



B777

Flight Crew Operating

Manual

Revision 2
March 2021

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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 777 airplane during all anticipated airline operations
- serve as a comprehensive reference for use during transition training for the 777 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

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 B777. Other documents which also form part of the BAVirtual B777 Operations Manual include:

- OM B GEN Procedures – available via DocStore
- FCOM – this document
- Checklists – available via [B777 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	8,400ft pressure altitude

Turbulent Air Penetration Speed

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

- 270 KIAS below 25,000 feet
- 280 KIAS/.82 Mach (whichever is lower) at and above 25,000 feet

Maintain a minimum speed of 15 knots above the minimum manoeuvring speed at all altitudes when airspeed is below 0.82 Mach.

Operational Information

#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

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.

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 in to the USA.

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

Maximum Taxi Weight

G-RAES, G-VIIA – G-VIIY

268,526 Kilograms

G-YMMA – G-YMMF, G-YMMR – G-YMMU

298,010 Kilograms

Ex-USA: 276,000 Kilograms

G-YMMG – G-YMMP

294,927 Kilograms

Ex-USA: 272,000 Kilograms

G-STBA – G-STBP

341,101 Kilograms

Ex-USA: 325,000 Kilograms

Maximum Takeoff Weight

G-RAES, G-VIIA – G-VIIY

267,619 Kilograms

G-YMMA – G-YMMF, G-YMMR – G-YMMU

297,000 Kilograms

Ex-USA: 275,000 Kilograms

G-YMMG – G-YMMP

293,927 Kilograms

Ex-USA: 271,000 Kilograms

G-STBA – G-STBP

340,101 Kilograms

Ex-USA: 324,000 Kilograms

Maximum Landing Weight

G-RAES, G-VIIA – G-YMMU

208,652 Kilograms

G-STBA – G-STBP

251,290 Kilograms

Maximum Zero Fuel Weight**G-RAES, G-VIIA – G-YMMU**

195,044 Kilograms

G-STBA – G-STBP

237,682 Kilograms

Autoflight**AFDS**

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

#Without LAND 2 or LAND 3 annunciated, the autopilot must be disengaged below 200 feet AGL.

PVD Takeoff

The PVD system has been demonstrated to perform satisfactorily in non-LVO conditions with crosswinds up to 25knots. Maximum crosswind allowed for LVOs where the PVD system is used is 15 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

Automatic landings can be made using flaps 20 or 30, with both engines operative or one engine inoperative. The autopilot flight director system (AFDS) autoland status annunciation must display LAND 2 or LAND 3 and the SLATS DRIVE EICAS message must not be present.

SGL SOURCE DISPLAYS, RAD ALT or ILS must not be displayed.

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

G-RAES, G-VIIA – G-YMMU

- Headwind: 32 knots
- Tailwind: 15 knots

- Crosswind: 28 knots

G-STBA – G-STBP

- Headwind: 33 knots
- Tailwind: 15 knots
- Crosswind: 29 knots

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

Non-AFM Operational Information

#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.

HF Communication System
G-VIIN - G-YMMD

If one HF radio is selected for transmission, deselect the other HF radio on all audio control panels to prevent audio interference.

Engines, APU
Engine Limit Display Markings

Maximum and minimum limits are red. Caution limits are amber.

Engine Oil System
G-YMMA – G-YMMU

#Oil temperature must be greater than -40C for engine start and 50 degrees C before advancing thrust levers to takeoff power.

Engine Fuel System

The maximum tank fuel temperature is 49 degrees C.

G-RAES - G-VIIY, G-STBK

Tank fuel temperature prior to takeoff must not be less than -40 degrees C or 3 degrees C above the fuel freezing point, whichever is higher. In-flight tank fuel temperature must be maintained at least 3 degrees 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.

G-YMMA - G-YMMU

Tank fuel temperature prior to takeoff must not be less -37 degrees C or 3 degrees C above the fuel freeze point, whichever is higher. In flight, tank fuel temperature must be maintained at least 3 degrees 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.

Reverse Thrust

#Intentional selection of reverse thrust in flight is prohibited.

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

G-YMMA - G-YMMU

After a rejected takeoff (RTO) is performed where thrust reversers were deployed, takeoff is prohibited until maintenance action is complete.

