



B787

Flight Crew Operating

Manual

Revision 1
December 2019

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0 Record of Amendments

Rev. No	Date Entered	Amended By
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Revision Highlights

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General

This Flight Crew Operations Manual (FCOM) has been prepared by Boeing Commercial Airplanes, Commercial Aviation Services organization.

The purpose of this FCOM is to:

- provide the operating limitations, procedures, performance, and systems information the flight crew needs to safely and efficiently operate the 787 airplane during all anticipated airline operations
- serve as a comprehensive reference for use during transition training for the 787 airplane
- serve as a review guide for use in recurrent training and proficiency checks
- provide necessary operational data from the FAA approved Airplane Flight Manual (AFM) to ensure that legal requirements are satisfied
- establish standardized procedures and practices to enhance Boeing operational philosophy and policy.

The manual is periodically revised to incorporate pertinent procedural and systems information. Items of a more critical nature will be incorporated in operational bulletins and distributed in a timely manner. In all cases, such revisions and changes must remain compatible with the approved AFM with which the operator must comply. In the event of conflict with the AFM, the AFM shall supersede.

This manual is written under the assumption that the user has had previous multi-engine jet aircraft experience and is familiar with basic jet airplane systems and basic pilot techniques common to airplanes of this type. Therefore, the manual does not contain basic flight information that is considered prerequisite training.

Any questions about the content or use of this manual can be directed to:

Flight Managers Technical B777/B787
BAVirtual

The FMTs may be contacted by navigating to the [Contact Management](#) section of the BAV Website and selecting “B777/B787 Flight Managers Technical” from the Recipients list or via the [B787 section of the BAVirtual Forums](#).

Organisation

The FCOM is organized in the following manner.

- Preface – contains general information regarding the manual’s purpose, structure, and content. It also contains lists of abbreviations, a record of revisions, bulletins, and a list of effective pages.
- Limitations and Normal Procedures chapters cover operational limitations and normal procedures. All operating procedures are based on a thorough analysis of crew activity required to operate the airplane, and reflect the latest knowledge and experience available.

- Supplementary Procedures chapter covers those procedures accomplished as required rather than routinely on each flight.

Statement of Applicability

The FCOM, QRH and FCTM form part of OM B for the B787. Other documents which also form part of the BAVirtual B787 Operations Manual include:

- OM B GEN Procedures – not yet available
- FCOM – this document
- Checklists – available via [B787 DocStore](#)
- QRH – not yet available
- FCTM – not yet available
- Performance Manual – not yet available
- DDG – not currently available

Warnings, Cautions and Notes

The following levels of written advisories are used throughout the FCOM and are not to be confused with EICAS messages, which are separately identified in the text.

- WARNING:** **An operating procedure, technique, etc., that may result in personal injury or loss of life if not carefully followed.**
- CAUTION:** **An operating procedure, technique, etc., that may result in damage to equipment if not carefully followed.**
- Note:** An operating procedure, technique, etc., considered essential to emphasize. Information contained in notes may also be safety related.

1 Limitations

General

This chapter contains:

- Aeroplane Flight Manual (AFM) operational information
- Non-AFM operational information

Information is included if:

- Operationally significant
- Required by another regulatory requirement

Information is not included if:

- Incorporated in to FCOM normal, supplementary or non-normal procedures
- Shown on a placard, display or other marking

Operational information in this chapter that must be memorised is marked with a # symbol. This information is such that flight crew access by reference cannot assure timely compliance, e.g. turbulence penetration speeds. They need only be memorised to the extent that compliance is assured – knowing the exact wording of the limitation is not required.

Assuming the remaining items are available to the flight crew by reference, they do not need to be memorised.

Airplane General

Operational Limitations

Runway Slope	+/- 2%
#Maximum Takeoff and Landing Tailwind Component	15 knots
Maximum Operating Altitude	43,100ft pressure altitude
#Maximum Takeoff and Landing Altitude	14,000ft pressure altitude

Note: The capability of the airplane has been satisfactorily demonstrated for takeoffs and landings with tailwinds up to 15 knots. BAVirtual has operational approval to conduct takeoffs or landings with tailwind up to 15 knots.

Turbulent Air Penetration Speed

#Turbulent air penetration speed (in severe turbulence) is defined as:

- 290 KIAS below 25,000 feet
- 310 KIAS/.84 Mach (whichever is lower) at and above 25,000 feet

Refer to Severe Turbulence in Chapter SP for additional information.

Operational Information**G-ZBJA – G-ZBJM**

The maximum demonstrated crosswind for takeoff is 35 knots and for landing is 33 knots.

G-ZBKA – G-ZBKS

The maximum demonstrated crosswind for takeoff is 29 knots and for landing is 35 knots.

Do not operate HF radios during refuelling operations.

Non-AFM Operational Information

#Avoid weather radar operation in a hangar, or within 50 feet (15.25 metres) or fuelling operations or a fuel spill.

Avoid weather radar operation when personnel are in the area normally enclosed by the aircraft nose radome,

Note: the hangar recommendation does not apply to the weather radar test mode.

RVSM operations

Do not fly in RVSM airspace on IFSD alone. The standby altimeter does not meet altimeter accuracy requirements for RVSM airspace.

Non-AFM Operational Information

Prior to takeoff the maximum allowable difference between Captain's or First Officer's altitude display and field elevation is 75 feet.

Main and upper deck emergency power assists and evacuation slide systems must be armed with the mode select lever in the AUTOMATIC position prior to taxi, takeoff and landing whenever passengers are carried in the respective area.

Passenger Evacuation

Main door emergency power assists and evacuation slide systems must be armed with the door mode select levers in the automatic position and the electronically dimmable door windows must be in the clear state prior to taxi, takeoff and landing whenever passengers are carried.

Weight Limitations

Note: For all departures ex-USA, alternative MTOW and maximum taxi weights apply. The alternative MTOW must be respected for all departures from the USA, including in the event of a diversion into the USA.

For all other departures, including flights to the USA, the standard MTOW applies.

Maximum Taxi Weight

G-ZBJA – G-ZBJM

228,383 Kilograms

Ex-USA: 217,500 Kilograms

G-ZBKA – G-ZBKS

248,115 Kilograms

Ex-USA: 239,000 Kilograms

Maximum Takeoff Weight

G-ZBJA – G-ZBJM

227,930 Kilograms

Ex-USA: 217,000 Kilograms

G-ZBKA – G-ZBKS

247,207 Kilograms

Ex-USA: 238,000 Kilograms

Maximum Landing Weight

G-ZBJA – G-ZBJM

172,365 Kilograms

G-ZBKA – G-ZBKS

192,776 Kilograms

Maximum Zero Fuel Weight

G-ZBJA – G-ZBJM

161,025 Kilograms

G-ZBKA – G-ZBKS

181,436 Kilograms

Autoflight

AFDS

#The autopilot must not be engaged below 200 feet after takeoff.

#Autoland capability may only be used for operations in to runways at or below 8400 feet field elevation.

G-ZBJA – G-ZBJM

#Without LAND 2 or LAND 3 annunciated, the autopilot must be disengaged below 100 feet AGL.

G-ZBKA – G-ZBKS

#Without LAND 2 or LAND 3 annunciated, the autopilot must be disengaged below 135 feet AGL.

#With LAND 2 or LAND 3 annunciated and glidepath angles greater than 3.25 degrees, the autopilot must be disengaged below 100 feet AGL.

If the glidepath angle for approach is greater than 3.77 degrees, the autopilot must be disengaged no later than 50 feet below DH/MDA.

Low Visibility (HUD) Takeoff

Low weather minima takeoff may only be performed using ILS guidance.

Maximum wind component speeds when takeoff whether minima are predicated on HUD takeoff operations:

#Headwind	25 knots
#Tailwind	15 knots
#Crosswind	20 knots (USA – 15 knots)

The HUD takeoff system has been demonstrated to perform satisfactorily in non-LVO conditions in the following wind conditions:

- Headwind: 50 knots
- Tailwind: 15 knots
- Crosswind: 36 knots

Automatic Landing

#Maximum wind component speeds when landing minima are predicated on autoland operations:

#Headwind	25 knots
#Tailwind	15 knots
#Crosswind	25 knots (USA – 15 knots)

#The maximum glideslope angle is 3.25 degrees

#The minimum glideslope angle is 2.5 degrees

Autoland capability may be used with flaps 20, 25, or 30, with both engines operative or with one engine inoperative.

The autopilot flight director system (AFDS) autoland status annunciation must have LAND 2 or LAND 3 displayed.

The automatic landing system has been demonstrated to perform satisfactorily with a single hydraulic failure to any one of the left, centre or right system.

SGL SOURCE APPROACH or RAD ALT messages must not be displayed.

The automatic landing system has been demonstrated to perform satisfactorily in non-LVO conditions with all engines and one engine inoperative, with and without autothrottle, in the following wind conditions:

Variant	-8	-9
Headwind	48	33
Tailwind	15	15
Crosswind	33	28
OEI Crosswind	28	37

Rollout performance has been demonstrated on both wet and dry runways. Each autobrake setting has been demonstrated.

Non-AFM Operational Information

BAVirtual has operational approval for low visibility operations using HUD TO/GA.

#Do not use FLCH on final approach below 1,000 feet AFE.

Communications

Flight Deck Communications Systems (Datalink)

The ACARS is limited to the transmission and receipt of messages which will not create an unsafe condition if the message is improperly received, such as the following conditions:

- the message or parts of the message are delayed or not received,
- the message is delivered to the wrong recipient, or
- the message content may be frequently corrupted.

However, Pre-Departure Clearance, Digital-Automatic Terminal Information Service, Oceanic Clearances, Weight and Balance, and Takeoff Data messages can be transmitted and received over ACARS if they are verified per approved operational procedures.

Audio Control Panel (ACP)

Use of the captains or first officers ACP to establish a SATCOM/cabin conference is prohibited.

Engines, APU

Engine Oil System

#Oil temperature must be greater than -40C for engine start.

Reverse Thrust

#Intentional selection of reverse thrust in flight is prohibited.

#Backing the airplane with use of reverse thrust is prohibited.

Engine Fire Bottle

If the airplane has been parked, un-powered, in an environment below -40° F (-40°C), the temperature of the compartment air surrounding the engine fire extinguishing bottles must be warmed to -10° F (-23° C) or greater and maintained at this temperature for a minimum of 1.5 hours before engine start. Verify the appropriate warming procedure was accomplished, prior to engine start.

Tailwind and Crosswind

Ground wind operating envelope:

- with a tailwind component and total wind greater than 42 knots, limit engines to taxi power
- for crosswinds greater than 45 knots, limit engines to taxi power
- for winds greater than 65 knots, do not run engines

Dual Engine Start Limitation

Dual engine starts are not recommended below an OAT of 5 degrees C (41 degrees F). Allow the first engine to stabilize before starting the second engine.

Flight Controls

Takeoff is permitted only in the normal flight control mode.

#Avoid rapid and large alternating control inputs, especially in combination with large changes in pitch, roll, or yaw (e.g. large side slip angles) as they may result in structural failure at any speed, including below VA.

The maximum altitude with flaps extended is 20,000 feet.

Fuel**Fuel Temperature**

Maximum tank fuel temperature at takeoff is 49° C (120° F) for Jet A, Jet A-1, JP-5, JP-8 or TS-1.

Inflight fuel temperature is limited to 65° C (150° F) for Jet A, Jet A-1, JP-5 or JP-8.

Inflight fuel temperature for TS-1 is limited to 57° C (135° F) at or above 35,000 feet and 65° C (150° F) below 35,000 feet.

Tank fuel temperature prior to takeoff must not be less than -29° C (-20° F).

In-flight tank fuel temperature must be maintained at least -42°C , as well as 3°C above the freezing point of the fuel being used. The use of Fuel System Icing Inhibitor additives does not change the minimum fuel tank temperature limit.

Fuel Loading

Main tanks must be scheduled to be full if center tank fuel is loaded.

Note: The center tank may contain up to 10000 kilograms of fuel with less than full main tanks provided center tank fuel weight plus actual zero fuel weight does not exceed the maximum zero fuel weight, and center of gravity limits are observed.

Warning Systems

GPWS – Look-Ahead Terrain Alerting

Do not use the terrain display for navigation.

The use of look-ahead terrain alerting and terrain display functions are prohibited within 15 NM of takeoff, approach or landing at an airport or runway not contained in the GPWS terrain database. All BA destinations and destination alternates will always satisfy this requirement unless notified in Brief.

TCAS

Pilots are authorized to deviate from their current ATC clearance to the extent necessary to comply with a TCAS resolution advisory. Evasive maneuvers must not be based solely on information from the traffic display or traffic advisory (TA) without visually sighting the traffic.

2 Normal Procedures

Introduction

General

This chapter gives:

- An introduction to the normal procedures philosophy and assumptions
- Step-by-step normal procedures
- General information regarding the execution of British Airways Operational Policy on the B787

Normal Procedures Philosophy and Assumptions

Normal procedures verify for each phase of flight that:

- the airplane condition is satisfactory
- the flight deck configuration is correct

Normal procedures are done on each flight. Refer to the Supplementary Procedures (SP) chapter for procedures that are done as needed, for example the adverse weather procedures.

Normal procedures are written for a trained flight crew and assume:

- all systems operate normally
- the full use of all automated features (LNAV, VNAV, autoland, autopilot, and autothrottle). This does not preclude the possibility of manual flight for pilot proficiency where allowed

Normal procedures also assume coordination with the ground crew before:

- hydraulic system pressurization, or
- flight control surface movement, or
- airplane movement

Normal procedures do not include steps for flight deck lighting and crew comfort items.

Normal procedures are done by memory and scan flow. The panel illustration in this section shows the scan flow. The scan flow sequence may be changed as needed.

Configuration Check

It is the crew member's responsibility to verify correct system response. Before engine start, use lights or indications to verify each system's condition or configuration.

If there is an incorrect configuration or response:

- verify that the system controls are set correctly
- check the respective circuit breaker as needed. Engineering must first determine that it is safe to reset a tripped circuit breaker on the ground

- test the respective system light as needed

Before engine start, review the EICAS alert messages and status display. If there are unexpected messages:

- check the Minimum Equipment List (MEL) to decide if the condition has a dispatch effect
- decide if maintenance is needed

If, during or after engine start, there is an alert message:

- do the respective non-normal checklist (NNC)
- on the ground, check the MEL

After dispatch, EICAS alert messages are the primary means of alerting the flight crew to non-normal conditions or incorrect configurations.

After dispatch, there is no need to check status messages. Any message that has an adverse affect on safe continuation of the flight appears as an EICAS alert message.

Crew Duties

On the ground until the aircraft starts to move, all duties are divided between the P1 and P2. From the start of the taxi phase until the after landing procedure is complete duties are divided between the Pilot Flying (PF) and the Pilot Monitoring (PM).

Each crewmember is responsible for moving the controls and switches in their area of responsibility:

- The phase of flight areas of responsibility for both normal and non-normal procedures are shown in the Area of Responsibility illustrations in this section. Typical panel locations are shown.
- The preflight and postflight areas of responsibility are defined by the “Preflight Procedure – P1” and “Preflight Procedure – P2”.

The captain may direct actions outside of the crewmember’s area of responsibility.

The general PF (or the P1 on the ground) phase of flight responsibilities are:

- taxiing
- flight path and airspeed control
- airplane configuration
- navigation

The general PM (or the P2 on the ground) phase of flight responsibilities are:

- checklist reading
- communications
- tasks asked for by the PF
- monitoring taxiing, flight path, airspeed, airplane configuration, and navigation

PF and PM duties may change during a flight. For example, the captain could be the PF during taxi but be the PM during takeoff through landing.

Normal procedures show who does a step by crew position (C, F/O, P1, P2, PF or PM):

- in the procedure title, or
- in the far right column, or
- in the column heading of a table

The mode control panel is the PF's responsibility. When flying manually, the PF directs the PM to make the changes on the mode control panel. PM may make MCP changes to heading and/or altitude without reference to PF in response to instructions given by ATC.

The captain is the final authority for all tasks directed and done.

In role reversal, at Captain's discretion, P1 and P2 duties may be reversed wholly or in part.

Control Display Unit (CDU) Procedures

Before taxi, the captain or first officer may make CDU entries. The other pilot must verify the entries.

WARNING: Performance Data entry is a highly critical task. Procedures for data entry contained in this manual are allocated in a way which improves data checking integrity between crew members. Follow these procedures carefully.

Make CDU entries before taxi or when stopped, when possible. If CDU entries must be made during taxi, the PM makes the entries. The PF must verify the entries before they are executed.

In flight, the PF usually makes the CDU entries when the autopilot is engaged. The PM may also make CDU entries as tasked by the PF or in manual flight. The pilot making the entries executes the change only after the other pilot verifies the entries.

During high workload times, for example departure or arrival, try to reduce the need for CDU entries. Do this by using the MCP heading, altitude, and speed control modes. The MCP can be easier to use than entering complex route modifications into the CDU.

Autopilot Flight Director (AFDS) Procedures

It is recommended that appropriate use of the Autoflight system is used throughout flight to:

- achieve maximum efficiency of aircraft operation
- to reduce workload and exposure to errors

Autothrottle should be engaged throughout the flight.

Flight Directors should be engaged for take-off, go-around and at any time the autopilot is engaged.

With the autopilot engaged, the PF will make the required AFDS, thrust mode selections and CDU entries. When the autopilot is not engaged the PM will select the F/D, thrust modes and CDU entries required by the PF.

The crew must always monitor:

- Airplane course
- Vertical path
- Thrust
- Speed

When selecting a value on the MCP, verify that the respective value changes on the flight instruments, as applicable.

The crew must verify manually selected or automatic AFDS changes. Use the FMA to verify mode changes for the:

- Autopilot
- Flight director
- Autothrottle

Use the PFD or HUD to verify mode changes to:

- Selected Altitude
- Selected/Managed Speed

In flight, commencing at or above 400 feet AAL after take-off, and continuing until P1 resumes PF duties on final approach, PM will announce:

- All manually selected, armed and automatic mode changes.
- All altitude selections.
- Changes to A/P and Autothrottle engagement status.

After P1 resumes PF duties, PM will monitor modes but will only announce any unexpected or anomalous changes.

Additionally, PM will announce all FMA modes in the following circumstances:

- During initial climb at or above 400ft AAL, after selection of any required AFDS modes.
- After initiation of a GA or rejected landing.
- After any Time Critical Maneuver.
- After any significant rebuild of the AFDS (e.g. late runway change).

WARNING: FMA indications are used to confirm that the aircraft is following the planned, programmed flight path and are vital for crew situational awareness and aircraft control.

Altimeter Settings

Changes to altimeter settings must be confirmed and cross checked by all operating crew on all altimeters.

QNH Operations

Before Takeoff/Below Transition Altitude:

- set QNH on all altimeters

Above Aa and cleared to climb above Transition Altitude:

- set 1013.2/29.92 on both primary altimeters
- set 1013.2/29.92 on standby altimeter when above MSA/MOA and transition altitude

Before Descent:

- set destination QNH on standby altimeter
- set DH or BARO DA for planned approach procedure
- When

When cleared to descend to an altitude:

- set QNH on both primary altimeters

QFE Operations

As above except substitute QFE for QNH, and BARO DH for BARO DA, except that QNH shall be set on the standby altimeter throughout QFE operations.

The QFE QNH difference shall be checked against data provided on the terminal charts.

See the Supplementary Procedures chapter for QFE operational procedures.

Late Closeout Procedure

The final loadsheet will be sent by ACARS to the aircraft. It will have one of two messages in it:

- Final loadsheet figures showing 'Compliance with' the provisional loadsheet indicate that the actual TOW is within +1,000kg and -4,000kg of the provisional TOW and the MACTOW and MACZFW are within $\pm 2\%$ of the provisional figure. No changes are required to FMC performance data before takeoff. The FMC ZFW will normally be amended during the climb.
- Final loadsheet figures showing 'Revisions to' the provisional loadsheet indicate that the actual TOW, MACTOW and/or MACZFW are outside the tolerances given above. The affected values are indicated by //. Revisions require pilots to complete the Critical Data Procedure – P1 and P2.

However, if the only change is to MACTOW, the pilot monitoring may amend CG TRIM on TAKEOFF REF 1/2, and then re-trim accordingly. The Before Takeoff Procedure details the sequence of events.

