeoff roll. The **NWS FAIL** CAS message is Takeoff Inhibited above 80 KIAS, thus the TO below 80 KIAS should be aborted and care needs to be taken. After the decision to reject the takeoff, use the NWS Landing Technique to safely stop on the runway. The nosewheel will be free casting after the NWS failure. Once at safe taxi speed, use the NWS INOP taxi technique. After 80 KIAS you should not notice the steering inoperative and once airborne (and above 400 feet), the CAS message should appear, which you will need for landing.

Minimize sharp turns entering the runway. Confirm that the airplane is lined up with the runway, ensure the nosewheel is also tracking in line with the runway before application of takeoff thrust.

As the airplane accelerates, maximize use of rudder via pedal input to maintain centerline control. If additional directional control is required at slower speed, modulate differential brake input (enough input to prevent or correct an undesired drift, but not enough to grossly impact normal acceleration) until aerodynamic forces on the rudder provide control. AFM Supplement 2 performance correction provides for differential braking during acceleration.

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**SECTION 6
SUPPLEMENTAL GUIDANCE**

Additional takeoff distance must be considered when using this technique.

- NOTE:**
1. Higher crosswinds will adversely impact centerline control.
 2. Do not ride the brakes.
 3. When runway length available is approaching runway length required, operators should consider not dispatching with NWS INOP.
 4. In the event of rejected takeoff, the crew should apply maximum braking as much as practicable and, if required, slightly reduce pedal pressure on applicable brake to maintain directional control, i.e. **reduce the brake on the pedal opposite of the desired direction.**

LANDING WITH NOSEWHEEL STEERING INOP

When a landing with NWS INOP is planned, the following apply:

- Choose the longest, widest available runway with minimum crosswind and turbulence to provide maximum deviation space and reduce pilot workload.
- Landing distances may be greater than for a normal landing because of the requirement to use differential or asymmetric braking for directional control as aerodynamic rudder control diminishes. The calculated landing distances are based upon a maximum symmetric brake application to a stop. Deviations from this technique, including asymmetric braking and less than maximum brake application, will increase the required stopping distance. Crews must properly account for this increase when selecting a landing runway.
- Select NWS to the OFF position.

If NWS fails during landing rollout, despite possible associated CAS message(s)/aural tone, crew awareness may be delayed until the airplane path deviates directionally even with significant pedal input to counter drift. Once aware, the pilot requires prompt transition to appropriate technique. Do not attempt to troubleshoot during the rollout.

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**SECTION 6
SUPPLEMENTAL GUIDANCE****NWS INOP AFTER LANDING TECHNIQUE**

The nosewheel will be free casting. As speed decreases, directional control will gradually transition from primarily aerodynamic control via rudder input, to differential braking. This will become apparent with ever-increasing rudder input to deflection limit. Approaching pedal travel limit, start applying appropriate differential brake input to control centerline.

During aggressive braking (large brake pedal application), precise differential braking may be more difficult to modulate. With large rudder pedal deflections, precise differential brake application on either pedal may require more conscious effort. In all cases, strict attention should be paid to prevent inadvertent brake application on the aft-moving brake pedal. Elevated crosswinds will adversely impact centerline control, making the task more difficult and may result in high asymmetric brake temperature.

At taxi speed, use differential braking and differential thrust to clear the runway. Use of high-speed turnoffs should be considered only when directional control is well in hand and conditions permit.

If directional control becomes difficult, the airplane should be stopped until a tow can be arranged.

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ROPAT

SECTION 7 RNP AR PROCEDURES

GENERAL

Operator must receive approval from authorities before performing RNP AR approaches. Approved training must be accomplished and SOPs implemented. The following covers RNP AR specific supplemental items that require attention. General operating preflight and flight procedures, technical requirements, and failures cases are not specifically addressed. AFM supplement 7 shall be used for limitations and compliance.

Effective 2021, the FAA has required that the operators supply the vendors with written approval prior to releasing RNP AR databases. Companies such as Collins have since removed RNP AR approaches from their database. A separate database including RNP AR approaches remains available upon request when accompanied by authority approval.

NOTE: The following procedures assume a fully functional aircraft. Impact of failures or MEL items shall be validated through **AFM Supplement 7**. In all cases, the required equipment list supersedes MEL relief, unless RNP AR is specifically addressed in the operator's MEL. For additional information, also refer to Equipment Failures in the FCOM 1.