Non-AFM Operational Information**G-STBA - G-STBP**

For ground operation (exclusive of takeoff) in tailwinds and crosswinds between 30 and 45 knots, engine power should be limited to a maximum of 70% N1. Avoid thrust levels above that required for normal taxi operation in all tailwinds and crosswinds greater than 45 knots.

APU

The APU's starter motors duty cycle for the electric starter motor and air turbine starter is 3 starts attempts in a 60 minute period each. APU start cycle restrictions are:

Between Starts	Electric Starter Motor wait:	Air Turbine Starter wait:
1 and 2	1 minute	1 minute
2 and 3	1 minute	1 minute

Flight Controls

#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.

Flight Instruments, Displays

Ground Maneuver Camera System

G-STBA - G-STBP

The ground maneuver cameras should not be used during takeoff, approach, and landing.

Flight Management, Navigation

ADIRU

ADIRU alignment must not be attempted at latitudes greater than 78 degrees, 14.75 minutes.

Fuel

Fuel Loading

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

Note: The center tank may contain up to 1360 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.

Runway Awareness and Advisory System (RAAS)

G-STBA - G-STBP

Do not use RAAS voice annunciations or alerts for navigation. Do not use RAAS voice annunciations or alerts as a substitute for NOTAM or ATIS information.

ETOPS

BAVirtual is permitted to operate ETOPS services using B777 aircraft powered by GE90-85B/GE90-90B, GE90-115BL, or TRENT 895 engines in accordance with Operations Manual requirements. The applicable rule time is 180 minutes and rule distance is 1200 nautical miles.

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 BAVirtual Operational Policy on the B777

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 (once the aircraft is moving in the Before Takeoff phase)

- tasks asked for by the PF
- executing procedures
- 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 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 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 -5,000kg 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.

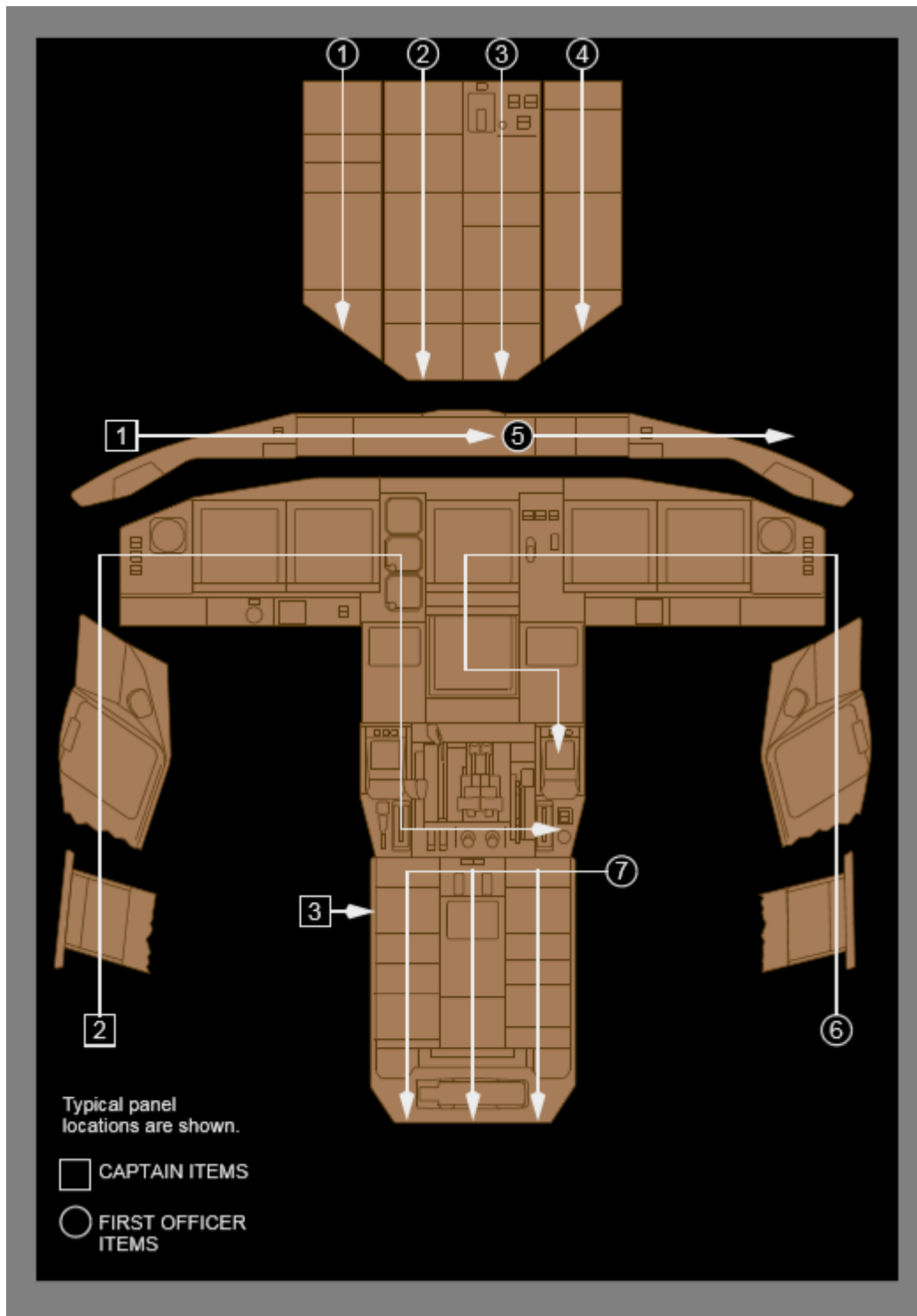
Note: For CG TRIM changes in excess of 3%, the FMC may delete other TAKEOFF REF data, which would then require a Critical Data Procedure.