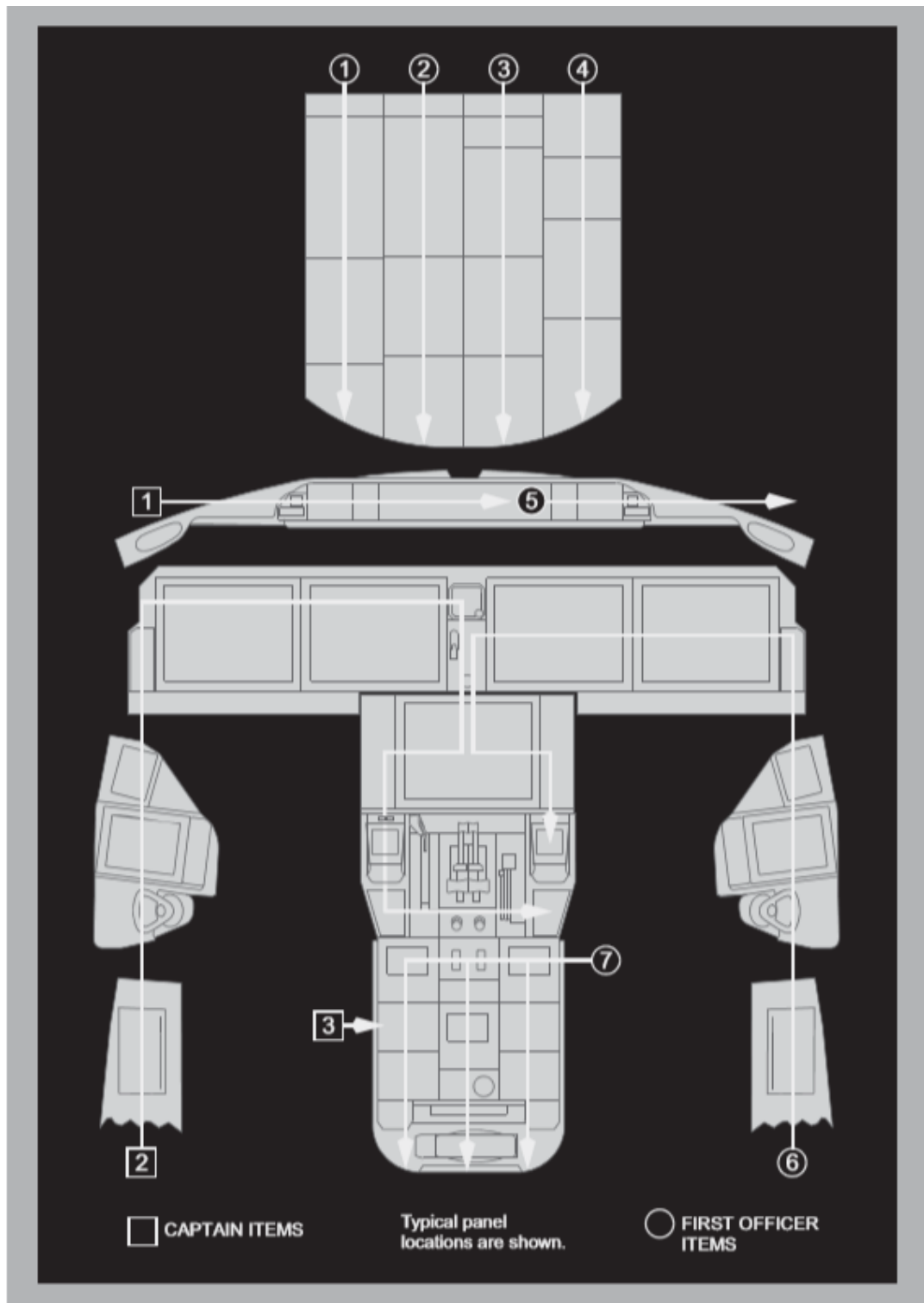
Note: For CG TRIM changes in excess of 3%, the FMC may delete other TAKEOFF REF data, which would then require a Critical Data Procedure.

Preflight and Postflight Scan Flow

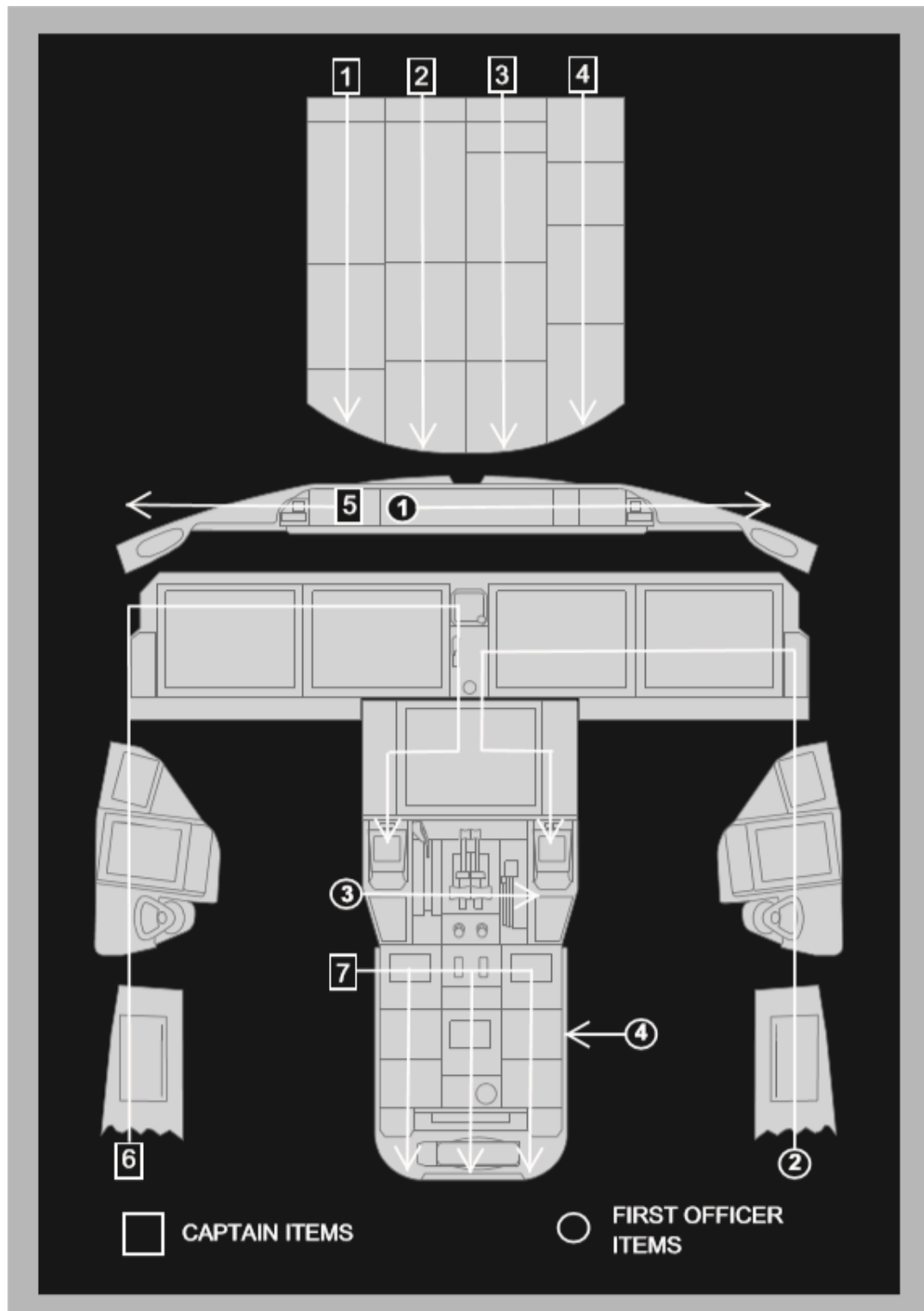
The scan flow diagrams shown below are representative and may not match the configuration(s) of your airplanes.

The scan flow diagram provides general guidance on the order each flight crew member should follow when doing the preflight and postflight procedures. Specific guidance on the items to be checked is detailed in the amplified Normal Procedures. For example, preflight procedure details are in the Preflight Procedure – P1 and Preflight Procedure – P2.

Captain as P1



First Officer as P1



Crew Briefing

P1 is required to conduct a briefing before takeoff, and before approach and landing.

Engine Failure on take-off and the rejected takeoff procedure should always be rehearsed at the start of the duty period. The briefing may also include other emergencies such as engine failure at other stages of flight.

The aim of the briefing is to:

- develop high crew situation awareness;
- identify potential problems, threats;
- develop strategies required to deal with them in both routine and non-normal situations.

This is best achieved through an open and interactive briefing style that allows all crew members to participate and share their experiences.

An effective briefing will:

- Be concise, relevant and conducted at a time of lower workload;
- Include open questions to share experiences and compare mental models;
- Establish gates and bottom lines;
- Review automation handling and use of relevant modes including intervention techniques;
- Anticipate and plan for potential high workload situations.
- Identify potential threats and errors.

The following guide provides a framework to enable crew to construct a relevant and effective brief.

Taxi and Takeoff	Description
Threats	Identify relevant BAV Safety Plan threats
MEL	ADDs/EICAS
AIS	Review
Weather	Icing Selections WX Radar Cabin service Windshear performance, avoidance, manoeuvre
Takeoff Alternate	Requirement Landing weight/fuel jettison
Taxi Route	Review likely taxi routing Hot Spots Departure Intersections
Flap	Required flap setting for takeoff Delayed if runway contaminated

Taxi and Takeoff	Description
Runway	Review planned departure runway Lighting, length etc.
Terrain Awareness	Proximate terrain and use of display Emergency turn and AFDS handling Non-standard climb-outs, noise considerations Reduced thrust capability
Performance NOTAMs & Restrictions	NOTAMS and MEL/CDL Performance restrictions Emergency turn and AFDS handling
MSA/SSA	Review including relationship to expected SID level-off altitude and associated emergency turn. Include other relevant MSA figures that may be encountered during a re-route or return to the departure airfield. Identify if SID/ATC cleared altitude is above MSA.
Transition Altitude	Review and check on VNAV CLB page
SID	Confirm SID selection on RTE page 2 Compare with clearance/DCL Confirm first cleared altitude Confirm RNP
AFDS	Review set-up. Discuss use and selections.
Radio Aids	Review
FMC	Route checked/winds Mileage gross error check
Emergencies	Review emergency handling
Review	Review key points in order of significance.

Approach	Description
Threats	Identify relevant BAV Safety Plan threats
Configuration	Recall, notes and ADDs
AIS	Review
Weather	Approach type/manual or auto
QNH	Set expected QNH on standby altimeter
Transition Level	Review and check DESCENT FORECAST page
MSA/SSA/Elevation	Review including expected point of 'Radio Altimeter' call and likely points on arrival where MSA/SSA will be encountered. Other relevant MSA figures that may be encountered during a re-route should be included.
Terrain	Terrain position and aircraft track Terrain Display
STAR	Discuss energy and ATC requirements Set approach gates
Approach	Automation Standard profile Appropriate AOM
Go-around	Profile review/automation/SOPs Acceleration height
Runway	Dimensions/slope/lighting
Landing Performance	MEL/CDL, Performance NOTAMs Flap setting/autobrake/reverse Stop margin Planned exit
Radio Aids	Review
Navigation Accuracy	Review serviceability of navaids RNP/ANP
Airfield Considerations	Noise and APU/Engine out taxi Taxi routing and parking position
Alternate	Discuss alternate
Fuel Capability	Review fuel endurance against fuel policy Options for holding/diversion
Review	Review key points in order of significance

Note: An additional approach briefing will be required in the event of change from the expected approach procedure, or change in configuration or change of runway in use.

Low Noise Approach

Low Noise Approach techniques may be used on instrument approaches with instrument glideslope/glidepath indications (ILS/GLS, IAN, VNAV). Delay landing gear extension and selection of final flap until deceleration from an intermediate approach speed is required. The objective of low noise approaches is to ensure thrust remains at or close to idle until final approach configuration is established and to minimise airframe noise by delaying flap extension until the aircraft is closer to the runway. There is no requirement to lower the landing gear in conjunction with flap extension.

Before conducting a Low Noise Approach consider:

- Aircraft weight and deceleration characteristics.
- Environmental considerations such as wind component and temperature.

CAUTION: The requirements for a stabilized approach must never be compromised.

Autobrake

Autobrake should normally be used to:

- reduce pilot workload
- reduce Brake Wear
- maintain even brake application during crosswind operations

Standard Callouts

Most standard callouts are referred to within a procedure. The following callouts are applicable throughout either more than one procedure or at a point in a procedure which is not easy to define.

- DA/DH referenced callouts only may be omitted after the “VISUAL” call is made.
- Automatic callouts replace a manual callout.

	CONDITION/LOCATION	CALLOUT	MADE BY
On Ground	In response to ground crew or to initiate ground crew communications	“FLIGHT DECK TO GROUND”	P1
	To remove ground power	“CLEAR TO REMOVE GROUND POWER”	P1
	When ready for pushback	“ARE WE READY TO PUSH?”	P1
	When pushback is approved	“PUSH APPROVED, FACE _____”	P1
Climb and Descent	Cleared to climb above transition altitude	“SET STANDARD” “STANDARD SET AND CROSSCHECKED”	PF PM
	Cleared to descend below Transition Level	“SET QNH” “QNH _____ SET AND CROSSCHECKED”	PF PM
	1,000ft above or below assigned altitude/flight level	“1,000 FT TO GO” “CHECKED”	PM PF
	Clearance above/below MSA	“CLEARANCE ABOVE/BELOW MSA” “MSA OF _____ FT” Note: PM must justify decision to continue flight if below MSA	PF PM
	Passing 10,000ft/FL100 and FL200	“ALTIMETER CHECK” “PASSING FL ____ CLIMBING (DESCENDING) FL(ALTITUDE) _____, STANDARD (QNH) SET AND CROSSCHECKED”	PF PM
All Approaches	Radio Altimeter Active	“Radio Altimeter” “POSITION CHECK” [Cognitively assess aircraft position and justify continued approach if appropriate] Note: Both pilots will check aircraft position relative to terrain is appropriate. PM justifies continuing the approach with a positive statement after comparing significant factors in relation to terrain.	Auto or PM PF

	1,000R and NOT STABLE	“ONE THOUSAND” “UNSTABLE, GO AROUND”	Auto or PM PM
	1,000R and STABLE except for SPEED	“ONE THOUSAND” “SPEED”	Auto or PM PM
	When STABLE	“STABLE”	PM
	500 callout or below and NOT STABLE	“UNSTABLE, GO AROUND”	PM
	1,000 callout and STABLE	“ONE THOUSAND” “STABLE” When stable call has been made: “MAN/AUTO LAND ___ BARO/RADIO”	Auto or PM PM PM
	When visual reference have been acquired and can be maintained	“VISUAL”	PF
	To assume control, when stable and visual	“I HAVE CONTROL”	PM
	Rate of descent more than 1,000fpm below 500R	“SINK RATE”	PM

Standard Callouts – ILS/GLS/IAN Approach

CONDITION/LOCATION	CALLOUT	MADE BY
First positive inward movement of localizer pointer, manual flight	“LOCALIZER/FAC ALIVE”	PM
First positive motion of Glide Slope pointer, manual flight	“GLIDE SLOPE ALIVE”	PM
Final approach or equivalent briefed position fix inbound	“GLIDEPATH CHECKED”	Both
1000R (Autoland only)	“AUTOLAND ___ RADIO, I HAVE CONTROL”	P1
50 ft above DA(H)	“FIFTY ABOVE”	AUTO or PF
At DA(H) with visual reference	“DECIDE”	AUTO or PF
At DA(H) – suitable visual reference established	“CONTINUE”	P1
At DA(H) – suitable visual reference not established	“GO AROUND”	P1

Standard Callouts – Non ILS Approach

CONDITION/LOCATION	CALLOUT	MADE BY
Final Approach Fix inbound	“VOR/NDB/FIX, PROFILE CHECKED”	PM
50 ft above DA or MDA	“FIFTY ABOVE”	Auto/PF
At DA or MDA with visual reference	“DECIDE”	PF
At DA or MDA – suitable visual reference established	“CONTINUE”	P1
At DA or MDA – suitable visual reference not established	“GO AROUND”	P1

Multi-Phase Phraseology

A partial list of standardized words and phrases follows:

Thrust:

- “SET TAKEOFF THRUST”
- “SET GO-AROUND THRUST”
- “SET MAXIMUM CONTINUOUS THRUST”
- “SET CLIMB THRUST”
- “SET CRUISE THRUST”

Flap Settings:

- “FLAPS UP”
- “FLAPS ONE”
- “FLAPS FIVE”
- “FLAPS FIFTEEN”
- “FLAPS TWENTY”
- “FLAPS TWENTY-FIVE”
- “FLAPS THIRTY”

Airspeed:

- “80 KNOTS”
- “V1”
- “ROTATE”
- “SET _____ KNOTS”
- “SET VREF PLUS (additive)”
- “SET FLAPS _____ SPEED”

Amplified Procedures

British Airways uses Boeing procedures as a baseline. This section describes detailed procedures and chronology for operating a normal flight.

Crew Briefing

Aircraft technical status.....	Confirm	P1
Use OPDEF if Tech Log is unavailable. When on board aircraft check Tech Log.		
Flight Documents	Collate	P2
Obtain and check:		
<ul style="list-style-type: none"> • Airfield RIM briefs • CIRRUS • Supplementary forms/handouts • Weather charts • Track message and ETOPS planning information if required 		
Supplementary operational information	Obtain	P1
<ul style="list-style-type: none"> • De-icing status • RVR 		
Pre-dispatch brief.....	Complete	P1
PF briefs PM as required.		
Fuel load	Approve	P1
Regenerate Simfest Dispatch OFP if required.		
Cabin Crew Preflight Brief.....	Complete	P1
Share all pertinent flight information with cabin crew.		

Preliminary Preflight Procedure – P2

The Preliminary Preflight Procedure assumes that the Electrical Power-Up supplementary procedure is complete.

IRS selectors OFF 30 seconds, then ON

Verify the ON BAT light is extinguished.

STATUS display Check

Verify that only expected messages are shown.

Verify that the following are sufficient for flight:

- Oxygen pressure
- Hydraulic quantity
- Engine oil quantity

Do the remaining actions after a crew change or maintenance action.

Verify the CREW OXYGEN LOW alert message is blank.

Maintenance documents Check

Emergency Equipment Check

Fire extinguisher – Checked and stowed

Crash axe – stowed

Flight deck overhead door – closed and latched

Emergency Descent Devices – stowed

Other needed equipment – checked and stowed

Parking brake Set

Set the parking brake if the brake wear indicators are to be checked during the exterior inspection.

WARNING: If the parking brake is not set, check with maintenance personnel before setting the brake to avoid injury to crews.

CDU/EFB Preflight Procedure – P1 and P2

Start the CDU/EFB Preflight Procedure any time after the Preliminary Preflight Procedure. The Initial Data and Navigation Data entries must be complete before the flight instrument check during the Preflight Procedure. The Performance Data entries must be complete before the Preflight Checklist can be completed.

The P1 or P2 may make CDU/EFB entries. The other pilot must verify the entries.

Enter data in all the boxed items on the following CDU/EFB pages.

Enter data in the dashed items or modify small font items that are listed in this procedure. Enter or modify other items at pilot's discretion.

Failure to enter enroute winds can result in flight plan time and fuel burn errors.

Do not load an instrument approach before departure. This prevents unwanted LNAV arming and activation if a TO/GA switch is pushed after takeoff.

Initial data Set P1

CDU IDENT page:

Verify that the MODEL is correct

Verify that the ENG RATING is correct

Verify that the navigation database ACTIVE date range is current

POS INIT page:

Verify that the time is correct

Enter the present position on the SET INERTIAL POS line. Use the most accurate latitude and longitude.

Navigation data Set P1

CDU RTE page:

Enter the route.

Enter the ATC callsign in the FLT NO field

CAUTION: Entering anything other than the ATC CALLSIGN will cause Mode S transponder problems with ATC and when attempting to log on to CPDLC.

Verify that the route is correct on the RTE page. Check the LEGS pages as needed to ensure compliance with the flight plan.

ACTIVATE and execute the route.

CDU DEPARTURES page:

Select the runway or HUD TAKEOFF

Select departure routing

Execute the runway or HUD TAKEOFF and departure routing

Note: If a change in HUD TAKEOFF runway is needed, select both flight director switches OFF. After the new runway is executed on the CDU, select the flight director switches back to ON.

POS REF page 2:

Verify or enter the correct RNP for departure, as needed.

NAV RADIO page:

Tune the navigation radios, as needed

VNAV Climb page Set

Verify correct TRANS ALT displayed.

PERF INIT page Set

Enter the RESERVES value from CIRRUS

Enter the COST INDEX from CIRRUS

Enter the initial CRZ ALT from CIRRUS

Electronic Flight Bag P1, P2

Select INITIALIZE FLIGHT.

Verify correct documents are loaded

Verify databases are current on the EFB IDENT page.

Review FAULTs, MEMOs and MSGs.

Select TERMINAL CHARTS as needed.

On all flights:

Independently load relevant NOTAM/MEL/CDL performance corrections into OPT, at a convenient point prior to commencing the Critical Data Procedure.