PREFLIGHT

1. Verify validity of the navigation database for ETA and confirm RNP AR NAV database is loaded
2. On GNSS CONTROL page, confirm GNSS 1 and 2 ENABLED
3. If no SBAS is available and/or enabled, check RAIM at ETA (confirm SBAS status on GNSS STATUS pages 1 and 2)

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ROPAT

SECTION 7
RNP AR PROCEDURES

BEFORE COMMENCING APPROACH

1. Load desired approach from FMS database (compare approach title with approach chart title):
 - (a) Do not modify the lateral path, with the exception of going Direct to Fix (DF), as long as that fix is prior to the final approach fix (FAF) and does not immediately precede an RF leg.
 - (b) ARRIVAL DATA – confirm APPR MODE is RNP AR, RNP FAF–MAP value is 0.30, GP mode is BARO, WGS–84 is YES
 - (c) LEGS page – Crosscheck route (waypoints, RF legs courses, descent angles, GP angles) and constraints with approach chart; Map PLAN view should be displayed for best RF Legs confirmation
 - (d) LEG INFO – verify RNP values associated with different segments (0.30 or greater for final segment, 1.00 for missed approach segment)
 - (e) Do not modify the lateral track on the LEGS page. Altitude/Airspeed waypoints may not be changed on the final leg
2. TEMP COMP as required
3. Altimeters set to local QNH (RNP AR not authorized for remote altimeter setting)
4. Verify both altimeters within 75 feet
5. The autopilot must be engaged between the final approach point FAP/FAF and the missed approach point on RNP AR approaches. Both flight directors must be operational and independently displayed.
6. EPU value within limits (see note below)
 - (a) Verify EPU value on PFD or FMS PROGRESS page 2/2
 - (b) Check no LOW POSITION ACCURACY message

NOTE: If EPU is greater than RNP or EPU is invalid for 8 seconds during approach phase of flight or 28 seconds at any other time, it will generate a **LOW POSITION ACCURACY** message on FMS CDU. The EPU is a total system error calculation by the FMS based on sensors available for position updates. Use this for Situational Awareness (SA).

CAUTION: RNP AR Approach operations are approved for RNP AR Approaches greater than or equal to RNP 0.3 in the approach segment and RNP 1.0 in the missed approach segment.

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SECTION 7 RNP AR PROCEDURES

APPROACH BRIEFING

Standard approach briefing as per FCOM 1 should be performed with the addition of RNP AR segment speed restrictions and supplemental standard calls (see tables below). Contingency plans specific to the approach to be flown must be briefed, including but not limited to:

1. Equipment failure (Refer to Equipment failures subsection)
 - (a) Before commencing approach
 - (b) After approach is commenced
2. Loss of VNAV
3. Initiating a missed approach on a RF Leg
4. Missed Approach Considerations
5. Any potential hazard due to terrain, wind variation or a combination of both. If information and/or terrain is conducive to windshear, flight crew should emphasize the planned recovery maneuver during an RF leg.

MAXIMUM SPEEDS IN RNP AR RF LEGS

MAXIMUM SPEEDS IN RF LEGS – TERPS REQUIREMENTS					
SEGMENT	INDICATED AIRSPEED BY AIRCRAFT CATEGORY				
	CAT A	CAT B	CAT C	CAT D	CAT E
Initial and Intermediate (IAF to FAF)	150	150	250	250	250
FINAL (FAF to DA)	90	120	140	165	As Spec
Missed Approach (DA to MAHP)	110	150	250	265	As Spec
MAXIMUM SPEEDS IN RF LEGS – PANS OPS REQUIREMENTS					
SEGMENT	INDICATED AIRSPEED BY AIRCRAFT CATEGORY				
	CAT A	CAT B	CAT C	CAT D	CAT E
Initial and Intermediate (IAF to FAF)	150	180	240	250	250
FINAL (FAF to DA)	100	130	160	185	As Spec
Missed Approach (DA to MAHP)	110	150	240	265	As Spec

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SECTION 7
RNP AR PROCEDURESSUPPLEMENTAL STANDARD CALLS DURING RNP AR
APPROACH