Preflight and Postflight Scan Flow

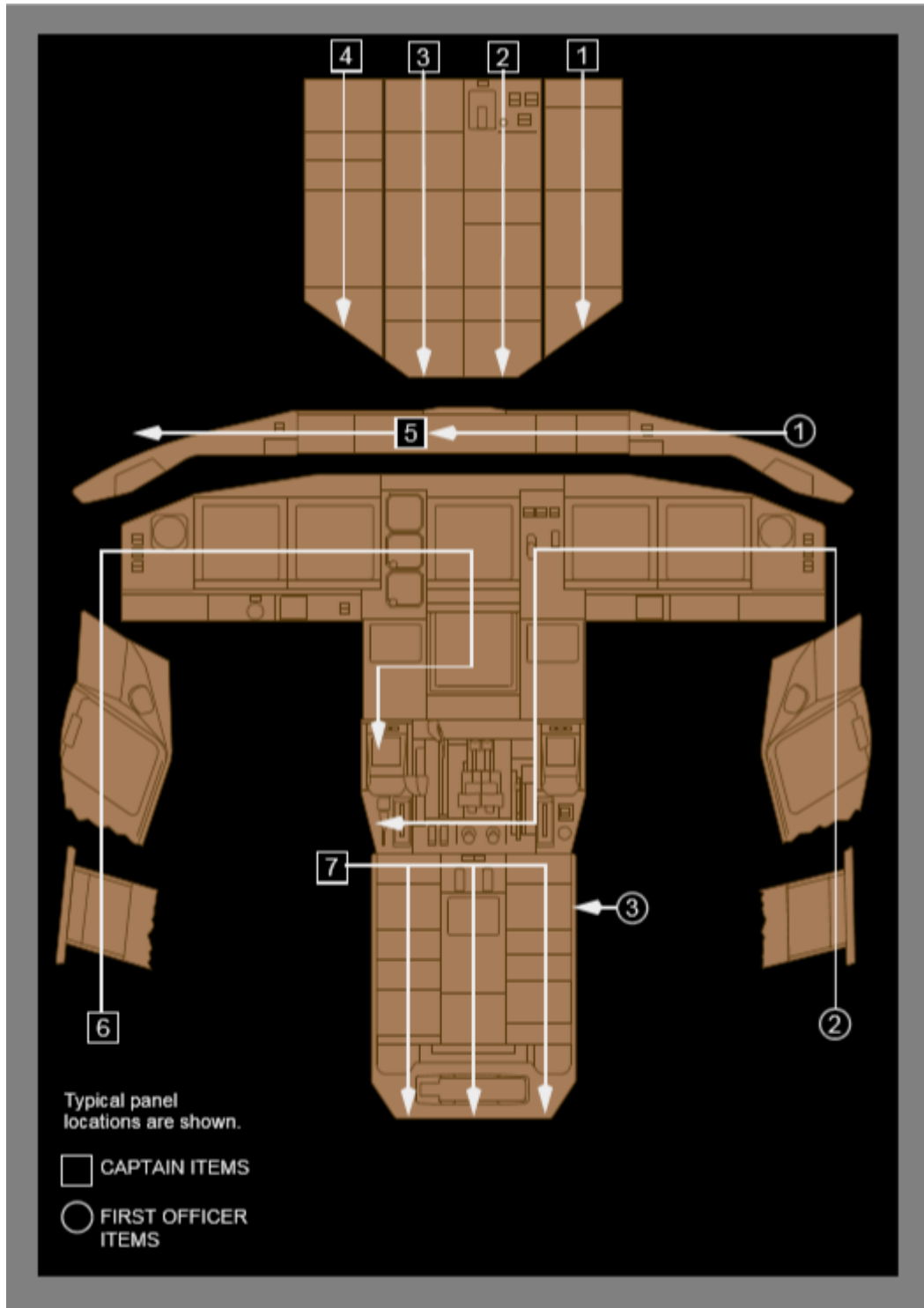
The scan flow diagrams shown below are representative and may not match the configuration(s) of your airplanes.