Refer to 787 Dispatch Performance Data manual for any Emergency Turn Procedures and relevant performance notes.

If required:

Do Performance Dispatch Calculations as needed. P2

Use ATIS and CIRRUS to obtain performance dispatch calculations from the OPT.

Critical Data Procedure..... Accomplish

Critical Data Procedure – P1 and P2

Critical Data are defined as those parameters used to perform a takeoff performance calculation.

The following procedure is used to ensure that data critical to the safe conduct of the flight is entered accurately and is cross-checked by the other pilot. This procedure should be conducted at a time of low workload and minimal distraction. This procedure is also to be used if performance data changes once the aircraft has dispatched.

Electronic Flight Bag Onboard Performance Tool (OPT)

Cross check and complete OPT data entry.

Note: P1 leads this phase of the procedure and both P1 and P2 cross-check each other's data has been correctly entered, using XFR function. Objective of this phase of the CDP is to pre-load and cross-check as much performance information as possible into OPT, prior to entering the loadsheet phase of the procedure.

PERFORMANCE page.....	Select	Both
COPY FMC DATA.....	Select if required	Both

Display and cross check all NOTAM/MEL/CDL performance corrections using EFB XFR function.

Agree and enter all remaining runway (including specific or multiple INTX as required), environmental, thrust, flap and AI entries.

Display and cross-check runway, environmental, thrust, flap and AI entries using EFB XFR function.

WARNING: The following steps must not be conducted until the Fuelling Procedure has been completed.

Loadsheet Data.....	Set
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CDU PERF INIT page:

State MACTOW	P1	
State ZFW from Loadsheet	P1	
Verify and enter the ZFW	P2	
State the GR WT from the CDU	P2	
Verify that the GR WT on the CDU and the Loadsheet agree	P1	
THRUST LIM Page.....	Select	Both
Verify that the OAT is displayed	P2	

Electronic Flight Bag Onboard Performance Tool (OPT):

PERFORMANCE-TAKEOFF page	Both	
Select COPY FMC DATA and load CG (%)	Both	
Select CALC to complete the performance calculations	Both	
Once OPT calculation complete, confirm preferred INTX and select it	Both	
State RWY/INTX, FLAP, Accel HT, Takeoff Thrust Rating (e.g. D-TO2), SEL Temp, C/G (%), V1/VR/V2 and note whether Performance Restrictions apply (these can be accessed from the Dispatch Performance Data manual or from OPT)	P1	
Verify OPT data	P2	
Select SEND OUTPUT	P2	
Note: SEND OUTPUT may be accomplished from either EFB. Attempts to SEND OUTPUT simultaneously from both EFBs will be unsuccessful and disable the transfer function.		
Select SEND TO FMC to transfer the performance data to the FMC	P2	
Select COMPLETE and verify FMC uplink displays on the FMC TAKEOFF REF page	P2	
CDU TAKEOFF REF pages:		
Verify the performance data is correct on the TAKEOFF REF 2/2 and 1/2 pages. Rationalise both the GR WT and TOGW against the Loadsheets gross weight.	P1	
Note: The EO ACCEL HT sent to the FMC is corrected for temperature and barometric setting, and may differ from the value displayed in the EFB Onboard Performance Tool. Use the FMC displayed value.		
Select ACCEPT on the TAKEOFF REF 1/2 page.	P1	
THRUST LIM page.....Set		P1
Select CLB, CLB1 or CLB as required		

TAKEOFF REF 2/2.....	Verify	P2
Verify selected climb thrust is correctly annunciated at LSK 3R		P2
Enter any non-standard EO ACCEL HT, ACCEL HT and THR REDUCTION values		P2
VNAV Page.....	Select	Both
Enter any non-standard speed and/or altitude restrictions		P2
Verify that FMC PREFLIGHT COMPLETE is displayed		P1
Verify the thrust reference mode and assumed temperature are correct on EICAS		P1
MCP.....	Set	P1
IAS/Mach selector – Set V2		
LNAV Switch – as required		
VNAV Switch – push		
Initial heading – set		
Initial altitude/FL – set		
Takeoff Data.....	Check	Both
Takeoff thrust setting (on EICAS)		
Runway (on ND)		
Initial altitude (on PFD)		
Selected V1 and V2 speeds (on PFD)		
VNAV armed (on PFD)		
LNAV as required (on PFD)		
Verify that the FMC SID matches the ATC clearance or Datalink clearance if available		
FMC COMM page	Select	
RTE 1 DATA		
• Request WIND DATA as needed		
• Load and execute en route winds		
• Load climb forecast winds		
• Load descent forecast winds		
CAUTION: Use the FMC COMM button instead of the VNAV button to load winds. This prevents inadvertent selection of the DES NOW button on the ground resulting in deletion of CRZ FL and other FMC data. A missing CRZ FL results in VNAV ALT at 400R on departure.		
Note: No environmental data will be uplinked to the FMC unless the Critical Data Procedure is completed before making a wind data request.		

Preflight Procedure – P2

The P2 completes this procedure. Where items are shown in brackets this indicates an alternate selection for use during role reversal.

FLIGHT CONTROL SURFACES panel	Set
TAIL switch.....	NORM
WINGS switch.....	NORM
HEADING REFERENCE switch.....	NORM
PRIMARY FLIGHT COMPUTERS DISCONNECT switch	Guard closed
Verify the DISC light is extinguished.	
ELECTRICAL panel	Set
BATTERY switch.....	ON
Verify the OFF light is extinguished.	
IFE/PASS SEATS power switch	ON
Verify that the OFF light is extinguished.	
CABIN/UTILITY switch.....	ON
Verify that the OFF light is extinguished.	
APU GENERATOR switches.....	ON
Verify the OFF lights are extinguished	
GENERATOR CONTROL switches.....	ON
Verify that the OFF lights are extinguished.	
Verify that the DRIVE lights are illuminated.	
APU selector (if needed).....	START, then ON
Verify that the FAULT light is extinguished	
L HUD BRIGHTNESS control	In
L WIPER selector.....	OFF
TOWING POWER panel lights	Off
FLIGHT DECK DOOR POWER switch	ON
CCR RESET switches	Guards closed
EMERGENCY LIGHTS switch.....	Guard closed

SERVICE INTERPHONE switch OFF

Note: Do not push the PASSENGER OXYGEN switch. The switch causes deployment of the passenger oxygen masks.

PASSENGER OXYGEN ON light..... Verify extinguished

WINDOW HEAT panel..... Set

 BACKUP WINDOW HEAT switches ON

 PRIMARY WINDOW HEAT switches ON

 Verify that the INOP lights are extinguished.

WARNING: Do not push the RAM AIR TURBINE switch. The switch causes deployment of the ram air turbine.

RAM AIR TURBINE UNLOCKED light..... Verify extinguished

HYDRAULIC panel..... Set

 LEFT and RIGHT ENGINE PRIMARY pump switches ON

 Verify that the FAULT lights are illuminated

 CENTER 1 and CENTER 2 ELECTRIC pump selectors..... OFF

 Verify that the FAULT lights are illuminated.

 LEFT and RIGHT ELECTRIC DEMAND pump selectors OFF

 Verify that the FAULT lights are illuminated.

SEAT BELTS selector Set

Lighting panel..... Set

 OVERHEAD panel light controlMid position

 MASTER BRIGHTNESS switch ON

 MASTER BRIGHTNESS control As needed

 GLARESHIELD PANEL light controlMid position

 LANDING LIGHT switches..... OFF

GROUND TEST selector NORM

APU Fire panel Set

 Verify that the APU BTL DISCH light is extinguished.

 APU fire switch In

 Verify that the APU fire warning light is extinguished.

CARGO FIRE panel.....	Set
CARGO FIRE ARM switches	Off
Verify that the FWD and AFT fire warning lights are extinguished.	
Verify that the cargo fire DISCH light is extinguished.	
Verify that the FWD and AFT lights are extinguished	
ENGINE panel.....	Set
EEC MODE switches	NORM
START selectors.....	NORM
FUEL JETTISON panel.....	Set
Fuel jettison NOZZLE switches	Off
Verify that the VALVE lights are extinguished.	
FUEL TO REMAIN selector	In
FUEL JETTISON ARM switch.....	Off
Verify that the FAULT light is extinguished.	
Fuel panel.....	Set
CROSSFEED switch	OFF
Verify that the VALVE light is extinguished.	
FUEL PUMP switches.....	OFF
Verify that the left aft pump PRESS lights is extinguished if the APU is on or illuminated if the APU is off.	
Verify that the other left and right pump PRESS lights are illuminated.	
Verify that the center pump PRESS lights are extinguished.	
FUEL BALANCE switch	Off
Verify that the ON light and FAULT light are extinguished.	
ANTI-ICE panel.....	Set
WING ANTI-ICE selector.....	AUTO
ENGINE ANTI-ICE selectors	AUTO
Verify that the VALVE light is extinguished.	

Lighting panel	Set
BEACON light switch	OFF
NAVIGATION light switch	As needed
LOGO light switch.....	As needed
WING light switch.....	As needed
INDICATOR LIGHTS switch.....	As needed
RUNWAY TURNOFF light switches	OFF
TAXI light switch	OFF
STROBE light switch	OFF

G-ZBKH – G-ZBKK

BROADBAND COMM switch	ON
ELT switch.....	Guard closed

G-ZBJA – G-ZBJH

FWD CARGO AIR CONDITIONING CONTROL PANEL	As needed
FWD CARGO FLOW selector	As needed
FORWARD CARGO AIR CONDITIONING CONTROL.....	As needed
If not in OFF, verify that the OFF light is extinguished.	
BULK CARGO TEMPERATURE switch	As needed
If in AUTO, verify that the OFF light is extinguished.	

G-ZBJI – G-ZBKS

FWD CARGO AIR CONDITIONING CONTROL PANEL	As needed
FWD CARGO FLOW selector	As needed
FORWARD CARGO AIR CONDITIONING CONTROL.....	As needed
Verify that the OFF light is extinguished.	
BULK CARGO TEMPERATURE switch	As needed
If in AUTO, verify that the OFF light is extinguished.	
AIR CONDITIONING panel	Set
EQUIPMENT COOLING switches.....	AUTO
Verify that the OVRD lights are extinguished.	
RECIRCULATION FANS switches	ON

FLIGHT DECK TEMPERATURE CONTROL.....	Mid position
CABIN TEMPERATURE control.....	Mid position
PACK switches	AUTO
Verify that the OFF lights are extinguished if the APU is running.	
TRIM AIR switches.....	ON
Verify that the FAULT lights are extinguished.	
VENTILATION switch	NORM
Verify that the ALTN light is extinguished.	
PRESSURIZATION panel	Set
OUTFLOW VALVE switches.....	AUTO
Verify that the MAN lights are extinguished.	
LANDING ALTITUDE selector	IN
R WIPER selector.....	OFF
R HUD BRIGHTNESS control	In
FLIGHT DIRECTOR switch.....	ON
Display select panel	Set
EFIS control panel	Set
MINIMUMS reference selector.....	RADIO or BARO
MINIMUMS selector.....	Set decision height or altitude reference
FLIGHT PATH VECTOR switch	As needed
METERS switch	As needed
BAROMETRIC reference and BAROMETRIC selectors.....	Set
Select INCHES or HECTOPASCALS	
Set local altimeter setting	
ND mode selector	MAP
ND mode select switch	Push
MENU.....	Select
Map selections	As needed

ND CENTER switch.....	As needed
ND RANGE selector.....	0.5, 1, 2 or 5
Displays airport map	
CAUTION: Do not use the Airport Map application as a primary navigation device. The Airport Map application is designed to aid flight crew positional awareness only.	
ND WXR switch.....	Off
Verify that weather radar indications are not shown on the ND or PFD mini-map.	
ND TFC and TERR switches	As needed
Oxygen.....	Test and set
Oxygen mask	Stowed and doors closed
RESET/TEST switch	Push and hold
Verify that the yellow cross shows momentarily in the flow indicator.	
REST/TEST switch.....	Release
G-ZBJA – G-ZBJH, G-ZBKA – G-ZBKP	
Normal/100% selector	100%
G-ZBJI – G-ZBJM, G-ZBKR, G-ZBKS	
Emergency/100%/Normal selector	100%
FORWARD PANEL brightness control.....	Mid position
INBOARD and OUTBOARD DISPLAY brightness and CONTRAST controls.....	Mid position
AIR DATA/ATTITUDE source selector.....	AUTO
PFD/MFD selector.....	NORM
Do the Initial Data and Navigation Data steps from the CDU/EFB Preflight Procedure and verify that the IRS alignment is complete before checking the flight instruments.	
Flight instruments	Check
Verify that the flight instrument indications are correct.	
Verify that only these flags are shown:	
<ul style="list-style-type: none"> • TCAS OFF • NO VSPD until takeoff V-speeds are selected 	

Verify that the flight mode annunciators are correct:

- Autothrottle mode is blank
- Roll mode is TO/GA or HUD TO/GA
- Pitch mode is TO/GA
- AFDS status is FLT DIR

Select the MAP mode.

Landing gear panel.....	Set
Landing gear lever.....	DN
ALTERNATE GEAR switch.....	Guard closed
AUTOBRAKE selector.....	RTO
EICAS display	Check
Secondary engine indications	Display
Verify that the engine indications display existing conditions	
Verify that no exceedance is shown	
MFD	Check
Select the Status display	
Status messages.....	Check
CHECKLIST display switch.....	Push
RESETS.....	Select
Verify that the AIRLINE DATABASE is correct	
RESET ALL	Select
COMM display switch.....	Push
INITIALISATION REQUEST	Select
Flight Number.....	Check or Enter
SEND.....	Select
Left (right) tuning and control panel	Set
Verify that the OFF light is extinguished	
Observer's audio control panel.....	As needed
FLIGHT DECK DOOR ACCESS selector	AUTO
Engine fire panel.....	Set

Verify that the ENG BTL 1 DISCH and ENG BTL 2 DISCH lights are extinguished.	
Engine fire switches.....	In
Verify that the LEFT and RIGHT fire warning signs are extinguished.	
GLIDESLOPE INHIBIT switch	BELOW G/S light extinguished
TRANSPONDER MODE selector	STBY
AURAL CANCEL light	Extinguished
Center tuning and control panel.....	Set
Verify that the OFF light is extinguished.	
Flight deck printer	Set
Verify that the FAIL and PAPER lights are extinguished.	
Verify that printer power is ON.	
Right (Left) tuning and control panel	Set
Verify that the OFF light is extinguished.	
VHF	Select
L & R VHF	Set
HF	Select
L & R HF.....	Set
WEATHER RADAR	Select
P2 GAIN and MODE.....	As needed
TRANSPONDER	Select
P2 TCAS DISPLAY	As needed
P2 TCAS alt.....	As needed
VHF.....	Select
P2 audio control panel.....	As needed
FLOOR LIGHTS switch	As needed
EVACUATION COMMAND switch	Guard closed
Observer AUDIO selector	NORM
AISLE STAND PANEL light control.....	Mid position

AISLE STAND FLOOD light controlMid position

WARNING: Do not place objects between pilot’s seat and aisle stand. Injury can occur when the seat is adjusted forward.

Seat.....Adjust

Position the seat for optimum eye reference

Whenever the seat is adjusted, verify a positive horizontal (fore and aft) seat lock by pushing against the seat.

Rudder pedals.....Adjust

Adjust to permit full rudder pedal and brake application

HUD combiner Down

HUD BRIGHTNESS control.....Adjust

Seat belt and shoulder harness.....Adjust

Do the Critical Data Procedure when required by the P1.

Do the PREFLIGHT checklist on the P1’s request.

Preflight Procedure – P1

The captain normally does this procedure. The first officer may do this procedure if needed.

- EFIS control panel Set
- MINIMUMS reference selector..... RADIO or BARO
- MINIMUMS selector.....Set decision height or altitude reference
- FLIGHT PATH VECTOR switch As needed
- METERS switch..... As needed
- BAROMETRIC reference and BAROMETRIC selectors..... Set
 - Select INCHES or HECTOPASCALS
 - Set local altimeter setting
- ND mode selector MAP
- ND mode select switch Push
- MENU..... Select
 - Map selections As needed
- ND CENTER switch..... As needed
- ND TRAFFIC switch..... As needed
- ND range selector 0.5, 1, 2 or 5
 - Displays airport map.
 - CAUTION: Do not use the Airport Map application as a primary navigation reference. The Airport Map application is designed to aid flight crew positional awareness only.**
- ND WXR switch..... Of
 - Verify that the weather radar indications are not shown on the ND or PDF mini-map.
- ND TFC and TERR switches..... As needed
- Display select panel..... Set
- EICAS TRANSFER switch..... As needed
 - Select EICAS to the desired side.

Mode control panel.....	Set
FLIGHT DIRECTOR switch.....	ON
AUTOTHROTTLE ARM switches.....	ARM
Autopilot DISENGAGE bar	UP
HEADING/TRACK reference switch	As needed
BANK LIMIT selector.....	AUTO
VERTICAL SPEED/FLIGHT PATH ANGLE reference switch	As needed
ALTITUDE increment selector	As needed
Oxygen.....	Test and set
Oxygen mask	Stowed and doors closed
RESET/TEST switch	Push and hold
Verify that the yellow cross shows momentarily in the flow indicator.	
RESET/TEST switch	Release
G-ZBJA – G-ZBJH, G-ZBKA – G-ZBKP	
Normal/100% selector	100%
G-ZBJI – G-ZBJM, G-ZBKR, G-ZBKS	
Emergency/100%/Normal selector	100%
FORWARD PANEL brightness control.....	Mid position
INBOARD and OUTBOARD DISPLAY brightness and CONTRAST controls.....	Mid position
AIR DATA/ATTITUDE source selector.....	AUTO
PFD/MFD selector.....	NORM
Do the Initial Data and Navigation Data steps from the CDU/EFB Preflight Procedure and ensure IRS alignment is complete before checking flight instruments.	
Flight instruments	Check
Verify that the flight instrument indications are correct.	
Verify that only these flags are shown:	
• TCAS OFF	
• NO VSPD until takeoff V-speeds are selected	

Verify that the flight mode annunciations are correct:

- Autothrottle mode is blank
- Roll mode is TO/GA or HUD TO/GA
- Pitch mode is TO/GA
- AFDS status is FLT DIR

Select the MAP mode

Integrated standby flight display Set

Verify that the approach mode display is blank

Set local altimeter setting

Verify that the flight instrument indications are correct

Verify that no flags or messages are shown.

SPEEDBRAKE lever DOWN

Reverse thrust levers Down

Forward thrust levers Closed

Flap lever Set

The flap position indicator does not show when flaps are up.

Set the flap lever to agree with the flap position.

PARKING BRAKE Set

Verify that the PARK BRAKE SET message shows.

STABILIZER cutout switches Guards closed

FUEL CONTROL switches CUTOFF

FUEL CONTROL switch fire warning lights Verify extinguished

ALTERNATE FLAPS panel Set

ALTERNATE FLAPS ARM switch Off

ALTERNATE FLAPS selector OFF

Left (Right) tuning and control Set

WEATHER RADAR Select

P1 GAIN and MODE As needed

TRANSPONDER Select

P1 TCAS DISPLAY As needed

P1 TCAS ALT	As needed
VHF	Select
P1 audio control panel	As needed
Seat.....	Adjust
Position the seat for optimum eye reference	
Whenever the seat is adjusted, verify a positive horizontal (fore and aft) seat lock by pushing against the seat.	
Rudder pedals.....	Adjust
Adjust to permit full rudder pedal and brake application	
HUD combiner	Down
HUD BRIGHTNESS control.....	Adjust
Do the Critical Data Procedure when data is available.	
Conduct Taxi and Takeoff briefing at a moment of appropriate workload.	
Call “PREFLIGHT CHECKLIST”.	

Before Start Procedure

Start the Before Start Procedure after all doors are closed.

Flight deck door..... Closed and locked P2

Do the Critical Data Procedure before completing this procedure.

CDU display..... Set Both

Normally the PF selects the TAKEOFF REF page

Normally the PM selects the LEGS page

Ground crew clearanceObtain P1

Obtain a clearance to pressurise hydraulic systems.

If pushback is needed:

Verify that the nose gear steering is locked out.

HYDRAULIC panel Set P2

WARNING: If the tow bar is connected, do not pressurize the hydraulic systems until the nose gear steering is locked out. Unwanted tow bar movement can occur.

RIGHT ELECTRIC DEMAND pump selector AUTO

Verify that FAULT light is extinguished.

CENTER 1 and CENTER 2 ELECTRIC
pump selectors AUTO

Verify that the FAULT lights are extinguished.

LEFT ELECTRIC DEMAND pump selector AUTO

Verify that the FAULT light is extinguished.

FUEL panel..... Set P2

LEFT and RIGHT FUEL PUMP switchesON

The PRESS lights are illuminated because of load shedding. If the APU is running, the left aft PRESS light is extinguished.