PHASE OF FLIGHT	CONDITION	PF	PM
RNP AR APPROACH	31 NM from the 1st way point on the RNP AR approach	CHECK	RNP AR ARM
	At IAF	CHECK	RNP AR APPR
	1/2 Dot Deviation from Glidepath	CORRECTING	GLIDEPATH
	1 Dot Deviation from Lateral Track	CORRECTING	TRACK
	Passing MAP on missed approach	CHECK	RNP AR MA

WHEN CLEARED FOR THE RNP AR APPROACH

1. Verify two independent FMS as the active NAV SRC
2. Arm APPR and Engage VNAV (or confirm active)
3. Confirm ADC and IRS independent sources on each PFD
4. TAWS should be operational and displayed
5. It will show RNP AR ARM when within 31 NM of a waypoint on the approach. Other RNP approaches use the destination airport, RNP ARs are different.
6. Altitude Preselector:
 - (a) Select FAF/ FAP altitude until VGP is the active vertical mode on FMA
 - (b) Select Missed Approach Altitude when VGP is captured
7. Adhere to published speed limits and segment speed limits
8. Confirm RNP AR APPR displayed on PFD at the IAF or Transition Waypoint
9. Confirm Lateral Deviation Scale RNP value indicates 0.30 prior to 2 NM from FAF/ FAP
10. Monitor EPU value throughout approach

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SECTION 7 RNP AR PROCEDURES

EXCESSIVE LATERAL OR VERTICAL DEVIATION

Discontinue Approach when:

- Excessive Lateral deviation (2 dots/1×RNP), or
- Excessive Vertical deviation (1 dot below path/−75'), or
- Either lateral or vertical scale shows an amber flashing display

MISSED APPROACH

The lateral track must be followed to the MAP and the MAHP, unless clear of obstacles or otherwise instructed by ATC. Pressing TOGA will sequence the lateral mode from APPR to NAV (LNV on FMA), and the vertical mode to GA. When conducting a go-around at any point during the approach, continue to follow the RNP AR approach lateral track and speed constraints until established at or above the min safe altitude.

Depending on ATC instructions or other requirements, initiating a GA early on the approach may require modification of the GA profile. Selecting GA and the ensuing GA thrust and GA pitch guidance may not be required or appropriate (for example maintaining altitude and speed constraints associated with portion(s) of RNP AR approach). In all cases, the PF will determine the appropriate thrust and aircraft configuration to meet the required profile and transition. It is essential to precisely follow the published approach track up to minimum safe altitude while maintaining any speed constraints. Altitude preselect may need to be reset to meet the changed requirement(s). For autothrottle installed aircraft, pressing TOGA will cause AT to activate thrust mode and subsequently go-around power. Depending on the situation and aircraft position along the RNP AR approach, GA power might be inappropriate for speed constraints. V_S vertical mode could be used with AT in speed mode for proper vertical tracking and speed constraint adherence.

Altitude preselect may need to be reset to meet the changed requirement(s). If TOGA is not used to trigger the GA, then the crew must ensure the FMS is sequenced appropriately. Ensure the SPEED bug is set appropriately.

Upon reaching the FAF/ FAP, the FMS transitions to SEQ INHB (sequence inhibit). When TOGA is selected, GA will re-enable auto-sequencing (AUTO).

NOTE: When responding to a TAWS alert, see Call out box, avoid deviating from lateral track due to protected airspace constraints.

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SECTION 7

RNP AR PROCEDURES

EQUIPMENT FAILURES

NAVIGATION EQUIPMENT

An RNP AR approach must not be commenced or continued unless the required navigation equipment, as specified in the RNP AR Approach Required Equipment List found in AFM Supplement 7, replicated below, are operating satisfactorily.

RNP AR APPROACH – REQUIRED EQUIPMENT LIST	
Equipment	Prior to Approach
Yaw damper and autopilot	Both must be operational
PFD 1 and 2	One (1) PFD available and operational for each side
ADC 1 and 2	Two (2) ADCs must be operational
GNSS 1 and 2	Two (2) GNSS sensors must be available to commence the approach; one (1) GNSS sensor is required to continue the approach
FMS 1 and 2	Two (2) FMSs must be available and operational for each side
IRS 1 and 2 (ATT and HDG)	Two (2) IRSs must be operational
TAWS	TAWS must be operational and displayed
FD 1 and 2	Two (2) FDs must be operational and independently displayed

RNP AR Approach operations are approved with Autothrottle engaged or disengaged (if installed).

NOTE: An approach is considered to be commenced once past the IAF.