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
Configuration	ADDs/EICAS/STATUS
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 and Performance restrictions	Proximate terrain and use of display Emergency turn and AFDS handling Non-standard climb-outs, noise considerations Reduced thrust capability Changes to ACCEL HT
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	Review Approach type/manual or auto
QNH	Set expected QNH on standby altimeter Account for any significant difference when operating shuttles
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	Review handling with respect to SAC Automation Standard profile Appropriate AOM
Go-around	Profile review/automation/SOPs Acceleration height
Runway	Landing performance Flap setting/autobrake
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 Set minimum hold exit fuel
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, etc). 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.

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	First indication of Radio Altitude	“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 Approach

CONDITION/LOCATION	CALLOUT	MADE BY
First positive inward movement of localizer pointer, manual flight	“LOCALIZER 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”	C
50 ft above DA(H)	“FIFTY ABOVE”	Auto/PF
At DA(H) with visual reference	“DECIDE”	Auto/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”	Auto/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

BAVirtual 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"> • NUBRF • CIRBUS • Airfield RIM briefs • 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 Simbrief 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.

ADIRU switch OFF 30 seconds, then ON
 Verify that the ON BAT light is extinguished.
 Verify that the OFF light is extinguished.

G-STBA – G-STBP, G-VIIN – G-YMMU

VOICE RECORDER switch ON
 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.

Maintenance documents Check

Emergency Equipment Check

Fire extinguisher – Checked and stowed

Crash axe – stowed

Escape ropes - stowed

Other emergency equipment – checked and stowed

Aircraft library Check

Check appropriate for the planned flight and stowed.

Overhead maintenance panel Guards closed

Verify that all lights are extinguished.

TOTAL AIR TEMPERATURE PROBE selector L from UK/R to UK

CARGO TEMPERATURE selectors As needed

Note: NOTOC dictates cargo control panel settings for the relevant Hold. If live animals or temperature sensitive cargo are carried, set relevant cargo hold to NOTOC setting (High or Low).

Circuit breakers Check

Parking brake.....As needed
 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.

BAV Merlin..... Initialise P1
 Select booked flight
 Verify DEPARTURE and DESTINATION are correct
 Verify or enter ALTERNATE
 Verify or enter FLIGHT LEVEL
 Verify or enter ROUTE
 Select GREEN TICK to proceed to Briefing tab.

CDU Preflight Procedure – P1 and P2

Start the CDU 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 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.

Initial data Set P1

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

RTE page:

Select ROUTE REQUEST

When ROUTE UPLINK READY message is displayed select LOAD and check origin, destination and route.

Or:

Manually enter the route.

Use COMPANY RTE, or ATC Flight Plan Route/Airways or FMC/WINDS page from CIRRUS.

Enter the CALLSIGN from Cirrus/VATSIM 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.

ACTIVATE and execute the route.

DEPARTURES page:

Select the runway and departure routing

Execute the runway and departure routing

RTE page Check
Verify ORIGIN and DEST are correct

LEGS page Check
Check each waypoint against CIRRUS

If the FMC route differs from CIRRUS, the CIRRUS waypoints must be entered by P1 and crosschecked by P2.

For waypoints which are not stored in the navigation database, the CIRRUS log must be annotated as follows:

- When the coordinates of the waypoint have been checked, the waypoint designator, or lat/long, on the the CIRRUS log should be circled.
- When the track and distance have been checked, they should be ticked.