If the FUEL IN CENTER message shows:

CENTER FUEL PUMP switchesON

Both PRESS lights illuminate until after engine start because of load shedding.

BEACON light switchON P2

CANCEL/RECALL switch	Push	P2
Verify that only the expected alert messages are shown.		
CANCEL/RECALL switch	Push	P2
Verify that the messages cancel		
Transponder.....	XPDR	P2
Select assigned code if ATC clearance is confirmed		
If ATC code is not assigned select 2000 unless an alternate code is required by local airport regulations.		
Trim	Set	P2
Note: If the target FMC stabilizer takeoff setting is close to the greenband limit, when setting the stabilizer position (STAB), approach the target takeoff STAB setting from the outside of the greenband towards the inside of the greenband. This minimizes nuisance CONFIG STABILIZER messages.		
Stabilizer trim - ____ UNITS		
Set the trim for takeoff		
Check that the trim is in the greenband.		
Rudder trim.....0 units		
Call “BEFORE START CHECKLIST”		P1
Do the BEFORE START CHECKLIST		P2

Pushback or Towing Procedure

The Engine Start procedure may be done during pushback or towing.

CAUTION: Do not push back without ATC clearance/authorization. Distraction events have resulted in unauthorized pushback events. Both pilots must verify clearances.

Ground handling personnel Establish communications P1

CAUTION: Do not hold or turn the nose wheel tiller during pushback or towing. This can damage the nose gear or the tow bar.

CAUTION: Do not use airplane brakes to stop the airplane during pushback or towing. This can damage the nose gear or the tow bar.

Set or release the parking brake as directed by ground handling personnel P1

When pushback or towing is complete:

Ground crew Release P1

Tow bar Verify not connected P1

Nose gear steering Verify not locked out P1

Engine Start Procedure

Ground Crew Start Clearance.....Obtain P1

Select the secondary engine indications. P2

Crew action to correct for abnormal engine indications is not needed. Respond to any EICAS messages that show.

Note: The engines will not start if external power and the APU are both supplying electric power at the same time. One source must be selected off. The APU is the preferred electric power source for engine start.

CAUTION: If OAT is above 40°C, do not attempt to start both engines at the same time.

Start sequence..... Announce P1

The engines may be started at the same time.

Call “START ___ ENGINE” P1

Engine START switch.....START P2

FUEL CONTROL switch.....RUN P2

If the engines were not started at the same time:

After the engine is stabilized at idle, start the other engine.

Before Taxi Procedure

Start the Before Taxi Procedure when the engines are stabilised at idle.

WARNING: Distraction at this phase is a major hazard. Collision risk with ground equipment and injury to ground personnel has resulted from the following procedure being omitted.

Verify that all engine generator OFF lights are extinguished	P2
APU selector..... OFF	P2
ENGINE ANTI-ICE selectorsAs needed	P2
Flap leverSelect takeoff flaps	P2
Secondary Engine Indications Off	P2
Recall..... Check	P2
Verify that only expected alert messages are shown.	
Update changes to the taxi briefing, as needed.	
Flight controls Check	P1
Make slow and deliberate inputs, one direction at a time.	
Move the control wheel and the control column to full travel in both directions and verify:	
• freedom of movement	
• that the controls return to center	
Hold the nose wheel tiller during rudder check to prevent undesired nose wheel movement	
Move the rudder pedals to full travel in both directions and verify:	
• freedom of movement	
• that the rudder pedals return to center	
Call “BEFORE TAXI CHECKLIST”	P1
Do the BEFORE TAXI checklist	P2

Before Takeoff Procedure

Engine warm up requirements:

- Run the engines for at least 5 minutes
- Use a thrust setting normally used for taxi operations
- Engine oil temperature must be above the lower amber band before takeoff

WARNING: Taxi is a critical phase of flight and distraction must be kept to a minimum.

WARNING: Performance data displayed must be considered provisional until FINAL LOADSHEET is received and runway start point is known.

Note: For the purposes of updating changes to the takeoff briefing, a Critical Data change owing to a change in RWY intersection will manifest itself as a change to RUNWAY POS on TAKEOFF REF page 1.

Pilot Flying	Pilot Monitoring
	Acknowledge Final Loadsheet.
If Critical Data changes: <ul style="list-style-type: none"> • Do the Critical Data Procedure 	
	If Critical Data changes: <ul style="list-style-type: none"> • Set Flap (as needed) • Set the trim for takeoff (as needed) • Verify that trim is in the greenband
For all takeoffs, carry out the takeoff Briefing Update by reviewing these items: <ul style="list-style-type: none"> • TAKEOFF REF pages • Departure routing • Supplementary Procedures • DDG Requirements 	
Set the weather radar display as needed	
Set the terrain display as needed.	
	Set the transponder mode selector to RA/TA.
	Verify that cabin is secure
Call "BEFORE TAKEOFF CHECKLIST"	Do the BEFORE TAKEOFF checklist.

Takeoff Procedure

Pilot Flying	Pilot Monitoring
Before entering the departure runway, verify that the runway and runway entry point are correct.	
	Signal the cabin crew.
	When entering the departure runway, set the STROBE light switch to ON. Use other lights as needed. Set the LEFT and RIGHT LANDING light switches to ON.
Verify that the brakes are released. Align the airplane with the runway.	
Verify that the airplane heading agrees with the assigned runway heading.	
Advance the thrust levers to approximately 20 TPR. Allow the engines to stabilise.	
Push the TO/GA switch.	
Verify that the correct takeoff thrust is set.	
	Monitor the engine instruments throughout the takeoff. Call out any abnormal indications. Adjust takeoff thrust before 80 knots if needed. During strong headwinds, if the thrust levers do not advance to the planned takeoff thrust, manually advance the thrust levers before 80 knots. Call "THRUST SET".
After takeoff thrust is set, the PF's hand must be on the thrust levers until V1.	
Monitor airspeed. Maintain light forward pressure on the control column.	Monitor airspeed and call out any abnormal indications.
Verify 80 knots and call "CHECK".	Call "80 KNOTS"
Verify V1 speed.	Verify the automatic V1 callout or call "V1".
At VR rotate toward 15° pitch attitude. After liftoff, follow F/D commands.	At VR, call "ROTATE". Monitor airspeed and vertical speed.
Establish a positive rate of climb.	
	Verify a positive rate of climb on the altimeter and call "POSITIVE RATE".
Verify a positive rate of climb on the altimeter and call "GEAR UP".	
	Set the Landing Gear lever to UP.
Above 400 ft radio altitude, call for a roll mode as needed.	Select or verify the roll mode. Verify VNAV engaged.
Verify that climb thrust is set.	

Pilot Flying	Pilot Monitoring
Verify acceleration at the acceleration height. Call “FLAPS___” according to the flap retraction schedule.	
	Set the flap lever as directed.
Engage the autopilot when above the minimum altitude for autopilot engagement.	
	After flap retraction is complete, set the ENGINE ANTI-ICE selectors to AUTO.
When cleared to climb above transition altitude set primary altimeter to standard pressure and call “SET STANDARD”	Set primary altimeter to standard pressure.
	Call “___ SET AND CROSSCHECKED”
Call “AFTER TAKEOFF CHECKLIST”	
	Do the AFTER TAKEOFF checklist.

Flap Retraction Speed Schedule

G-ZBJA – G-ZBJM

Takeoff Flaps	At Speedtape “Display”	Select Flaps
20 or 15	“20” or “15” “5” “1”	5 1 UP
5	“5” “1”	1 UP

G-ZBKA – G-ZBKS

Takeoff Flaps	At Speedtape “Display”	Select Flaps
20, 18, 17, 15 or 10	“20”, “18”, “17”, “15”, “10” “5” “1”	5 1 UP
5	“5” “1”	1 UP

Climb and Cruise Procedure

Complete the After Takeoff Checklist before starting the Climb and Cruise Procedure.

Pilot Flying	Pilot Monitoring
When cleared to climb above transition altitude set primary altimeter to standard pressure and call "SET STANDARD"	Set primary altimeter to standard pressure "___ SET AND CROSSCHECKED"
	During climb and cruise, verify the RNP as needed.
When passing 10,000 ft/FL100 call "ALTIMETER CHECK"	Check all altimeters are correctly set and call "FL (ALTITUDE)___ CLIMBING FL (ALTITUDE)___, STANDARD (QNH___) SET"
	Set the LANDING and LOGO light switches to OFF
	Set the seatbelt signs as needed.
When above transition altitude and MSA, set standby altimeter to standard	
Enter the final ZFW in to the FMC	Verify entry of final ZFW
Enter the CRZ CG in to the FMC	Verify entry of CRZ CG
When passing 10,000ft/FL100 or MSA, whichever highest, check/select CLB2	Verify CLB2 is active climb thrust derate
When passing FL200 ensure all altimeters are set to standard pressure and call "ALTIMETER CHECK"	Check all altimeters are correctly set and call "FL___ CLIMBING FL___, STANDARD SET"
At or near T/C, and thereafter as needed, use the FMC to optimize the flight.	
	Before the top of descent, modify the active route as needed for the arrival and approach.

Note: If better climb performance is required, tactical use of Cost Index 0 and/or a different climb thrust rating is acceptable to meet ATC or operational requirements. Once these requirements are complied with, standard operation should be resumed.

Descent Procedure

Start the Descent Procedure before the airplane descends below the cruise altitude for arrival at destination.

Complete the Descent Procedure by MSA, FL100 or 10,000 feet MSL, whichever is higher.

Pilot Flying	Pilot Monitoring
	During descend, verify the RNP as needed.
Set Standby Altimeter to arrival airport pressure setting.	
Set the most up-to-date TRANS LVL in FMC DESCENT FORECAST Page.	
Review all alert messages.	Recall and review all alert messages.
Review all operational notes	Recall and review all operational notes
Verify VREF on the APPROACH REF page.	Enter VREF on the APPROACH REF page.
Set the RADIO/BARO minimums as needed for approach	
	Set the NAV RADIO page for the approach.
	Check landing performance.
	Set the AUTOBRAKE selector to the needed brake setting.
Do the approach briefing.	
Call "DESCENT CHECKLIST"	Do the DESCENT checklist.

Approach Procedure

The Approach Procedure is normally started in the descent, above transition level.

Complete the Approach Procedure before:

- The initial approach fix, or
- The start of radar vectors to the final approach course, or
- The start of a visual approach

Do not manually build the approach or add waypoints to the selected FMC procedure. For an instrument approach using IAN, select the G/S prompt OFF if flying an ILS approach where the G/S transmitter is inoperative or when the G/S data is unreliable.

Pilot Flying	Pilot Monitoring
	Set the seatbelt signs ON
When passing FL200 call "ALTIMETER CHECK"	Check all altimeters are correctly set and call "FL (ALTITUDE) ___ DESCENDING FL(ALTITUDE) ___ STANDARD (QNH ___) SET"
Update the arrival and approach, as needed. Verify the RNP as needed. Monitor aircraft position and energy against briefed gates.	
Select VSD on as needed.	
Update the approach briefing as needed.	
	At or above 10,000 feet MSL/FL100, set the LEFT and RIGHT LANDING light switches to ON. Set the LOGO lights to ON as appropriate
When passing 10,000 ft MSL/FL100 call "ALTIMETER CHECK"	Check all altimeters are correctly set and call "FL (ALTITUDE) ___ DESCENDING FL (ALTITUDE) ___, STANDARD (QNH ___) SET".
When cleared below transition level call "SET QNH" and reset primary altimeter.	Set primary altimeter and call "QNH ___ SET AND CROSSCHECKED".
Call "APPROACH CHECKLIST"	Do the APPROACH checklist.

Flap Extension Schedule

Current Flap Position	At Speedtape "Display"	Select Flaps	Command Speed for Selected Flaps
UP*	"UP"	1	"1"
1	"1"	5	"5"
5	"5"	20	"20"
20	"20"	25 or 30	(VREF25 or VREF30) + wind additives

Landing Procedure – ILS or GLS

Pilot Flying	Pilot Monitoring
Initially: <ul style="list-style-type: none"> If on radar vectors <ul style="list-style-type: none"> HDG SEL Pitch mode (as needed) If enroute to a fix <ul style="list-style-type: none"> LNAV or other roll mode VNAV or other pitch mode 	
	Verify that the cabin is secure
Call “FLAPS___” according to the flap extension schedule.	Set the flap lever as directed.
When on localizer intercept heading: <ul style="list-style-type: none"> Verify that the ILS is tuned and identified Verify that the deviation pointers are shown 	
Arm the LOC/FAC mode.	
WARNING: When using LNAV to intercept the final approach course, LNAV might parallel the localizer without capturing it.	
Use LNAV, HDG SEL/TRK SEL or HDG HOLD/TRK HOLD to intercept the final approach course, as needed.	
Verify that the localizer is captured.	Verify final approach course heading.
Arm the APP mode	
	Call “GLIDESLOPE ALIVE”.
At glideslope alive, call: <ul style="list-style-type: none"> “GEAR DOWN” “FLAPS 20” 	Set the landing gear lever to DN. Set the flap lever to 20.
Set the speedbrake lever to ARMED	
At glideslope capture, call “FLAPS___” as needed for landing.	Set the flap lever as directed.
Set the missed approach altitude on the MCP.	
Call “LANDING CHECKLIST”	Do the LANDING checklist.
At final approach fix (LOM, MKR, DME) verify the crossing altitude.	
Monitor the approach.	
Verify the autoland status at 500 feet AGL.	

Landing Procedure – Instrument Approach Using IAN

IAN should be used only for approaches that have one of the following features:

- a published GP angle on the LEGS page for the final approach segment
- a RWxx waypoint at the approach end of the runway
- a missed approach waypoint before the approach end of the runway (for example, MXxx)

Use of IAN is not recommended when an approach has a visual manoeuvre or segment that is not in the FMC database.

This procedure is not authorized using QFE.

Pilot Flying	Pilot Monitoring
Initially: <ul style="list-style-type: none"> • If on radar vectors <ul style="list-style-type: none"> ○ HDG SEL ○ Pitch mode (as needed) • If enroute to a fix <ul style="list-style-type: none"> ○ LNAV or other roll mode ○ VNAV or other pitch mode 	
	Verify that the cabin is secure
Call “FLAPS__” according to the flap extension schedule.	Set the flap lever as directed.
When on localizer/final approach course intercept heading <ul style="list-style-type: none"> • verify that the navigation radios are tuned and identified (as needed) • verify that the deviation pointers are shown 	
Arm the LOC/FAC mode.	
Use LNAV, HDG SEL, TRK SEL, HDG HOLD or TRK HOLD to intercept the final approach course as needed.	
Verify that the localizer/final approach course is captured.	
Arm the APP mode.	
At glide path alive or approximately 2 NM before the final approach fix, call: <ul style="list-style-type: none"> • “GEAR DOWN” • “FLAPS 20” 	Set the Landing Gear lever to DN Set the flap lever to 20.
Set the SPEEDBRAKE lever to ARMED	
At glide path capture, call “FLAPS__” as needed for landing.	Set the flap lever as directed.
Set the missed approach altitude on the MCP	
Call “LANDING CHECKLIST”	Do the LANDING checklist
At the final approach fix, verify the crossing altitude.	
Monitor the approach.	
If suitable visual reference is established at DA(H), MDA(H), or the missed approach point, disengage the autopilot. See Limitations – Autopilot/Flight Director System .	
Maintain the glide path to landing.	

Landing Procedure – Instrument Approach Using VNAV

IAN should be used only for approaches that have one of the following features:

- a published GP angle on the LEGS page for the final approach segment
- a RWxx waypoint at the approach end of the runway
- a missed approach waypoint before the approach end of the runway (for example, MXxx)

This procedure is not authorized using QFE.

Pilot Flying	Pilot Monitoring
Initially: <ul style="list-style-type: none"> • If on radar vectors <ul style="list-style-type: none"> ○ HDG SEL ○ Pitch mode (as needed) • If enroute to a fix <ul style="list-style-type: none"> ○ LNAV or other roll mode ○ VNAV or other pitch mode 	
	Verify that the cabin is secure
Call “FLAPS__” according to the flap extension schedule.	Set the flap lever as directed.
The recommended roll modes for the final approach are: <ul style="list-style-type: none"> • for an RNAV, GPS, VOR or NDB approach use LNAV • for a B/CRS approach use LNAV or B/CRS. B/CRS roll mode is only available for approaches in the FMC database. • for a LOC, SDF, LDA, ILS (G/S off), IGS (G/S off) approach use LNAV or LOC 	
When on the final approach course intercept heading for LOC, B/CRS, SDF, or LDA approaches: <ul style="list-style-type: none"> • verify that the localizer is tuned and identified • verify that the LOC pointer is shown 	
Arm the LNAV or LOC mode.	
WARNING: When using LNAV to intercept the final approach course, LNAV might parallel the localizer without capturing it. The airplane can then descend on the glide slope with the localizer not captured.	
Use LNAV, HDG SEL, TRK SEL, HDG HOLD or TRK HOLD to intercept the final approach course as needed.	
Verify that LNAV is engaged or that the localizer is captured.	
Approximately 2 NM before the final approach fix and after ALT, VNAV PTH, or VNAV ALT is annunciated: <ul style="list-style-type: none"> • set DA(H) or MDA(H) on the MCP • select or verify VNAV • select or verify speed intervention 	Approximately 2NM before the final approach fix, call “APPROACHING GLIDE PATH”.
Call: <ul style="list-style-type: none"> • “GEAR DOWN” • “FLAPS 20” 	Set the Landing Gear lever to DN Set the flap lever to 20.
Set the SPEEDBRAKE lever to ARMED	
Beginning the final approach descent, call “FLAPS__” as needed for landing	Set the flap lever as directed.
Call “LANDING CHECKLIST”	Do the LANDING checklist

Pilot Flying	Pilot Monitoring
When at least 300 feet below the missed approach altitude, set the missed approach altitude on the MCP.	
At the final approach fix, verify the crossing altitude	
Monitor the approach.	
If suitable visual reference is established at MDA(H), DA(H), or the missed approach point, disengage the autopilot in accordance with Limitations – Autopilot/Flight Director System .	
Maintain the glide path to landing.	

Go-Around and Missed Approach Procedure

Pilot Flying	Pilot Monitoring
At the same time: <ul style="list-style-type: none"> • Push either TOGA switch • Call “GO-AROUND, FLAPS 20” 	Set the flap lever to 20.
Verify: <ul style="list-style-type: none"> • The rotation to go-around attitude • That the thrust increases 	
	Verify that the thrust is sufficient for the go-around or adjust as needed
Verify a positive rate of climb on the altimeter and call “GEAR UP”	Verify a positive rate of climb on the altimeter and call “POSITIVE RATE” Set the Landing Gear lever to UP.
Above 400 feet radio altitude, select a roll mode.	Verify that the missed approach altitude is set.
Verify that the missed approach route is being tracked.	
Verify that the missed approach altitude is captured.	
At missed approach altitude, set speed to the manoeuvre speed for the planned flap setting.	
Call “FLAPS ___” according to the flap retraction schedule.	Set the flap lever as directed.
After flaps are set to the planned flap setting and at or above the flap maneuvering speed, select FLCH or VNAV as needed.	
Verify that climb thrust is set	
Call “AFTER TAKEOFF CHECKLIST”	Do the AFTER TAKEOFF checklist.

Rejected Landing Procedure

Manual Landing: This procedure is to be carried out where the go around is initiated at, or after, the commencement of the flare.

Autoland: During an automatic landing it is desirable to retain the automatic go-around functionality for as long as possible. Crews should ordinarily use the TO/GA function for rejected landings from DH. Where the rejected landing is initiated from below DH or after touchdown, crews should be prepared to use the Rejected Landing Procedure.

Pilot Flying	Pilot Monitoring
WARNING: At low radio altitudes the AFDS TOGA mode is not available.	
WARNING: Once reverse thrust is initiated following touchdown, a full stop landing must be made.	
CAUTION: If the aircraft is on the runway when the Pilot Flying applies maximum thrust, the takeoff configuration warning will activate.	
Call "GO AROUND"	
Disengage autopilot. Disconnect autothrottles. Aggressively apply maximum thrust. Verify thrust increases.	Verify that maximum thrust is selected and achieved; adjust if necessary.
Maintain current configuration	
Prevent the altitude from increasing rapidly. Maintain directional control and keep wings level.	
At Vref or above, rotate towards the go-around attitude. WARNING: Excessive rates of rotation must be avoided in order to prevent a tail strike. CAUTION: FD pitch guidance may not be valid and should be disregarded at the commencement of this manoeuvre. CAUTION: Expect out of trim forces after the engines spool up, leading to the possibility of over-rotation.	
When safely climbing away, carry out the standard go-around procedure.	