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ROPAT

SECTION 7
RNP AR PROCEDURES**APPROVED FLAPS SETTINGS**

RNP AR Approach operations are approved for any FLAP configuration up to the FAF and FLAP 30 from FAF to MAP.

ENGINE FAILURE

RNP AR Approach operations are approved following failure of one engine.

NOTE: As a contingency plan briefing, one could decide that an engine failure while flying an RF Leg would trigger an immediate go-around. If a go-around is conducted, continue to follow the RNP AR approach lateral track and speed constraints until established at or above the min safe altitude.

NO APPR CAUTION MESSAGE ON PFD

A NO APPR caution message on PFD can be triggered by numerous causes. In all cases, the approach shall be discontinued.

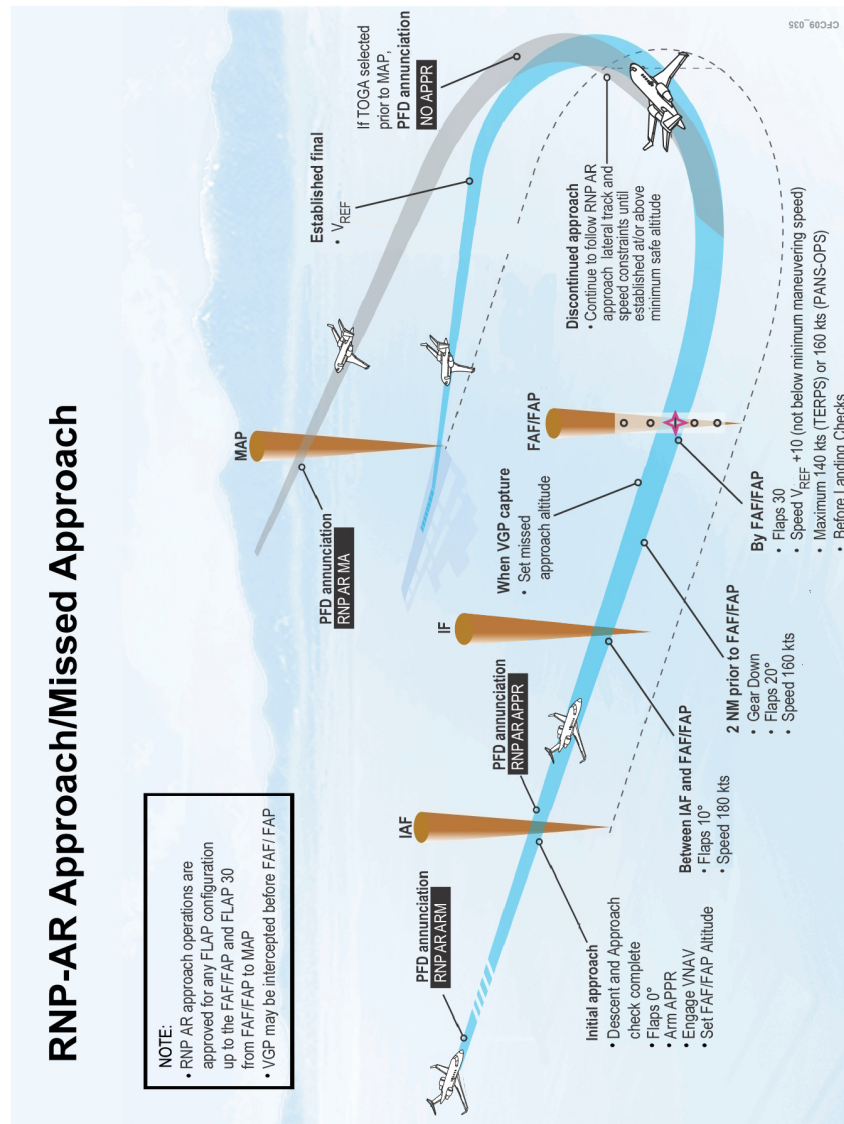
EFIS PARAMETER MISCOMPARE

The approach shall be discontinued when **EFIS MISCOMP** caution message is displayed and is accompanied by amber **ALT** annunciation on PFD.

NOTE: When conducting a go-around, at any point during the approach, continue to follow the RNP AR approach lateral track and speed constraints until established at or above the min safe altitude.

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SECTION 7
RNP AR PROCEDURESRNP AR Approach/Missed Approach
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