POS REF page 2:

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

NAV RADIO page:

Tune the navigation radios, as needed

Initial performance data Set

PERF INIT page:

Enter the RESERVES value from CIRRUS

Enter the COST INDEX from CIRRUS

Enter the initial CRZ ALT from CIRRUS

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.

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

Note: For minor changes in Critical Data post-dispatch P1 and P2 procedural steps may be conducted independently. Control must be transferred to facilitate this independent check.

PERF INIT page.....	Select	Both
Loadsheet identification	Verify	P1
State MACTOW.....	Read	P1
Zero Fuel Weight.....	Read	P1
Loadsheet Critical Data	Enter	P2

G-RAES, G-VIIA - G-YMMP

CAUTION: Do not enter the ZFW into the GR WT boxes. The FMC will calculate performance data with significant errors.

Enter the ZFW

Verify GR WT from CDU

Verify that FUEL value on CDU and Fuel Quantity indicator agree with Loadsheet value.

CIRRUS page 1:

Check for significant ZFW difference.

Calculated CDU GR WT.....	State	P2
Taxi weight.....	Confirm	P1

Verify that GR WT from CDU is similar to Taxi Weight on Loadsheets.

Takeoff performance calculation..... Verify P1
 Verify performance calculation weight value is appropriate for the aircraft type,
 runway start point and environmental conditions

GR WT Verify P1
 Verify GR WT and write in CARD output confirmation box.

THURST LIM Page Select Both

SEL derate..... Set P2
 Select climb derate as required.
 For full thrust takeoff leave SEL field blank.

Upper EICAS screen..... Verify Both
 Check derate and selected/default assumed temperature are displayed.

TAKEOFF REF Page..... Select Both

Takeoff performance calculation Verify P1
 State FLAP/ACCEL HT, EO ACCEL HT and THR REDUCTION.
 State V1.
 State VR and V2.
 State MACTOW to nearest integer.

Takeoff performance data Enter P2
 Flap
 Enter ACCEL HT, EO ACCEL HT and THR REDUCTION. If only ACCEL
 HT provided then enter this in to the three fields.
 V1, VR and V2
 MACTOW

**WARNING: If data checking after dispatch ensure that selected flap agrees with
 calculated value.**

**WARNING: CARD automatically uses IMPROVED CLIMB performance correction
 to maximise TOPL and improves assumed temperature (see
 Performance Manual). CARD values for VR and V2 must be used
 instead of the FMC values but FMC min Vs speeds must be observed.**

MCP Set P1
 IAS/Mach selector – Set V2
 Arm LNAV as needed
 Arm VNAV
 Initial Heading or Track – Set
 Initial Altitude – 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)

RTE page 2..... Verify Both
 Verify that the SID matches the ATC or Datalink clearance, if available

WIND REQUEST Select

- Load and execute en-route winds
- Load descent forecast winds

Note: No environmental data will be uplinked to the FMC unless the Critical Data procedure is completed before making a WIND 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.

THRUST ASYMMETRY COMPENSATION switch Auto

Verify that the OFF light is extinguished.

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.

G-RAES - G-VIIN, G-VIIS, G-YMMO - G-YMMU

IFE/PASS SEATS power switch ON

Verify that the OFF light is extinguished.

G-RAES - G-VIIN, G-VIIS, G-YMMO - G-YMMU

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.

BACKUP GENERATOR switches ON

The OFF lights stay illuminated until the respective engine is started.