Landing Roll Procedure

Pilot Flying	Pilot Monitoring
<p>Verify that the thrust levers are closed.</p> <p>Verify that the SPEEDBRAKE lever is UP.</p>	<p>Verify the speedbrakes are extended, if not manually select speedbrake lever UP and call "SPEEDBRAKES UP".</p> <p>If the speedbrake lever cannot be selected up call "SPEEDBRAKES NOT UP".</p>
Monitor the rollout progress.	
Verify correct autobrake operation.	
<p>WARNING: After the reverse thrust levers are moved, a full stop landing must be made. If an engine stays in reverse, safe flight is not possible.</p>	
If reverse thrust greater than idle is required call "FULL/PARTIAL REVERSE" as required.	Apply reverse thrust as needed.
	<p>Verify that the forward thrust levers are closed.</p> <p>Without delay, raise the reverse thrust levers to the interlocks and hold light pressure until the interlocks release.</p> <p>Apply reverse thrust as briefed.</p> <p>When both REV indications are green, call "REVERSERS NORMAL."</p> <p>If there is no REV indication(s) or the indication(s) stays amber, call "NO REVERSER LEFT ENGINE", "NO REVERSER RIGHT ENGINE" or "NO REVERSERS".</p>
If full reverse thrust is needed call "FULL REVERSE"	Apply reverse thrust as directed.
When speed is decreasing below 60 knots call "REVERSE IDLE".	<p>Call "60 KNOTS."</p> <p>By 60 KIAS, start movement of the reverse thrust levers to reach the reverse idle detent by taxi speed.</p>
Safe stop assured and taxi speed reached call "FORWARD IDLE".	After the engines are at reverse idle, move the reverse thrust levers full down.
<p>Before taxi speed, disarm the autobrake. Use manual braking as needed.</p> <p>Call "MANUAL BRAKES".</p>	Call "AUTOBRAKE".
Before turning off the runway, disconnect the autopilot.	

After Landing Procedure

Start the After Landing Procedure when clear of the active runway and initial taxi routing is known.

Engine cool down recommendations:

- run the engines for at least 5 minutes
- use a thrust setting no higher than that normally used for taxi operations

Pilot Flying	Pilot Monitoring
Position/verify the SPEEDBRAKE lever is DOWN.	
	If needed for Engine Out Taxi, set the APU selector to START, then ON.
	Set the ENGINE ANTI-ICE switches to ON, if needed.
	Set the exterior lights as needed.
Set the weather radar to off.	
	Set the AUTOBRAKE selector to OFF.
	Set the flap lever to UP.
	Set the transponder mode selector to XPNDR.
	Do the "AFTER LANDING CHECKLIST".

Shutdown Procedure

Start the Shutdown Procedure when approaching the parking stand.

APU selector.....START, then ON P2

External Lights.....As Required P2

Cabin DoorsInitiate Disarm P2

PA call: “CABIN CREW DOORS TO MANUAL AND CROSSCHECK.”

Parking brakeSet P1

Verify that the PARK BRAKE SET message is shown.

Electrical powerSet P2

If APU power is needed:

Check that the APU RUNNING message is shown.

If external power is needed:

Verify that the FORWARD EXTERNAL POWER L AVAIL light is illuminated.

FORWARD EXTERNAL POWER L switch.... Push

Verify that the ON light is illuminated.

If the FORWARD EXTERNAL POWER R AVAIL light is illuminated:

FORWARD EXTERNAL
POWER R switch Push

Verify that the ON light is illuminated.

EXTERNAL POWER 1 or EXTERNAL POWER 2, or both, switches – Push

Verify that the respective ON light is illuminated.

Call “SHUTDOWN” P1

FUEL CONTROL switchesCUTOFF P2

If towing is needed:

Establish communications with ground handling personnel P1

WARNING: If the nose gear steering is not locked out, any change to hydraulic power with the tow bar connected can cause unwanted tow bar movement.

Verify that the nose gear steering is locked out.

CAUTION: Do not hold or turn the nose wheel tiller during pushback or towing. This can damage the nose gear or the tow bar.

CAUTION: Do not use airplane brakes to stop the airplane during pushback or towing. This can damage the nose gear or the tow bar.

Set or release the parking brake as directed by ground handling personnel P1

When parked (pushback or towing is complete):

SEATBELTS selectorOFF P2

CAUTION: Verify Passenger DOORS MANUAL EICAS before selecting SEATBELT selector OFF.

HYDRAULIC panelSet P2

LEFT ELECTRIC DEMAND pump selectorOFF

CENTER 1 and CENTER 2 ELECTRIC
pump selectorsOFF

RIGHT ELECTRIC DEMAND pump selectorOFF

FD DOOR POWER.....OFF P2

FORWARD CARGO AIR CONDITIONING CONTROL.....OFF P2

Note: Set the control to OFF to minimise the risk of FCAC failure during ground operations.

FUEL PUMP switchesOFF P2

BEACON light switchOFF P2

FLIGHT DIRECTOR switches.....OFF P2

Transponder mode selectorSTANDBY/2000 P2

Local airport regulations may require an alternate code to be selected.

EFB CLOSE FLIGHT Select Both

HUD CombinerStow Both

Note: To prevent the possibility of injury, ensure the combiner is fully raised and securely latched in the stowed position.

Status messages.....Check P2

Note: Disregard EICAS alert and status messages displayed during the PFC self test after hydraulic shutdown. Wait approximately 3 minutes after HYD PRESS SYS L+C+R message is shown before recording status and alert messages in the maintenance log.

APU selector	As needed	P2
Call “SHUTDOWN CHECKLIST”		P1
Do the SHUTDOWN checklist		P2

Secure Procedure

IRS selectors.....	OFF	P2
BATTERY switch.....	OFF	P2
EMERGENCY LIGHTS switch.....	OFF	P2
PACK switches.....	OFF	P2
RECIRC FAN LOWER	___	P2

At LHR, or where PCA is available downroute, set the Lower Recirc Fan off.

EFB PWR switch.....	OFF	Both
FWD EXT PWR.....	ON	P2

Verify that the FWD EXT PWR L AVAIL light is illuminated.

FWD EXT PWR L switch Push

Verify that the ON light is illuminated.

If the FWD EXT PWR R AVAIL light is illuminated:

FWD EXT PWR R switch..... Push

Verify that the ON light is illuminated.

APU selector.....	___	P2
-------------------	-----	----

Switch the APU off if both FWD EXT PWR are ON.

CAUTION: The Power Electronics Cooling System (PECS) requires a cool-down period to prevent damaging the units and degrading the coolant. A wait of up to 22 minutes may be required before removing power. (Refer to Electrical Power Down in Chapter 3 for additional information.)

Do the SECURE checklist.

3 Supplementary Procedures

Introduction

General

This chapter contains procedures (adverse weather operation, engine crossbleed start, and so on) accomplished as required rather than routinely performed on each flight. Systems tests are described in the System Description chapter of the applicable system.

Note: System tests are not normally a flight crew action.

Procedures accomplished in flight, or those that are an alternate means of accomplishing normal procedures (such as manual engine start), are usually accomplished by recall. Infrequently used procedures, not normally accomplished (such as engine crossbleed start) are usually accomplished by reference.

Supplementary procedures are provided by section.

Airplane General, Emergency Equipment, Doors, Windows**Aft CG Takeoff**

Airplane operations with an aft CG configuration require additional considerations to accommodate the effects of reduced nose gear steering effectiveness. The procedures in this section supplement the normal procedures and should be observed when applicable.

The combination of aft CG, rapid thrust application, and sudden brake release can result in reduced directional control during the initial takeoff phase. Crosswinds and runway contamination can cause further reduction of directional control. If the value of CG (%MAC) is at or greater (more aft) than the value in the table below, the following procedures must be applied to ensure directional control during takeoff roll:

G-ZBJA – G-ZBJM

787-8	Gross Weight (1000 KG)							
	108	120	140	160	180	200	220	240 or greater
CG (%MAC)	25.3	27.2	30.5	33.6	36.0	37.5	37.5	37.5

G-ZBKA – G-ZBKS

787-9	Gross Weight (1000 KG)							
	108	120	140	160	180	200	220	240 or greater
CG (%MAC)	23.1	24.7	27.4	29.8	32.1	34.4	36.8	37.5

- Use reduced thrust wherever possible
- Release brakes before increasing engine thrust above idle

CAUTION: If a static engine run-up is needed before brake release, do not exceed 55% N1. Do not release the brakes with N1 greater than 55%. A tip-up can occur and directional control can be reduced.

- Crosswind capability may be reduced if brakes are released above 20 TPR. (Crosswind limits are determined by the operator. If the operator uses Boeing takeoff crosswind guidelines as limits, reduce crosswind limits by 5 knots when brakes are released above 20 TPR).
- Maintain forward pressure on the control column until 80 knots to increase nose wheel steering effectiveness. Above 80 knots, relax the column pressure to the neutral position.

Air Systems

Ground Conditioned Air Use

Before connecting ground conditioned air:

PACK switches (both) - OFF

Packs can be damaged if they are operated while ground conditioned air is connected.

LOWER RECIRC FAN switch - OFF

Allows conditioned air unit to operate at maximum efficiency.

After disconnecting ground conditioned air:

PACK switches (both) - AUTO

LOWER RECIRC FAN switch – ON

Automatic Pressurization Control - Departure Airport Elevation At or Above 8,000 Feet

Note: The HIGH CABIN ALT MODE memo message shows when the departure elevation is at or above 9,650feet. When this memo is shown, the CABIN ALTITUDE warning limit is raised to as high as 15,600feet (depending on the departure airport elevation).

If departure elevation is above 10,000feet or the HIGH CABIN ALT MODE memo message shows:

Oxygen mask and regulator.....ON, Normal

Note: Supplemental oxygen must be used from departure until the cabin altitude is below 10,000 feet and the HIGH CABIN ALT MODE memo message blanks

Crew communications.....Establish

Once the airplane is airborne, the pressurization system starts lowering the cabin altitude according to the normal pressurization schedule.

Monitor cabin altitude and cabin rate indications during climbout to confirm that the cabin is pressurizing as described above. The EICAS cabin altitude information can be displayed by selecting the AIR synoptic on any MFD.

After the cabin altitude descends below 9,650 feet, the pressurization system automatically changes the CABIN ALTITUDE warning limit to the normal setpoint of 10,000 feet.

Automatic Pressurization Control - Landing Airport Elevation At or Above 8,000 Feet

Note: The HIGH CABIN ALT MODE memo message shows at top of descent when the landing airport elevation is at or above 9,650 feet. When this memo shows, the CABIN ALTITUDE warning limit is raised to as high as 15,600 feet (depending on the landing airport elevation).

Accomplish normal procedures except as modified below:

At top of descent:

If landing elevation is above 10,000 feet or the HIGH CABIN ALT MODE memo message shows:

Oxygen masks and regulators.....ON, Normal

Note: Supplemental oxygen must be used anytime the cabin altitude is above 10,000 feet or the HIGH CABIN ALT MODE memo message shows.

Crew communications.....Establish

Monitor cabin altitude and cabin rate indications during descent to confirm cabin altitude is climbing above 6,000 feet to match the landing airport elevation. The EICAS cabin altitude information can be displayed by selecting the AIR synoptic on any MFD.

Automatic Flight

AFDS

AFDS Operation

FLIGHT DIRECTOR switchesON
 Verify FLT DIR is displayed in the AFDS system status annunciator.

If autopilot desired:

AUTOPILOT engage switchPush
 Verify A/P is displayed in the AFDS system status annunciator.

Heading Hold

If the airplane is operating in polar regions:

HEADING REFERENCE switch..... TRUE

Verify HDG is displayed in the HDG/TRK window.

Heading/track HOLD switchPush
 Verify HDG HOLD is displayed in the roll mode annunciator.

Heading Select

Maintains the airplane heading the same as the selected heading.

If the airplane is operating in polar regions:

HEADING REFERENCE switch..... TRUE

HEADING/TRACK reference switchPush

Verify HDG is displayed in the HDG/TRK window.

Heading/track SELECT switchPush
 Verify HDG SEL is displayed in the roll mode annunciator.

Heading/track selector Rotate
 Set desired heading in HDG/TRK window.

Track Hold

If the airplane is operating in polar regions:

HEADING REFERENCE switch..... TRUE

Verify TRK is displayed in the HDG/TRK window.

Heading/track HOLD switchPush
 Verify TRK HOLD is displayed in the roll mode annunciator.

Track Select

Maintains the airplane track the same as the selected track.

If the airplane is operating in polar regions:

HEADING REFERENCE switch..... TRUE

HEADING/TRACK reference switch.....Push

Verify TRK is displayed in the HDG/TRK window.

Heading/track SELECT switchPush

Verify TRK SEL is displayed in the roll mode annunciator.

Heading/track selector..... Rotate

Set desired heading in HDG/TRK window.

Altitude Hold

ALTITUDE HOLD switch.....Push

Verify ALT is displayed in the pitch mode annunciator.

Flight Level Change, Climb or Descent

ALTITUDE selector..... Rotate

Set desired altitude in the MCP ALTITUDE window.

FLCH switchPush

Verify FLCH SPD is displayed in the pitch mode annunciator.

IAS/MACH selector..... Rotate

Set desired speed in IAS/MACH window.

Vertical Speed, Climb or Descent

ALTITUDE selector..... Rotate

Set desired altitude in the MCP ALTITUDE window.

VERTICAL SPEED/FLIGHT PATH ANGLE reference switch..... Push

Verify V/S is displayed in the vertical speed/flight path angle window.

VERTICAL SPEED/FLIGHT PATH ANGLE switch..... Push

Verify V/S is displayed in the pitch mode annunciator.

VERTICAL SPEED/FLIGHT PATH ANGLE selector..... Rotate

Set desired vertical speed in the VERTICAL SPEED/FLIGHT PATH ANGLE window.

If climb desired:

Select climb thrust limit on CDU THRUST LIM page.

Flight Path Angle, Climb or Descent

ALTITUDE selector.....	Rotate
Set desired altitude in the MCP ALTITUDE window.	
VERTICAL SPEED/FLIGHT PATH ANGLE reference switch.....	Push
Verify FPA is displayed in the vertical speed/flight path angle window.	
VERTICAL SPEED/FLIGHT PATH ANGLE switch.....	Push
Verify FPA is displayed in the pitch mode annunciator.	
VERTICAL SPEED/FLIGHT PATH ANGLE selector.....	Rotate
Set desired flight path angle in the VERTICAL SPEED/FLIGHT PATH ANGLE window.	

If climb desired:

Select climb thrust limit on CDU THRUST LIM page.

Autothrottle Operation

AUTOTHROTTLE ARM switches..... ARM

If pitch mode TO/GA:

TO/GA switch.....Push
Verify THR REF is displayed in the autothrottle mode annunciator. THR REF changes to HOLD at 80 knots.

If pitch mode ALT, V/S, FPA, G/S, G/P, or no pitch mode:

AUTOTHROTTLE engage switch.....Push

Verify that SPD is displayed in the autothrottle mode annunciator.

If a constant speed is desired:

IAS/MACH selector Rotate
Set desired speed in IAS/MACH window.

If climb or continuous thrust is desired:

CLB CON switch.....Push
Verify that THR REF is displayed in the autothrottle mode annunciator

If FLCH or VNAV is desired:

FLCH or VNAV switch.....Push
Verify that THR REF, THR, SPD, IDLE, or HOLD as appropriate is displayed in the autothrottle mode annunciator. **If VNAV desired:**

If TO/GA is desired:

TO/GA switch.....Push

The pitch mode changes to TO/GA. Verify that THR or THR REF is displayed in the autothrottle mode annunciator.

If pitch mode is VNAV PTH, VNAV ALT, VNAV SPD, or FLCH SPD:

AUTOTHROTTLE engage switch.....Push

Verify THR REF, THR, SPD, IDLE, or HOLD as appropriate is displayed in the autothrottle mode annunciator.

Instrument Approach Using Vertical Speed (V/S) or Flight Path Angle (FPA)

Pilot Flying	Pilot Monitoring
Initially: <ul style="list-style-type: none"> • If on radar vectors <ul style="list-style-type: none"> ○ HDG SEL ○ Pitch mode (as needed) • If enroute to a fix <ul style="list-style-type: none"> ○ LNAV or other roll mode ○ VNAV or other pitch mode 	
	Verify that the cabin is secure
Call "FLAPS__" according to the flap extension schedule.	Set the flap lever as directed.

Recommended roll modes:

- RNAV, GPS, B/CRS, VOR or NDB approach: LNAV, TRK SEL, or HDG SEL
- B/CRS approach: LNAV, B/CRS, TRK SEL, or HDG SEL. B/CRS roll mode is only available for approaches in the FMC database.
- LOC, SDF, or LDA approach: LOC or LNAV

Note: When using LNAV to intercept a localizer, LNAV might parallel the localizer without capturing it. Use HDG SEL/TRK SEL or HDG HOLD/TRK HOLD to intercept the final approach course, if needed.

Ensure appropriate nav aids (VOR, LOC, or NDB) are tuned and identified before commencing the approach.

Use LNAV or other roll mode to intercept the final approach course, as needed.	
Approximately 2 NM before the final approach fix, set the first intermediate altitude constraint or MDA(H). If constraints or MDA(H) do not end in zero zero (00) for example, 1820, set the MCP ALTITUDE window to the closest 100 foot increment below the constraint or the closest 10 foot increment above the MDA(H). When the current constraint is assured, set the next constraint before ALT is engaged to achieve a continuous descent path.	Approximately 2 NM before the final approach fix, call "APPROACHING GLIDE PATH."
Call: <ul style="list-style-type: none"> • "GEAR DOWN" • "FLAPS 20" 	Set the landing gear lever to DN. Set the flap lever to 20.
Set the speedbrake lever to ARMED	
At descent point, call "FLAPS__" as needed for landing.	Set the flap lever as directed.

V/S or FPA switch.....Push

Verify V/S or FPA mode annunciates.

Desired V/S or FPA.....Set

Set desired V/S or FPA to descend to MDA(H). Use a V/S or FPA that results in no level flight segment at MDA(H).

Call "LANDING CHECKLIST"	Do the LANDING checklist.
--------------------------	---------------------------

When at least 300 feet below the missed approach altitude:

MCP altitude.....Set Missed Approach Altitude

At MDA(H)/missed approach point:

If suitable visual reference is not established, execute missed approach.

After suitable visual reference is established:

Disengage the autopilot in accordance with regulatory requirements.

Circling Approach

CAUTION: If using ILS/GLS or IAN, do not use APP or the AFDS will not capture Circling Altitude.

If a missed approach is needed at any time while circling, make an initial climbing turn toward the landing runway and intercept the missed approach course.

Configuration at MDA(H):

Gear down

Flaps 20 (landing flaps optional)

Speedbrake armed

MCP Altitude selector.....Set

Accomplish an instrument approach, establish suitable visual reference, and level off at MDA(H).

Verify ALT or VNAV ALT mode annunciates.

Select ALT HOLD as needed.

MCP Altitude selector.....Set Missed Approach Altitude

HDG SEL/HDG HOLD or TRK SEL/TRK HOLD switch.....Push

Verify HDG SEL/HDG HOLD or TRK SEL/TRK HOLD mode annunciates.

Before starting the turn to base:

- Landing flaps (if not previously selected)
- Do the LANDING checklist

Intercepting the landing profile:

Autopilot disengage switch.....Push

Instrument Approach - RNAV (RNP) AR

Note: This procedure is not authorized using QFE.

The procedure below supplements normal Preflight, Cruise, Descent and Approach Procedures and replaces the Landing Procedure.

Preflight Procedure

Review RNP availability predictions.

Pre-approach Requirements

Airplane equipment required to begin the approach:

- 2 A/Ps or 2 F/Ds (SINGLE SOURCE F/D alert not shown)
- 2 PFD/MFD Displays (PFD mini-map may be used)
- Verify the following EICAS alerts are not shown:
- FMC VERIFY POSITION
- GND PROX SYS
- NAV AIR DATA SYS
- NAV INERTIAL SYS
- NAV IRU
- NAV SINGLE GPS
- NAV UNABLE RNP
- SGL SOURCE RAD ALT
- SINGLE FMC
- TERR POS

Note: Go-around/missed approach is required if the NAV UNABLE RNP or FMC VERIFY POSITION alert is displayed unless suitable visual reference is established and maintained.

Do the following prior to starting the approach:

- verify that the approach RNP is equal to or greater than 0.10 (F/D or A/P)
- verify that the winds are within limits published for the approach (if applicable)
- verify that the reported airport temperature is within published limits for the approach
- review the maximum IAS for each segment of the approach as determined by aircraft category and applicable regulatory airspeed requirements
- set current local altimeter (remote altimeter settings not allowed)

Cruise Procedure

Pilot Flying	Pilot Monitoring
	<p>When selecting the approach from the navigation database verify ACT RTE LEGS page matches the charted approach.</p> <p>If there is an “at or above” altitude restriction before the FAF, it may be changed to an “at” altitude restriction using the same altitude. Speed modifications are allowed as long as the maximum published speed is not exceeded.</p>

Descent Procedure

Pilot Flying	Pilot Monitoring
<p>In the approach briefing include speed and altitude restrictions, missed approach, engine failure, and unable RNP procedures.</p>	<p>Select or verify VOR/DME NAV OFF on POS REF page 3.</p> <p>Inhibit other nav aids as needed per NOTAM.</p>

Approach Procedure

Complete the Approach Procedure before the initial approach fix, or the start of radar vectors to the final approach course.

Note: When receiving radar vectors from ATC, intercept course modifications may be used to join the LNAV path at any point on initial, intermediate, or missed approach segments.

Note: Direct to modifications are not permitted when:

- the fix is the beginning of an RF leg
- the fix is the Final Approach Fix (FAF) for the procedure

Pilot Flying	Pilot Monitoring
	<p>On the RNP PROGRESS page verify RNP for the approach.</p>
<p>Select VSD on.</p>	

Note: The vertical RNP is set to 125 feet by default. While there are no vertical RNP values published on the approach chart, the use of 125 feet will cause the NPS amber deviation exceedance alert to occur at 75 feet or slightly less deviation, since vertical ANP will be at least 50 feet at all times.

Landing Procedure

Pilot Flying	Pilot Monitoring
Initially: <ul style="list-style-type: none"> If on radar vectors <ul style="list-style-type: none"> HDG SEL Pitch mode (as needed) If enroute to a fix <ul style="list-style-type: none"> LNAV or other roll mode VNAV or other pitch mode 	
	Notify the cabin crew to prepare for landing. Verify that the cabin is secure.
Select TERR on map. Select ACT RTE LEGS page.	Select TERR or WXR on map.
Use LNAV and VNAV or other pitch mode for initial descent. VNAV is required FAF inbound. Some approach procedures can require use of VNAV from the IAF onward. On intercept heading, arm or verify LNAV.	
Call “FLAPS___” according to the flap extension schedule.	Set the flap lever as directed.
Approximately 2 NM before the final approach fix and after ALT or VNAV PTH or VNAV ALT is annunciated: <ul style="list-style-type: none"> set DA(H) on the MCP select or verify VNAV select or verify speed intervention 	Call “APPROACHING GLIDE PATH.”
Maximum Lateral Deviation (XTK ERROR): NPS amber indication or 1 x RNP. Maximum Vertical Deviation - FAF to DA: 75 feet. Monitor NPS.	
Approaching glide path, call: <ul style="list-style-type: none"> “GEAR DOWN” “FLAPS 20” 	Set the landing gear lever to DN. Set the flap lever to 20.
Set the SPEEDBRAKE lever to ARM	
Beginning the final approach descent, call “FLAPS ___” as needed for landing.	Set the flap lever as directed.
Call “LANDING CHECKLIST	Do the LANDING checklist.
When at least 300 feet below the missed approach altitude, set the missed approach altitude on the MCP.	
Monitor the approach.	
If suitable visual reference is established at DA(H), disengage the autopilot in accordance with regulatory requirements. Maintain the glide path to landing.	

Alternate Go-Around and Missed Approach Procedure

This procedure provides steps to use flaps 5 as an alternate flap setting during a go-around from a flaps 25 approach only.

Note: This procedure is not authorized from a flaps 30 approach.

Note: If a landing at greater than maximum landing weight is needed, do the Overweight Landing checklist and use flap settings from that checklist.

Do the normal Go-Around and Missed Approach Procedure with the following modifications:

Pilot Flying	Pilot Monitoring
At the same time: <ul style="list-style-type: none"> • Push the TO/GA switch • Call "FLAPS 5" 	
	Position the FLAP lever to 5.
Above 400 feet radio altitude, select or verify a roll mode.	Verify that the missed approach altitude is set. Verify flaps 5.

Landing Procedure – ILS PRM and SOIA

The ILS PRM Instrument Approach Procedure below supplements Normal Cruise, Descent and Approach Procedures and replaces the complete Go-Around and Missed Approach Procedure. Additional information is given for the Landing Procedure.

Pre-Approach Requirements

Confirm both pilots qualified	PF, PM
Brief the PRM Breakout Maneuver and Approach-specific requirements	P1
Radio requirements	
Manually flown PRM Breakout	
MCP selections and Autopilot re-engagement	
Workload Management	
Audio Control PanelSet	PF, PM
Set VHF L to Transmit and Receive	
Set VHF R to Receive only, and monitor throughout the procedure	
Adjust VHF R volume as needed	
Tuning Control Panel	PM
Set VHF R STBY to Approach Monitor frequency	

Landing Procedure

It is recommended that the ILS portion of the procedure be flown using autopilot.

Complete a normal ILS Landing Procedure with the following additions:

Tuning Control PanelSet	PM
Set VHF L ACTIVE to Tower frequency as directed, then XFR Approach Monitor frequency to VHF R from STBY to ACTIVE	

Simultaneous Offset Instrument Approaches (SOIA)

Refer to airport chart for specific approach instructions:

- Use the ILS-PRM Landing Procedures
- Use the autopilot until LDA Missed Approach Point
- Disconnect autopilot during visual maneuvering
- Use the PRM Breakout Maneuver if needed

Go Around and Missed Approach Procedure – PRM Breakout

ATC may transmit Breakout instructions on either Tower or Approach Monitor frequency. Breakout instructions will include one of the following instructions:

- Turn and climb
- Turn and maintain altitude
- Turn and descend

Pilot Flying	Pilot Monitoring
PRM Breakout is required.	
At the same time: <ul style="list-style-type: none"> • Disconnect the autopilot • Manoeuvre to PRM Breakout heading and vertical profile 	Switch off Flight Directors <ul style="list-style-type: none"> • Make MCP selections to follow PRM manoeuvre.
<ul style="list-style-type: none"> • For climbing breakout use a maximum of 5 degrees HUD climb angle (or 10 degrees PFD pitch angle) • For descending breakout maintain previous descent rate 	
	Switch Flight Directors on once breakout trajectory is established.
Verify autothrottle is controlling speed appropriately.	
	Select a pitch and roll mode as directed by PF
Engage autopilot if required.	
Set speed to the manoeuvre speed for the planned flap setting.	
Call “FLAPS__” according to the flap retraction schedule.	Set the flap lever as directed.
Verify flap setting is 20 or less.	Set the landing gear lever to UP.
Call “GEAR UP”.	
Call “AFTER TAKEOFF CHECKLIST”	Do the AFTER TAKEOFF checklist.

CAUTION: In the event of a TCAS RA with simultaneous Breakout instruction:

- **Continue the turn as instructed**
- **Follow the vertical guidance for the RA**

Note: A descending breakout will be given when there is no other reasonable option. Descent will not be below the Minimum Vectoring Altitude.

Note: Autothrottle will provide speed control with Flight Directors off.

Communications

Flight Deck Communications System (Datalink)

The following procedures are one means which may be used to verify Pre-Departure Clearance, Digital-Automatic Terminal Information Service (D-ATIS), Oceanic Clearances, Weight and Balance and Takeoff Data messages transmitted via the COMPANY format.

Pre-Departure Clearance

The flight crew shall manually verify (compare) the filed flight plan versus the digital pre-departure clearance and shall initiate voice contact with Air Traffic Control if any question/confusion exists between the filed flight plan and the digital pre-departure clearance.

Ensure that the ATC Callsign is entered on this page. Use of the incorrect callsign will cause the ATC request to be rejected.

Digital-Automatic Terminal Information Service

The flight crew shall verify that the D-ATIS altimeter setting numeric value and alpha value are identical. If the D-ATIS altimeter setting numeric value and alpha value are different, or the alpha value is not present, the flight crew must verify the altimeter setting by other means.

Oceanic Clearances

The flight crew shall manually verify (compare) the filed flight plan versus the digital oceanic clearance and initiate voice contact with Air Traffic Control if any questions/confusion exists between the filed flight plan and the digital oceanic clearance.

Weight and Balance

The flight crew shall verify that the Weight and Balance numeric and alphabetic values are identical. If the Weight and Balance numeric and alphabetic values are different, the flight crew must not accept the Weight and Balance data.

Takeoff Data

The flight crew shall verify that the Takeoff Data numeric and alphabetic values are identical. If the Takeoff Data numeric and alphabetic values are different, the flight crew must not accept the Takeoff Data message.

Initialisation

Ensure initialisation page fields are completed before the PREFLIGHT checklist is accomplished. FLT NO will only show the commercial flight identifier (flight number), not the ATC Callsign.

Ensure that RTE page 1 contains ATC Callsign information.

Defect Reporting

Defects should be reported by FREE TEXT message as soon as crew workload permits.

Diversion

If a diversion is necessary and workload allows, enter the diversion station and an approximate ETA and SEND after the decision to divert is made.

Note: Notification of diversion must **also** be sent via BAV Merlin as soon as possible prior to landing. Failure to use the BAV Merlin 'Declare Divert' function will result in an inability to stop Merlin after landing at the diversion airfield and the flight may be lost.

Electrical**Electrical Power Up**

The following procedure is accomplished to permit safe application of electrical power.

BATTERY switch	ON
C1 and C2 ELEC pump selectors	OFF
DEMAND pump selectors	OFF
WIPER selectors	OFF
Landing gear lever	DN
ALTN FLAPS selector	OFF
Electrical power	Establish

If external power desired:

EXT PWR AVAIL light(s)	Illuminated
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EXT PWR switch(es).....	Push
-------------------------	------

If APU power desired:

APU GENERATOR switches	ON
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Note: Prior to APU start, wait 15 seconds after the left CCR is online (left CCR online is indicated by the captain's inboard and lower display unit showing the default formats).

APU selector	START, then ON
--------------------	----------------

Position APU selector back to ON position. Do not allow APU selector to spring back to ON position.

Note: The MAIN BATTERY LOW message can show when power is established. The main battery is charging, and when the battery charge is sufficient for takeoff, the message blanks.

Electrical Power Down

The following procedure is accomplished to remove all electrical power from the aircraft.

IRS selectors OFF

BATTERY switch OFF

EMER LIGHTS switch OFF

PACK switches OFF

Verify HYD PRESS SYS L+C+R message is displayed.

CAUTION: The APU or external power must remain ON for the specified cool-down period following pack and hydraulic EMP shutdown. The cool-down period allows the Power Electronics Cooling System (PECS) to remain powered, dissipating residual heat from the liquid-cooled LRUs. With the APU providing power, or with both forward external power receptacles connected and switches selected ON, wait 10 minutes before removing power. With one forward external power receptacle connected and switch selected ON, wait 22 minutes before removing external power.

APU selector OFF

EXTERNAL POWER switches OFF

Verify that all external power AVAIL lights are extinguished.

External power sources Removed

Engines, APU

Ground Power Engine Start

Note: This SP is also available in ECL, Non-Normal, Unannounced, Supp/Ops Info.

This procedure assumes the APU is not available for engine start. Engine starts from ground power require the forward left and right external power sources to be providing power. The aft external power source may also be used, if available. This reduces electrical load shedding during the start of the right engine. Every effort should be made to obtain a third external power source.

Note: During ground power starts, expect significant equipment reconfigurations and electrical load shedding while the first engine is starting. This includes F/O displays, EFB, right CCR, MCP, and numerous cabin loads. Audio control panel receive and transmit selections may be lost. Reselect if needed after the first engine is running.

If three external power sources are used, start the right engine first to reduce load shedding.

Note: Attempting ground power start with cabin temperatures above 46° C may be unsuccessful due to PECS overheat during start.

External power sources.....Connect

Select FWD EXT PWR L and FWD EXT PWR R switches ON.

Select AFT EXT PWR switch ON, if available.

Note: Advise the cabin to expect the loss of some cabin functions during engine start.

Start the first engine.

After the first engine start is complete:

External power sourcesDisconnect

Verify that all external power AVAIL lights are illuminated.

Disconnect external power sources.

Use normal procedures to start the remaining engine.

Flight Instruments, Displays

Heading Reference Switch Operation

Use TRUE when operating in a region where true referencing is needed.

Use NORM in all other regions.

HEADING REF switch.....NORM or TRUE

Note: If the HEADING REF switch position is changed for a HUD takeoff, change it before the HUD TAKEOFF runway is selected.

Note: If the HEADING REF switch position is changed after the HUD TAKEOFF runway is selected:

- Heading on the ISFD will not change when the HEADING REF switch position is changed
- HUD TO/GA guidance can be degraded
- Selecting both flight director switches OFF exits the HUD TO/GA mode. This restores normal operation of the HEADING REF switch and the AFDS. The flight directors may be selected ON to restore the HUD TO/GA mode.

Note: If using HDG SEL or TRK SEL, and the HEADING REF switch position is changed, the AFDS roll mode will change to HDG HOLD or TRK HOLD, respectively. HDG SEL or TRK SEL may be reselected.

Note: If the HEADING REF switch position is changed for an approach, change it before the APP mode is armed.

Note: If the HEADING REF switch position is changed after the APP mode is armed:

- The AFDS roll mode will not change from HDG SEL or TRK SEL to HDG HOLD or TRK HOLD respectively
- The AFDS will not follow the MCP-selected heading
- LOC capture, and FAC capture, and tracking performance can be degraded
- Exiting the APP mode restores normal operation of the HEADING REF switch and the AFDS. APP mode may be reselected.

QFE Operation

Most destinations or alternates will provide QNH on request. However, if they are unable, there are two procedures that may be accomplished when ATC altitude assignments are referenced to QFE altimeter settings. The preferred option is the Derived QNH Procedure.

Derived QNH Procedure

The Derived QNH Procedure will be used whenever possible; it allows the use of LNAV, VNAV and IAN. Threshold corrections are shown on AFC, SID, STAR and IAC charts. Always add the hPa correction to QFE to derive QNH altimeter setting.

CAUTION: If ATC issue QFE radar-vectoring heights, add the QNH altitude conversion. This procedure does not require corrections to any procedural QNH altitudes published on charts.

CAUTION: To avoid confusion, do not refer to QNH during the procedure when communicating with ATC.

Note: Do not select QFE on the FMC approach reference page. Confirm that QNH is set as the landing altitude reference:

CDU APPROACH REF page.....Select

Verify QNH selected.

Altimeters.....Set QNH

- Tables are provided in Lido GEN, Legends and Tables, General Information for conversion of mmHG or inHG to hPa.
- Tables showing standard metric levels and Meters QFE to Feet QNH conversions are shown on the appropriate charts.
- It is recommended that metric altimeter be switched off below transition to avoid confusion.

FMC QFE Procedure

Note: All options for obtaining a QNH from ATC or using the Derived QNH Procedure above should be exhausted before using this procedure. Do not use IAN, LNAV and/or VNAV below transition altitude/level. Altitudes in the navigation database are not referenced to QFE. Use only raw data for navigation.

CDU APPROACH REF pageSelect

LANDING REF key.....Push

Verify QFE selected.

This sets the landing altitude to zero.

AltimetersSet QFE

Set primary altimeters to QFE when below transition altitude/level.

The QNH shall be set on the standby altimeter throughout QFE operations.

The QFE QNH difference shall be checked against data provided on the terminal charts.

If the QFE altimeter setting is beyond the range of the altimeters, QNH procedures must be used with QNH set in the altimeters.

Flight Management, Navigation**Alignment/Position Update**

If a position update is desired during an automatic realignment (on ground only):

CDUSET

When dash prompts appear on the SET INERTIAL POS line of the POS INIT page, enter the most accurate position. Entry may be accomplished by selecting latitude/longitude from LAST POS, REF AIRPORT, GATE, GPS POS, or making a manual entry.

If a manual alignment is desired (on ground only):

IRS selectors.....OFF 30 seconds, then ON

Wait an additional 30 seconds.

CDUSET

Enter the present position on the SET INERTIAL POS line, if needed.

If box prompts appear on the SET INERTIAL POS line, the most accurate latitude and longitude must be entered.

Alignment requires from six to fifteen minutes depending on latitude (six minutes at the equator, ten minutes average).

Departure or Destination Airport not in the FMC Navigation Database

When departing from or landing at an airport that is not in the FMC navigation database, the following items are affected:

- Cabin pressurization schedule
- Availability of departure, arrival, and approach procedures in the FMC
- Automatic tuning of VOR, DME, and ILS radios for departure, arrival, and approach procedures
- Format of altitudes and flight levels on the ND and CDU
- Barometric transition altitude alerts (amber display and box) on the PFD
- Landing altitude reference bar (white/amber bar) on the PFD altitude tape
- Landing altitude indication (amber crosshatched area) on the PFD altitude tape

Use the following procedures when departing from or landing at an airport that is not in the FMC navigation database.

Departure Airport Not in the FMC Navigation Database

CDU/EFB Preflight Procedure – Captain and First Officer

RTE key Select

If ORIGIN contains an ICAO identifier:

The following steps clear the ORIGIN and erase the previous route:

INIT REF key Select

INDEX Select

IDENT Select

Inactive date range Select

ACTIVE date range Select

Transfers the inactive navigation database to the ACTIVE line and removes the previously entered route.

Clear the NAV DATA OUT OF DATE scratchpad message.

Inactive date range Select

ACTIVE date range Select

Transfers the inactive navigation database to the ACTIVE line.

Verify the ACTIVE date range is current.

RTE key Select

Leave ORIGIN blank.

DEST Enter

Route..... Enter

LEGS key..... Select

Enter the latitude and longitude of the departure airport as the first waypoint on the route.

ACTIVE and execute the route.

VNAV key Select

Shows the CLB page

TRANS ALT..... Enter

NAV RAD key..... Select

Departure navaid frequency and CRS (as needed) Enter

LDG ALT selector Pull

Rotate to set the departure airport altitude manually. This reduces crew workload in the event of a return to the departure airport

Do **not** accomplish the following checklist:

LANDING ALTITUDE

After engine start, cancel the LANDING ALTITUDE message.

Note: The LDG ALT flag is shown on the PFD.

Note: The landing altitude reference bar (white/amber bar) is not shown on the PFD altitude tape.

Note: The landing altitude indication (amber crosshatched area) is not shown on the PFD altitude tape.

When no longer needed, delete the departure navaid frequency and CRS.

Before Descent

LDG ALT selector..... Push

The FMC sets the destination altitude automatically.

VNAV key..... Select

NEXT PAGE key Select

FORECAST..... Select

Displays the DESCENT FORECAST page

TRANS LVL Enter

Overwrites the manually entered departure airport transition altitude.

Destination Airport Not in the FMC Navigation Database
CDU/EFB Preflight Procedure – Captain and First Officer

The following steps can also be done in flight:

LEGS key Select

Enter the latitude and longitude of the destination airport as the final waypoint on the route.

Enter a speed/altitude constraint for the final waypoint. The speed constraint should be the planned approach speed and the altitude constraint should be the destination airport elevation.

ACTIVATE (if needed) and execute the route.

Before Descent

VNAV key Select

NEXT PAGE key Select

FORECAST Select

Displays the DESCENT FORECAST page

TRANS LVL Enter

LDG ALT selector Pull

Rotate to set the destination airport altitude manually

Do **not** accomplish the following checklist:

LANDING ALTITUDE

Override the LANDING ALTITUDE checklist.

Note: The LDG ALT flag is shown on the PFD.

Note: The landing altitude reference bar (white/amber bar) is not shown on the PFD altitude tape during approach.

Note: The landing altitude indication (amber crosshatched area) is not shown on the PFD altitude tape during landing.

Note: The ARRIVALS page is not available for the destination airport.

Before Approach

NAV RAD key Select

Destination navaid frequency and CRS (as needed) Enter

Note: To create a reference on the ND map, on the FIX INFO page, enter the latitude and longitude of the runway threshold and enter the reciprocal of the final approach course as a bearing. This creates a dashed green line, aligned with the final approach course on the ND map.

FMS Position Update

When the message FMC VERIFY POSITION shows, the FMC position may require updating.

INIT REF key.....Select

POS.....Select

POS REF page.....Select

POS REF is the second page of POS INIT.

Compare the FMS positions with the displayed GPS, RADIO, and INERTIAL positions.

Select the most appropriate source for FMC position updating.

ARM.....Select

The ARM prompt changes to ARMED and NOW prompts appear to the right of the remaining position sources.

Appropriate source NOW.....Select

Navaid Inhibit

INIT REF key Select

INDEX key Select

POS Select

POS REF page Select

POS REF is the third page of POS INIT.

To inhibit GPS updating:

Note: For terminal operations, if the airspace, FMC database, and charts are not referenced to the WGS-84 datum, inhibit GPS updates unless other appropriate procedures are used.

GPS NAV Select
Verify GPS NAV OFF selected.

To inhibit DME/DME updating:

DME/DME..... Select

Verify DME/DME OFF selected.