APU selector (if needed) START, then ON

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

Verify that the FAULT light is extinguished

G-STBA – G-STBP

CAMERA LIGHTS switch As needed

L WIPER selector OFF

G-STBA – G-STBP

GROUND PROXIMITY OVERRIDE switch Off

G-STBA - G-STBP, G-YMMR - G-YMMU

ELT switch Guard 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 switch Guard closed
- 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 PRIMARY pump switches OFF
Verify that the FAULT lights are illuminated.
- DEMAND pump selectors..... OFF
Verify that the FAULT lights are illuminated.
- PASSENGER SIGNS panel Set
- NO SMOKING selector..... ON
- SEAT BELTS selector.....AUTO or ON when fuelling is complete
- Lighting panel..... Set
- OVERHEAD panel light controlMid position
- CIRCUIT BREAKER panel light control.....Mid position
- MASTER BRIGHTNESS switch ON
- MASTER BRIGHTNESS control As needed
- GLARESHIELD PANEL light controlMid position
- FLOOD light controlMid position
- LANDING LIGHT switches..... OFF
- 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.	
ENGINE panel	Set
EEC MODE switches	NORM
G-RAES, G-VIIA - G-VIIY	
START/IGNITION selectors	NORM
G-STBA - G-STBP, G-YMMA-G-YMMU	
START selectors	NORM
AUTOSTART switch	ON
Verify that the OFF light is extinguished.	
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 switches	OFF
Verify that the VALVE light is extinguished.	
FUEL PUMP switches	OFF
Verify that the left forward pump PRESS light 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.	
ANTI-ICE panel	Set
WING ANTI-ICE selector	AUTO
ENGINE ANTI-ICE selectors	AUTO
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
THERAPEUTIC OXYGEN switch.....	Guard closed
AIR CONDITIONING panel	Set
EQUIPMENT COOLING switches.....	AUTO
Verify that the OVRD lights are extinguished.	
RECIRCULATION FANS switches	ON
FLIGHT DECK TEMPERATURE CONTROL.....	Mid AUTO position
CABIN TEMPERATURE control.....	Mid position
PACK switches	AUTO
Verify that the OFF lights are extinguished.	
TRIM AIR switches.....	ON
Verify that the FAULT lights are extinguished.	
BLEED AIR panel	Set
LEFT, CENTER and RIGHT ISOLATION switches	AUTO
Verify that the CLOSED lights are extinguished.	
ENGINE bleed switches	ON
The OFF lights stay illuminated until the respective engine is started.	
APU bleed switch	AUTO
Verify that the OFF 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
FLIGHT DIRECTOR switch.....	ON
Display select panel	Set
LOWER CENTER display switch.....	Push
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

VOR/ADF switches As needed

ND mode selector MAP

ND CENTER switch..... As needed

ND RANGE selector As needed

ND TRAFFIC switch..... As needed

WEATHER RADAR.....Off
 Verify that the weather radar indications are not shown on the ND

Map switches As needed

G-RAES, G-VIIA - G-YMMP

PVD (As required).....ON and checked

Oxygen..... Test and set

Oxygen mask Stowed and doors closed

RESET/TEST switchPush and hold
 Verify that the yellow cross shows momentarily in the flow indicator.

EMERGENCY/TEST selector.....Push and hold
 While continuing to hold the RESET/TEST switch down, push the EMERGENCY/TEST selector for 5 seconds. Verify that the yellow cross shows continuously in the flow indicator.

Verify that the crew oxygen pressure does not decrease more than 50 PSIG.

If the oxygen cylinder valve is not in the full open position, pressure can:

- decrease rapidly, or
- decrease more than 50 PSIG, or
- increase slowly back to normal

RESET/TEST switch and EMERGENCY/TEST selector.....Release
 Verify that the yellow cross does not show in the flow indicator.

Normal/100% selector 100%

Crew and passenger oxygen pressure Check STATUS display
Verify that the pressure is sufficient for dispatch.

G-RAES, G-VIIA - G-YMMP

PVD brightness control..... As needed

G-RAES, G-VIIA - G-YMMF

SIDE DISPLAY control As needed

FORWARD PANEL brightness controlsMid position

Instrument source select panel Set

NAVIGATION source switchOff

DISPLAY CONTROL source switch.....Off

AIR DATA/ATT source switch.....Off

Clock..... Set

Time/date selector..... UTC

INBOARD DISPLAY selector MFD

FMC Selector..... AUTO

Do the Initial Data and Navigation Data steps from the CDU 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:

- 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
- Pitch mode is TO/GA
- AFDS status is FLT DIR

Select the MAP mode.

Landing gear panel..... Set

Verify that the GND PROX light is extinguished.