To inhibit VOR/DME updates:

VOR/DME Select
Verify VOR/DME OFF selected

To inhibit localizer updating:

LOC NAV Select
Verify LOC NAV OFF selected

To inhibit data from a specific navaid:

INIT REF key Select

INDEX key Select

NAV DATA Select

Using scratchpad, enter identifiers of specific nav aids or VORs to be inhibited on the
NAVAID INHIBIT or VOR ONLY INHIBIT lines.

RNP Manual Entry

The FMC automatically supplies appropriate RNP values based on phase of flight. When the airplane is on a procedure or airway that has an RNP requirement, and does not have an RNP value stored in the navigation database, a manual RNP entry may be made.

PROG key.....Select

RNP PROGRESS page.....Select

RNP PROGRESS is the fourth page of PROGRESS.

If the displayed RNP is different from the RNP for the current airway or procedure:

RNP.....Enter

When the manually entered RNP is no longer required:

PROG keySelect

RNP PROGRESS pageSelect

RNP PROGRESS is the fourth page of PROGRESS.

RNP.....Delete

MNPS Route Checking and Waypoint Crossing Procedure

The following procedure must be completed in full when a clearance or re-clearance is received for MNPS or Oceanic airspace.

CAUTION: ATC Clearances must be entered into the FMC and checked rigorously, to avoid Gross Navigational Errors:

- **Named alphabetic waypoints that are in the database (eg. NEDUL) may be checked/entered directly in the FMC LEGS page.**
- **Unnamed waypoints (eg. N48W030) must be checked using full lat/long by expanding into the scratchpad where possible.**
- **Unnamed waypoints which cannot be expanded into the scratchpad (eg. 4830N) must be checked using full lat/long with the NAV DATA function.**

CAUTION: Erroneous waypoint entry is a significant cause of GNEs. Use all available resources (CIRRUS, Lido, SFC) to ensure accurate translation of ATC voice or free text (eg ACARS Oceanic Clearance) clearances into FMS waypoints.

CAUTION: The ND truncates waypoint names, so must not be used for checking.

Note: Unnamed MNPS waypoint checking requirements:

- Unnamed waypoints uplinked via CPDLC – Crew do not have to expand and check unnamed waypoints due to downlink and check by the ATC system. See below.
- Unnamed waypoints uplinked via ACARS – PM does not have to expand and check unnamed waypoints; PF must expand and check all unnamed waypoints
- Unnamed waypoints entered manually – Both PF & PM must expand and check all unnamed waypoints

Note: ATC Oceanic Clearances uplinked via CPDLC have greater data integrity than those received using ACARS or voice and therefore should be accepted into the FMC. The subsequent automatic downlink to ATC closes the loop and confirms the clearance; there is therefore no requirement to manually check the lat/long of ATC-uplinked waypoints using CPDLC.

However, CPDLC uplinks do not necessarily contain the domestic flight-planned route beyond the MNPS exit point, which should therefore be confirmed and restored as needed.

Note: Following any reroute, uplink revised wind and temperature data.

Pilot Flying	Pilot Monitoring
	<p>Read and Acknowledge text ATC clearance.</p> <p>Accept ATC Uplink clearance.</p>
Listen and transcribe voice ATC clearance	Listen and transcribe voice ATC clearance
	<p>Validate and check clearance against FMC:</p> <ul style="list-style-type: none"> • Entry point • NAT Track, referring to TMI (if applicable) • Exit point • Flight level and Mach number • Check each waypoint (see CAUTIONS & Notes above)
	<p>If needed, modify FMC, then check each waypoint (see CAUTIONS & Notes above)</p> <ul style="list-style-type: none"> • LOAD the FMC and EXECUTE for large ATC Uplinks when possible. • Translate ATC-format to FMC lat/long format with care. The hemisphere (eg N or W) is moved from after the degrees to before the degrees (e.g. 55N030W is inserted as N55W030). • To enter un-named waypoint format (e.g. 5530N) refer to Lido Gen Navigation 8.1.2 for a description of the required format. Exercise extreme caution, entering the letter in the wrong position totally changes the position of the waypoint.
<p>Independently validate and check FMC against clearance:</p> <ul style="list-style-type: none"> • Entry Point. • NAT Track, referring to TMI (if applicable). • Exit point. • Flight Level and Mach Number. • Check each waypoint (see CAUTIONS & Notes above). 	
Starting at first MNPS waypoint, read aloud each MNPS waypoint sequentially from CDU.	Check each waypoint read by PF directly against the clearance.
	Amend Master CIRRUS to reflect cleared route.
Amend Lido Enroute to reflect cleared route.	Amend Lido Enroute/SFC to reflect cleared route.
	Revise ETPs.

Pilot Flying	Pilot Monitoring
Waypoint Crossing Procedure: Confirm: <ul style="list-style-type: none"> • Active waypoint matches clearance • LNAV Roll FMA • Aircraft turns towards next waypoint 	
	Check: <ul style="list-style-type: none"> • ANP against RNP. • Active waypoint matches clearance. • LNAV Roll FMA. • Aircraft turns towards next waypoint. • Record ATA & Fuel on CIRRUS. • Revise ETAs and advise ATC if required.

Fuel**Fuel Balancing**

If a fuel leak is suspected, accomplish the Fuel Leak checklist.

The fuel balance system is inhibited (not available) if any of these occur:

- the fuel balance system is failed
- a center tank pump is on
- on the ground and one or both engines are running
- in flight and the fuel jettison system is active, or the FUEL DISAGREE or FUEL QTY LOW message shows

If fuel balancing is desired while the airplane is on the ground, and both engines are shutdown:

One fuel pump in the higher quantity tank.....ON

FUEL BALANCE switch.....Push and hold for 1 second

The fuel balance system may take up to 30 seconds to activate.

When fuel balance is complete:

FUEL PUMPS AFT and FWD switches (all).....Off

If fuel balancing is desired and fuel balance operation is not inhibited:

FUEL BALANCE switch.....Push and hold for 1 second

The fuel balance system may take up to 30 seconds to activate.

If fuel balancing is desired in flight or on the ground, and fuel balance operation is inhibited with 1 or 2 engines running:

FUEL CROSSFEED switch.....On

If the left main tank quantity is low:

L FUEL PUMPS AFT and FWD switches (both).....Off

This allows fuel from the higher quantity tank to feed both engines.

Do not accomplish the following checklists:

- FUEL PUMP L AFT
- FUEL PUMP L FWD

If the right main tank quantity is low:

R FUEL PUMPS AFT and FWD switches (both).....Off

This allows fuel from the higher quantity tank to feed both engines.

Do not accomplish the following checklists:

- FUEL PUMP R AFT
- FUEL PUMP R FWD

When fuel balancing is complete:

FUEL PUMPS AFT and FWD switches (all).....ON

FUEL CROSSFEED switchOff

Warning Systems

Operations at Airports Not in GPWS Database

When operating to an aerodrome that is not in the GPWS database complete the following steps:

Preflight Procedure – P2

Complete the procedure as normal except:

Tuning and Control Panel GPWS keyPush

GPWS TERR OVRDOVRD

Take-off Procedure – PM

Complete the procedure as normal except, after the flaps are UP:

Tuning and Control Panel GPWS keyPush

GPWS TERR OVRDNORM

Approach Procedure – PM

Complete the procedure as normal except before LOC capture:

Tuning and Control Panel GPWS keyPush

GPWS TERR OVRDOVRD

Adverse Weather

Introduction

Airplane operation in adverse weather conditions may require additional considerations due to effects of extreme temperatures, precipitation, turbulence, and windshear. Procedures in this section supplement normal procedures and should be observed when applicable.

Takeoff – Wet or Contaminated Runway Conditions

The following information applies to takeoffs on wet or contaminated runways:

- For wet runways, reduced thrust (fixed derate, assumed temperature method, or both) is allowed provided suitable takeoff performance accountability is made for the increased stopping distance on a wet surface.
- For runways contaminated by slush, snow, standing water, or ice, reduced thrust (fixed derate) is allowed provided takeoff performance accounts for the runway surface condition. Reduced thrust using assumed temperature method, whether alone or in combination with a fixed derate is not allowed.
- V1 may be reduced to minimum V1 to provide increased stopping margin provided the field length required for a continued takeoff from the minimum V1 and obstacle clearance meet the regulatory requirements. The determination of such minimum V1 may require a real-time performance calculation tool or other performance information supplied by dispatch

G-ZBJA - G-ZBJM

- takeoffs are not recommended when slush or standing water depth is more than .5 inches (13 mm), wet snow depth is more than 1.2 inches (30 mm), or dry snow depth is more than 3.9 inches (100mm).

G-ZBKA - G-ZBKS

- takeoffs are not recommended when slush or standing water depth is more than .6 inches (15 mm), wet snow depth is more than 1.2 inches (30 mm), or dry snow depth is more than 3.9 inches (100 mm).

Cold Weather Operation

Considerations associated with cold weather operation are primarily concerned with low temperatures and with ice, snow, slush, and standing water on the airplane, ramps, taxiways and runways.

Icing conditions exist when OAT (on the ground) or TAT (in flight) is 10°C or below, and any of the following exist:

- visible moisture (clouds, fog with visibility of one statute mile (1600 m) or less, rain, snow, sleet, ice crystals, and so on) is present, or
- ice, snow, slush, or standing water is present on the ramps, taxiways, or runways.

CAUTION: Do not use nacelle anti-ice when OAT (on the ground) is above 10°C. Do not use nacelle or wing anti-ice when TAT (in flight) is above 10°C.

Preliminary Preflight Procedure - P1 or P2

Do the normal Preliminary Preflight Procedure - P1 or P2 with the following modifications:

If taxi-in on the previous flight occurred in visible moisture (fog with visibility of one statute mile (1600 m) or less, rain, snow, sleet, ice crystals, and so on) in icing conditions and the temperature stayed 3°C or below, the taxi-in time from the previous flight in the airplane logbook or other approved document must be included in the total taxi time. If the engine is considered free of ice before engine start, only the taxi-out time should be included in the total taxi time. The engine is considered free of ice before engine start if:

- the engine has been manually de-iced, or
- the engine has been visually inspected per the Aircraft Maintenance Manual (AMM)
- the engine was run up to a minimum of 20 TPR (42% N1) for at least 30 seconds during taxi-in, less than 5 minutes before engine shutdown

Exterior Inspection

Although removal of surface snow, ice and frost is normally a maintenance function, during preflight procedures, the captain or first officer should carefully inspect areas where surface snow, ice or frost could change or affect normal system operations.

Do the normal Exterior Inspection with the following additional steps:

SurfacesCheck

Takeoff with light coatings of frost, up to 1/8 inch (3mm) in thickness, on lower wing surfaces due to cold fuel is allowable; however, all leading edge devices, all control surfaces, and upper wing surfaces must be free of snow, ice and frost. Thin hoarfrost is acceptable on the upper surface of the fuselage provided all vents and ports are clear. Thin hoarfrost is a uniform white deposit of fine crystalline texture, which usually occurs on exposed surfaces on a cold and cloudless night, and which is thin enough to distinguish surface features underneath, such as paint lines, markings or lettering.

Pitot probes and static ports.....Check

Verify that all pitot probes and static ports are free of snow and ice. Water rundown after snow removal may freeze immediately forward of static ports and cause an ice buildup which disturbs airflow over the static ports resulting in erroneous static readings even when static ports are clear.

Air conditioning inlets and exits.....Check

Verify that the air inlets and exits, including the outflow valves, are free of snow and ice.

Engine inlets.....Check

Verify that the inlet cowling is free of snow and ice.

Fuel tank vents.....Check

Verify that all traces of ice and frost are removed.

Landing gear doors.....Check

Landing gear doors should be free of snow and ice.

APU air inletsCheck

The APU inlet door must be free of snow and ice before APU start.

Preflight Procedure - P2

Do the normal Preflight Procedure - P2 with the following modifications:

During the hydraulic panel preflight, if all electric pump selectors are found selected ON and the APU is running, maintenance personnel may have performed a maintenance procedure for cold weather hydraulic system warm-up. If maintenance personnel have performed the cold weather hydraulic system warm-up procedure, leave the electric pump selectors ON and the APU running. This ensures all four hydraulic electric pumps remain operating and the hydraulic fluid remains warmed. During the Before Start Procedure, select all electric pumps AUTO and resume normal procedures for operation of the hydraulic systems.

Note: If the fuel temperature is less than or equal to -17 degrees C, and if the electric hydraulic pump selectors are in the AUTO or OFF position for more than 10 minutes prior to engine hydraulic pump operation, notify maintenance personnel.

Engine Start Procedure

Dual engine starts are not recommended below an OAT of 5degreesC (41degreesF). Allow the first engine to stabilize before starting the second engine. If dual engine starts are performed on cold days and ENG CONTROL L/R advisory occurs, contact Maintenance.

Do the normal Engine Start Procedure with the following considerations:

- oil pressure may be slow to rise
- initial oil pressure rise may be higher than normal
- additional warm-up time may be needed to allow oil temperature to reach the normal range
- displays may require additional warm-up time before displayed engine indications accurately show changing values. Displays may appear less bright than normal

Engine Anti-Ice Operation – On the Ground

Engine anti-ice must be selected ON immediately after both engines are started and remain on during all ground operations when icing conditions exist or are anticipated except when temperature is less than -40°C OAT.

WARNING: Do not rely on airframe visual icing cues before activating engine anti-ice. Use the temperature and visible moisture criteria

because late activation of engine anti-ice may allow excessive ingestion of ice and result in damage or failure.

CAUTION: Do not use engine anti-ice when OAT is above 10° C.

When nacelle anti-ice is needed:

ENGINE ANTI-ICE selectors ON P2

Confirm that “EAI” is shown on the primary engine display for both engines. If the EAI indication is blank, confirm the area behind the airplane is clear, then increase thrust until EAI indication shows (no more than 10% above idle). Confirm the EAI indication shows, then resume normal thrust management.

When nacelle anti-ice is no longer needed:

ENGINE ANTI-ICE selectors AUTO or OFF P2

If ice detection is available, position the selectors to AUTO. If ice detection is inoperative, position the selectors to OFF.

Before Taxi Procedure

Do the normal Before Taxi Procedure with the following modifications:

If there is snow or ice accumulation on the wing, consider delaying the flight control check until after de-icing/anti-icing is accomplished.

If taxi route is through ice, snow, slush, or standing water in low temperatures or if precipitation is falling with temperatures below freezing, taxi out with the flaps up. Taxiing with the flaps extended subjects the flaps and flap drives to contamination. Leading edge devices are also susceptible to slush accumulations.

Call “FLAPS___” as needed P1

Flap lever Set flaps, as needed P2

Taxi Out

CAUTION: Taxi at a reduced speed. Use smaller tiller and rudder inputs, and apply minimum thrust smoothly. Differential thrust may be used to help maintain airplane momentum during turns. At all other times, apply thrust evenly. Taxiing on slippery taxiways or runways at excessive speed or with high crosswinds can start a skid.

CAUTION: Precautions must be taken for jet blast up to 600 feet (200 meters) behind the aircraft, snow and ice at the edge of the taxiway that can be ingested by the engines, slippery taxi surfaces, and airport noise restrictions.

In icing conditions with visible moisture (fog with visibility of one statute mile (1600m) or less, rain, snow, sleet, ice crystals, and so on), do the following procedure:

If OAT is at or below 3°C and at or above -7°C:

Check that the area behind the airplane is clear. P1

Run-up to a minimum of 20 TPR (42% N1) for at least 30 seconds at intervals no greater than 60 minutes.

If OAT is below -7°C:

Check that the area behind the airplane is clear. P1

Run-up to a minimum of 20 TPR (42% N1) for at least 30 seconds within 60 minutes.

If takeoff is not completed within 60 minutes after the first runup, manually de-ice the engines before takeoff.

Note: If the time since the last de-icing procedure or run-up is more than 60 minutes, the engine must be de-iced per the AMM procedure.

De-/Anti-icing

Testing of undiluted de-icing/anti-icing fluids has shown that some of the fluid remains on the wing during takeoff rotation and initial climb. The residual fluid causes a temporary decrease in lift and increase in drag, however, the effects are temporary. Use the normal takeoff rotation rate.

CAUTION: Operate the APU during de-icing only if necessary. Ingestion of snow, slush, ice, or de-icing/anti-icing fluid can cause damage to the APU.

If de-icing/anti-icing is needed:

G-ZBKH - G-ZBKK

BROADBAND COMM switchOff P2

APU.....As needed P2

The APU should be shut down unless APU operation is necessary.

Call “FLAPS UP” P1

FlapsUP P2

Prevents ice and slush from accumulating in flap cavities during de-icing.

Thrust levers.....Idle P1

Reduces the possibility of injury to personnel at inlet or exhaust areas.

PACK switches.....OFF P2

After de-icing/anti-icing is completed:

G-ZBKH - G-ZBKK

BROADBAND COMM switchON P2

APU.....As needed P2

PACK switches.....	AUTO	P2
Flight Controls.....	Check, as needed	P1

Before Takeoff Procedure

Do the normal Before Takeoff Procedure with the following modification:

Call “FLAPS ___” as needed for takeoff.		PF
Flap lever.....	Set takeoff flaps, as needed	PM
Extend the flaps to the takeoff setting at this time if they have been held because of slush, standing water, or icing conditions, or because of exterior de-icing/anti-icing.		
Engine oil temperature.....	Above amber limit	PF
Oil temperature must be above the amber limit before takeoff.		

Takeoff Procedure

Do the normal Takeoff Procedure with the following modification:

When engine anti-ice is required and the OAT is 3°C or below, the takeoff must be preceded by a static engine run-up. Use the following procedure:

Run-up to a minimum of 50% N1 and a maximum of 55% N1 for at least 2 seconds to shed any possible ice on the fan.

Engine Anti-ice Operation - In flight

Engine anti-ice must be AUTO or ON during all flight operations when icing conditions exist or are anticipated, except during climb and cruise when the temperature is below –40°C SAT.

CAUTION: Do not use engine anti-ice when TAT is above 10°C.

Manual Use of Engine Anti-ice

When using the nacelle anti-ice system manually in areas of possible icing, activate nacelle anti-ice before entering icing conditions.

WARNING: If using the engine anti-ice system manually, do not rely on airframe visual icing cues before activating engine anti-ice. Use the temperature and visible moisture criteria because late activation of engine anti-ice may allow excessive ingestion of ice and result in engine damage or failure.

When manual use of engine anti-ice is needed:

ENGINE ANTI-ICE selectors	ON	PM
Confirm that “EAI” is shown on the primary engine display for both engines. If not displayed, avoid icing conditions.		

When manual use of engine anti-ice is no longer needed:

ENGINE ANTI-ICE selectors AUTO or OFF PM
 If ice detection is available, position the selectors to AUTO. If ice detection is inoperative, position the selectors to OFF.

Fan Ice Removal

CAUTION: Avoid prolonged operation in moderate to severe icing conditions.

If moderate to severe icing conditions are encountered:

During flight in moderate to severe icing conditions for prolonged periods, if fan icing is suspected due to high engine vibration, the fan blades must be cleared of any ice. Do the following procedure on both engines, one engine at a time: quickly reduce thrust to idle for five seconds, then restore the required thrust. If vibration persists, advance thrust lever to Max Climb N1 for at least 2 seconds, then resume normal thrust management.

Wing Anti-ice Operation – In flight

Ice accumulation on the flight deck window frames, windshield center post, or windshield wiper arm, or side windows may be used as an indication of structural icing conditions and the need to turn on wing anti-ice.

The wing anti-ice system may be used as a de-icer or anti-icer in flight only. The primary method is to use the automatic ice detection system to control wing anti-ice operation automatically throughout the entire flight envelope. This automatic mode uses a combination of symmetric slat anti-ice and de-icing functions to provide the cleanest airfoil surface, the least possible runback ice formation, and the least thrust and fuel penalty.

The secondary method is to select the WING ANTI-ICE selector ON when wing icing is possible and use for anti-icing.

CAUTION: Do not use wing anti-ice when TAT is above 10°C.

Manual Use of Wing Anti-Ice

When manual use of wing anti-ice is needed:

WING ANTI-ICE selector ON PM
 Confirm that “WAI” is shown on the primary engine display for both engines. If not displayed, avoid icing conditions.

When manual use of wing anti-ice is no longer needed:

WING ANTI-ICE switch Auto or OFF PM

If ice detection is available, position the selector to AUTO. If ice detection is inoperative, position the selector to OFF.

The WING ANTI-ICE OFF advisory message is shown when the WING ANTI-ICE selector is in the OFF position.

After Landing Procedure

CAUTION: Taxi at a reduced speed. Use smaller tiller and rudder inputs, and apply minimum thrust smoothly. Differential thrust may be used to help maintain airplane momentum during turns. At all other times, apply thrust evenly. Taxiing on slippery taxiways or runways at excessive speed or with high crosswinds may start a skid.

CAUTION: Precautions must be taken for jet blast up to 600 feet (200 meters) behind the aircraft, snow and ice at the edge of the taxiway that can be ingested by the engines, slippery taxi surfaces, and airport noise restrictions.

Do the normal After Landing Procedure with the following modifications:

After prolonged operation in icing conditions with the flaps extended, or when an accumulation of airframe ice is observed, or when operating on a runway contaminated with ice, snow, slush, or standing water:

Do not retract the flaps until the flap areas have been checked to be free of contaminants.

Engine anti-ice must be selected ON and remain on during all ground operations when icing conditions exist or are anticipated, except when the temperature is below -40°C OAT.

WARNING: Do not rely on airframe visual cues before activating nacelle anti-ice. Use the temperature and visible moisture criteria because late activation of engine anti-ice may allow excessive ingestion of ice and result in engine damage or failure.

CAUTION: Do not use nacelle anti-ice when OAT is above 10°C.

When engine anti-ice is needed:

Nacelle anti-ice switches ON P2
Confirm that “EAI” is shown on the primary engine display for both engines.

When engine anti-ice is no longer needed:

Nacelle anti-ice switchesAUTO P2

In icing conditions with visible moisture (fog with visibility of one statute mile (1600m) or less, rain, snow, sleet, ice crystals, and so on), and OAT is 3°C or below, do the following procedure:

Check that the area behind the airplane is clear. P1

Run-up to a minimum of 20 TPR (42% N1) for at least 30 seconds at intervals no greater than 60 minutes.

If the run-up procedure is not done (either it cannot be done, or time to gate is less than 60 minutes) do one of the following:

Record the taxi-in time without an engine run-up in the airplane logbook or other approved document

Do the run-up procedure less than 5 minutes before the arrival at the gate and record this in the airplane logbook or other approved document

Secure Procedure

Do the normal Secure Procedure with the following modifications:

If the airplane will be attended:

PACK switches.....AUTO P2

If the airplane will not be attended, or if staying overnight at off-line stations or at airports where normal support is not available, the flight crew must arrange for or verify that the following steps are done:

OUTFLOW VALVE switchesMAN

OUTFLOW VALVE MANUAL switches.....CLOSE

Position the outflow valves fully closed to inhibit the intake of snow and ice.

Wheel chocks Verify in place

Parking brake.....Released

Reduces the possibility of frozen brakes.

Hot Weather Operation

During extended ground operations prior to flight deck preparation, consideration should be given to reducing the heat being generated on the flight deck. Window heat, radar, and other electronic components which contribute to a high temperature level on the flight deck may be turned off. All the flight deck air outlets should be open.

Both packs should be used (when possible) for maximum cooling. Recirculation fans should be on for maximum cooling capacity. To maximize the cooling capacity of the air conditioning system, all doors, including cargo doors, should be kept closed as much as possible. All gasper outlets should be open. Passenger cabin windows should be fully dimmed. Flight deck cooling can be improved by closing the flight deck door and lowering the side trays adjacent to the pilot seats.

CAUTION: Recirculation fans must remain ON unless a non-normal checklist or supplementary procedure directs to select them off

Moderate to Heavy Rain, Hail or Sleet

Flight should be conducted to avoid thunderstorms, hail activity or visible moisture over storm cells. To the maximum extent possible, moderate to heavy rain, hail or sleet should be avoided.

Operation in a Sandy or Dusty Environment

The main hazards of a sandy or dusty environment are erosion (especially of engine fan blades), accumulation of sand or dust on critical surfaces, and blockage. The effects of sand ingestion occur predominantly during takeoff, landing and taxi operations. The adverse effects, however, can occur if the airplane's flight path was through a cloud of visible sand or dust, or the airplane was parked during a sand or dust storm. Premature engine deterioration can result from sand or dust ingestion, causing increased fuel burn and reduced EGT margins.

CAUTION: After a sandstorm, if all taxiways and runways are not carefully inspected and swept for debris before flight ops are conducted, the risk of engine damage and wear is increased.

Preflight Procedure - P2

Do the normal Preflight Procedure - P2 with the following modifications:

Note: Minimize the use of air conditioning, other than from a ground air conditioner, as much as possible. If the packs must be used for air conditioning, maintain a temperature as high as possible while still providing a tolerable flight deck and cabin environment.

Taxi-Out

Do the following, conditions permitting, to minimize sand and dust ingestion by the engines and to improve visibility during taxi:

- Use all engines during taxi and taxi at low speed. Limit ground speed to 10 knots and maintain thrust below 40% N1 whenever possible to avoid creating a vortex during ground operations.
- Maintain a greater than normal separation from other aircraft while taxiing and avoid the ingestion of another engine's wake.
- Avoid engine overhang of unprepared surfaces.
- Minimize thrust on the outboard side of the turn during 180° turns.
- In the event of a crosswind during 180° turns, turn away from the wind if possible to minimize sand and dust ingestion.
- Whenever possible, avoid situations that would require the airplane to be brought to a complete stop.
- Avoid excessive braking. The presence of sand or dust will increase brake wear.

Takeoff

Do the following to minimize sand and dust ingestion by the engines during takeoff:

- Use the full fixed derate and/or assumed temperature thrust reduction that meets performance requirements.
- Before takeoff, allow sand and dust to settle
- Do not take off into a sand or dust cloud.

- Use a rolling takeoff. Whenever possible, avoid setting high thrust at low speed.
- When visible sand and dust exist, consider delaying flap retraction until above the dust cloud, if operations allow.

Landing

Do the following to minimize sand and dust ingestion by the engines during landing:

- Use autobrake on landing to help minimize the need for reverse thrust.
- If performance allows, minimize the use of reverse thrust to prevent ingestion of dust and sand and to prevent reduction of visibility. Reverse thrust is most effective at high speed.

Taxi-In

Do the following, if conditions allow, to minimize sand and dust ingestion by the engines and to improve visibility during the taxi-in:

- Use all engines and taxi at low speed. Limit ground speed to 10knots and maintain thrust below 40% N1 whenever possible.
- Maintain a greater than normal separation from other aircraft while taxiing and avoid the ingestion of another engine's wake.
- Avoid engine overhang of unprepared surfaces.
- Minimize engine thrust on the outboard side of the turn during 180° turns.
- In the event of a crosswind during 180° turns, turn away from the wind if possible to minimize sand and dust ingestion.
- Whenever possible, avoid situations that would require the airplane to be brought to a complete stop.
- Avoid excessive braking. The presence of sand or dust will increase brake wear.

Secure Procedure

Do the normal Secure Procedure with the following modifications:

OUTFLOW VALVE switches.....MAN F/O

OUTFLOW VALVE MANUAL switch CLOSE F/O

Position the outflow valves fully closed to inhibit the intake of sand and dust.

Additional procedures for securing the airplane during sandy or dusty conditions may be needed. These procedures are normally done by maintenance personnel, and include, but are not limited to:

- Verify that engine covers, if applicable, are in place while the airplane is parked.
- Verify that airplane doors are closed.
- Verify that all openings are plugged or covered while the airplane is parked. Streamers should be used to remind personnel to remove before flight.
- Ensure all compartments are closed.

Severe Turbulence

The turbulent air penetration speed provides ample protection from stall and high speed buffet, while also providing protection from exceeding the structural limit (Refer to [Limitations](#) for additional information)

The recommended procedures for flight in severe turbulence are summarized below.

Passenger signsON

Advise passengers to fasten seatbelts prior to entering areas of reported or anticipated turbulence. Instruct flight attendants to check all passengers' seat belts are fastened.

Structural Considerations

Flap extension in an area of known turbulence should be delayed as long as possible because the airplane can withstand higher gust loads in the clean configuration. Diversion to another airfield is recommended if severe turbulence persists in the area.

Climb, Cruise and Descent Considerations

After takeoff, and when established in a clean climb configuration, use of the autoflight system is recommended for flight through turbulence.

During climb and descent, use of VNAV or flight level change may result in excessive pitch changes as the AFDS attempts to fly speed with the elevators. Therefore, vertical speed mode (speed on autothrottles) is recommended for climb and descent in severe turbulence.

During cruise, VNAV and altitude hold modes both fly speed on autothrottles and can be used in turbulence.

In severe turbulence during cruise, it may be necessary to disconnect the autothrottles to prevent excessive thrust changes. Thrust setting guidance is available on EICAS when VNAV is engaged. Set TPR at or slightly above the magenta VNAV target TPR indication. Change thrust setting only if required to modify an unacceptable speed trend.

Manual Flight in Severe Turbulence

If manual flight in severe turbulence becomes necessary, trim the airplane for the turbulent air penetration speed. Control the airplane pitch attitude with the elevators using the attitude indicator as the primary instrument. In extreme drafts, large altitude changes may occur. Do not make sudden large control inputs. Corrective actions to regain the desired attitude should be smooth and deliberate. Altitude variations are likely in severe turbulence and should be allowed to occur if terrain clearance is adequate. Control airplane attitude first, then make corrections for airspeed, altitude, and heading.

Windshear

Windshear is a change of wind speed and/or direction over a short distance along the flight path. Indications of windshear are listed in the Non-Normal Manoeuvres section in this manual.

Avoidance

The flight crew should search for any clues to the presence of windshear along the intended flight path. Presence of windshear may be indicated by:

- Thunderstorm activity
- Virga (rain that evaporates before reaching the ground)
- Pilot reports
- Low level windshear alerting system (LLWAS) warnings.

Stay clear of thunderstorm cells and heavy precipitation and areas of known windshear. Do not penetrate an area of known severe windshear. If the presence of windshear is confirmed, delay takeoff or do not continue approach.

Precautions

If windshear is suspected, be especially alert to any of the danger signals and be prepared for the possibility of an inadvertent encounter. The following precautionary actions are recommended if windshear is suspected:

WARNING: **Whenever windshear is reported or anticipated that might adversely compromise the take-off and initial climb performance of the aircraft full thrust should be used. Where conditions indicate that severe windshear may be present, do not take-off.**

Takeoff

- takeoff with full rated takeoff thrust is recommended, unless the use of a fixed derate is required to meet a dispatch performance requirement

G-ZBJA - G-ZBJM

- for optimum takeoff performance, use flaps 20 for takeoff unless limited by obstacle clearance and/or climb gradient. Flaps 15 may be used as a precautionary setting and will provide nearly equivalent performance to Flaps 20

G-ZBKA - G-ZBKS

- for optimum takeoff performance, use flaps 20 for takeoff unless limited by obstacle clearance and/or climb gradient. Flaps 15, 17, or 18 may be used as a precautionary setting and will provide nearly equivalent performance to Flaps 20
- Use the longest suitable runway provided it is clear of areas of known windshear.
- Use the flight director after takeoff.
- consider increasing VR speed to the performance limited gross weight rotation speed, not to exceed actual gross weight VR+20 knots. Set V speeds for the actual

gross weight. Rotate at the adjusted (higher) rotation speed. This increased rotation speed results in an increased stall margin, and meets takeoff performance requirements. If windshear is encountered at or beyond the actual gross weight VR, do not attempt to accelerate to the increased VR, but rotate without hesitation

- Be alert for any airspeed fluctuations during takeoff and initial climb. Such fluctuations may be the first indication of windshear.
- Know the all-engine initial climb pitch attitude. Rotate at the normal rate to this attitude for all non-engine failure takeoffs. Minimize reductions from the initial climb pitch attitude until terrain and obstruction clearance is assured, unless stick shaker activates.
- Crew coordination and awareness are very important. Develop an awareness of normal values of airspeed, attitude, vertical speed, airspeed buildup. Closely monitor vertical flight path instruments such as vertical speed and altimeters. The pilot monitoring should be especially aware of vertical path instruments and call out any deviations from normal.
- Should airspeed fall below the trim airspeed, unusual control column forces may be required to maintain the desired pitch attitude. If stick shaker is encountered, reduce pitch attitude. Do not exceed the Pitch Limit Indication.

Approach and Landing

- Use either Flaps 25 or 30 for landing.
- Establish a stabilized approach no lower than 1,000 feet above the airport to improve windshear recognition capability.
- Use the most suitable runway that avoids the areas of suspected windshear and is compatible with crosswind or tailwind limitations. Use ILS G/S, VNAV path or VASI/PAPI indications to detect flight path deviations and help with timely detection of windshear.
- If the autothrottle is disconnected, or is planned to be disconnected prior to landing, add an appropriate airspeed correction (applied in the same manner as gust), up to a maximum of 15 knots.
- Avoid large thrust reductions or trim changes in response to sudden airspeed increases, as these may be followed by airspeed decreases.
- Crosscheck flight director commands using vertical flight instruments.
- Crew coordination and awareness are very important, particularly at night or in marginal weather conditions. Closely monitor the vertical flight path instruments such as vertical speed, altimeters and glide slope displacement. The pilot monitoring should call out any deviations from normal. Use of the autopilot and autothrottle for the approach may provide more monitoring and recognition time.

Recovery

Accomplish the WINDSHEAR maneuver found in the Non-Normal Maneuvers section of this manual.

Ice Crystal Icing (ICI)

At temperatures below freezing near convective weather, the airplane can encounter visible moisture made up of high concentrations of small ice crystals. Ice crystals can accumulate aft of the engine fan, in the engine core. Ice shedding can cause engine vibration, engine power loss, and engine damage.

These weather conditions are difficult to detect because ice crystals do not cause significant weather radar returns. They are often found in high concentrations above and near regions of heavy precipitation. Ice crystals do not stick to cold aircraft surfaces.

Avoid ICI conditions. Flight in clouds containing high concentrations of ice crystals has been associated with engine vibration, engine power loss, engine damage, and airplane Total Air Temperature (TAT) probe icing.

Because these conditions can be difficult to recognize, careful preflight planning is a key component of in-flight situational awareness. When ICI is encountered or suspected, do the Ice Crystal Icing non-normal checklist to mitigate the effect on the flight.

Recognizing Ice Crystal Icing Weather

Ice crystals are most frequently found in areas of visible moisture and above altitudes normally associated with icing conditions. Their presence can be indicated by one or more of the following:

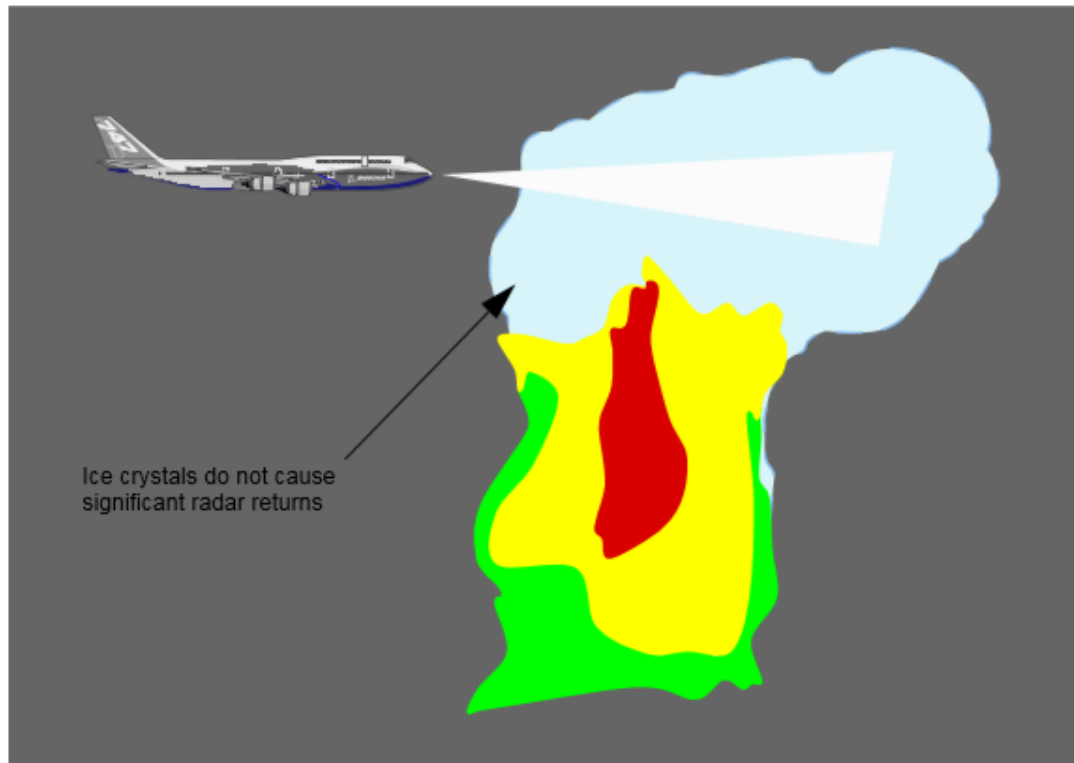
- Appearance of rain on the windshield at temperatures too cold for liquid water to exist. This is due to ice crystals melting on the heated windows (sounds different than rain)
- Airplane TAT indication remains near 0 degrees C due to TAT probe icing
- Areas of light to moderate turbulence
- In IMC with:
 - No significant radar returns at airplane altitude and
 - Heavy precipitation below the airplane, identified by amber and red radar returns on weather radar
- Cloud tops above typical cruise levels (above the tropopause)
- Smell of ozone or sulphur
- Humidity increase
- Static discharge around the windshield (St. Elmo's fire)

Note: The ice detection system does not detect ice crystal icing. It is designed to detect supercooled water only.

Avoiding Ice Crystal Icing

During flight in IMC, avoid flying directly over significant amber or red radar returns, even if there are no returns at airplane altitude.

Use the weather radar controls to assess weather radar reflectivity below the airplane flight path. Refer to weather radar operating instructions for additional information.



Ice Crystal Icing Suspected

Exit the ice crystal icing conditions. Request a route change to minimize the time above red and amber radar returns.

Do the Ice Crystal Icing non-normal checklist.

Centre of Gravity

Alternate Forward CG Limit for Takeoff

Use of Alternate Forward CG Limit for Takeoff is not necessary on the current British Airways' B787 network.

Changing CRZ CG

The default value for CRZ CG is 6.0%. It is fleet policy to update the CRZ CG in flight to ensure that the displayed MAX level on the FMC VNAV CRZ page accurately reflects aircraft performance capability.

PERF INIT page.....Set PF

Enter the furthest forward (lowest value) of the final loadsheet MACZFW and MACTOW in the CRZ CG field.

Engine Out Taxi (EOT)

Engine Out Taxi Out (EOT Out)

EOT Out is NOT APPROVED.

Engine Out Taxi In (EOT In)

It is fleet policy to employ EOT In whenever this can be achieved in a manner that ensures safe operation of the aircraft.

The maximum aircraft weight permitted for EOT In is Maximum Landing Weight, as defined in Limitations.

Consideration should be given to:

- Systems defects which may not be compatible with EOT
- Gradient and direction of turn
- Surface contamination
- Blast hazard to proximate ground handling equipment
- Crew workload

Note: The APU should be running to prevent undesired load-shedding and possible loss of air conditioning capability.

Note: After landing, several automatic tests run to check the Flight Control Electronics when:

- Airplane speed drops below 30 KTS, and
- The flaps are in the up position, and
- The spoilers are retracted

The tests will only pass provided that there are no hydraulic pressure fluctuations for 45 seconds after these parameters have been achieved. Shutting down an engine during the test window will cause a hydraulic pressure interruption, which in turn may result in a non-dispatchable airplane configuration. During the 45-second test window, large column, wheel, rudder, and speedbrake inputs should be avoided and ground speed must remain below 30 knots. There is no restriction on the use of tiller or rudder pedals for taxi-in purposes.

Note: Shutting down an engine will result in a HYD PRESS SYS Caution on the associated side. There is no requirement to complete the ECL for the Caution during EOT-In, or to record it as a defect in the Logbook.

After Landing Procedure

Complete the After Landing Procedure, observing the engine cooldown recommendations and the Flight Control Electronics self-test restrictions, with the following additions:

Pilot Flying	Pilot Monitoring
	Set the APU selector to START , then ON .
Call “ SHUTDOWN L/R ” (as needed)	Set the FUEL CONTROL switch L/R (as needed) to CUTOFF .

Positioning and Ferry Flights

The minimum operating crew for Positioning Ferry flights is 2 pilots. There is no requirement to carry additional persons in the cabin for any reason.

The following procedures should be completed to prevent damage and minimise the risk of fire/fumes:

Preflight Procedure

Do the normal Preflight Procedure with the following modifications:

IFE/PASS SEATS switch.....OFF

Note: The CABIN/UTILITY switch should remain ON

SEAT BELT SIGNS selector.....OFF

Before Start Procedure

Do the normal Before Start Procedure with the following modifications:

Flight deck doorUnlocked

Doors 1L, 1R.....AUTO

Shutdown Procedure

Do the normal Shutdown Procedure with the following modifications:

Doors 1L, 1RMANUAL