FLAP OVERRIDE switchOff

GEAR OVERRIDE switch	Off
TERRAIN OVERRIDE switch	Off
Landing gear lever.....	DN
ALTERNATE GEAR switch	Guard closed
AUTOBRAKE selector.....	RTO
EICAS display	Check
Verify that the primary engine indications display existing conditions	
Verify that no exceedance is shown	
MFD	Check
Secondary ENGINE indications	Check
Verify that the secondary engine indications show existing conditions	
Verify that no exceedance is shown.	
STATUS display switch	Push
Check status messages.	
CHECKLIST display switch.....	Push
LOWER CENTER cursor location switch	Push
Verify that the lower center cursor location light is illuminated.	
RESETS.....	Select
RESET ALL	Select
G-STBI – G-STBP	
COMMUNICATION display switch.....	Push
MANAGER	Select
SYSTEM INFORMATION.....	Select
Verify TAIL NUMBER is correct.	
INITIALISATION REQUEST.....	Select
Flight Number.....	Check or Enter
SEND.....	Select
PERFORMANCE REQUEST	Select
Enter the following data and ensure this is verified by the other pilot prior to sending the request. If this is not possible then the output must be verified by the other pilot.	
<ul style="list-style-type: none"> • Airport, runway • Intersection (only if necessary) 	

- Wind
- Temperature
- Pressure
- Wet or dry
- Anti-ice
- Estimated takeoff weight
- Performance correction codes (refer to Performance Manual)
- Card utilizes the wind/temperature information entered by the crew to obtain the optimum performance data. In the same way as with a manual calculation the performance calculation is a reflection on the data entered. Therefore if, after making a CARD request, the wind changes adversely, submit a further request (time permitting) with the latest wind information. If time does not permit another CARD request, then the CARD data can be adjusted by using the increment per knot figure from the appropriate part of the relevant takeoff page in the performance manual, as with a manual calculation.

SEND Select
MCP Set
Set V2 from mid value in CARD.

Center DISPLAY CONTROL source switch Off
CENTER PANEL BRIGHTNESS controls Mid position
Left radio tuning panel Set
Verify that the OFF light is extinguished
WEATHER RADAR panel Set
Select L from home base. R for return.
Center radio tuning panel Set
Verify that the OFF light is extinguished.
Observer’s audio control panel As needed
Flight deck door panel As needed
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.
Center CDU Set
Flight deck printer Set
Right radio tuning panel Set
Verify that the OFF light is extinguished.

- First Officer (Captain’s) audio control panel As needed
- Transponder panel Set
 - Verify L selected.
 - Verify 2000 STBY
- EVACUATION COMMAND switch Guard closed
- FLOOR LIGHTS switch As needed
- OBSERVER AUDIO selector NORM
- AISLE STAND PANEL light control Mid position
- AISLE STAND FLOOD light control Mid position
- Electronic Charting App Set
 - Select and sequence charting for the planned departure
 - Select and sequence charting for contingency procedures.

CAUTION: Distraction or excessive workload may occur if charting app is not correctly configured before critical flight phases.

CAUTION: Crews should consider the possibility of a non-normal event, e.g. airborne return when setting up the chart clip, in order to minimise the potential for distraction during times of high workload.

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
- 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.

Note: Captain Only duties include Check and sign Loadsheet, NOTOC and relevant customs documentation and sign AML. These items cannot be delegated and are not described within this section

G-RAES, G-VIIA - G-YMMP

PVD (As required)ON and checked

EFIS control panel Set

MINIMUMS reference selector RADIO or BARO

MINIMUMS selectorSet 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 CENTER switch..... As needed

ND range selector As needed

ND TRAFFIC switch..... As needed

WEATHER RADAROff

Verify that the weather radar indications are not shown on the ND.

Map switches As needed

Mode control panel..... Set

FLIGHT DIRECTOR switch..... ON

AUTOTHROTTLE ARM switches ARM

G-STBA - G-STBP, G-YMMR - G-YMMU

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 switchPush and hold

Verify that the yellow cross shows momentarily in the flow indicator.

EMERGENCY/TEST selector.....Push and hold
While continuing to hold the RESET/TEST switch down, push the
EMERGENCY/TEST selector for 5 seconds. Verify that the yellow cross shows
continuously in the flow indicator.

Verify that the crew oxygen pressure does not decrease more than 50 PSIG.

If the oxygen cylinder valve is not in the full open position, pressure can:

- decrease rapidly, or
- decrease more than 50 PSIG, or
- increase slowly back to normal

RESET/TEST switch and EMERGENCY/TEST selector.....Release
Verify that the yellow cross does not show in the flow indicator.

Normal/100% selector 100%

Crew and passenger oxygen pressure Check STATUS display
Verify that the pressure is sufficient for dispatch.

G-RAES, G-VIIA - G-YMMP

PVD brightness control..... As needed

G-RAES, G-VIIA - G-YMMF

SIDE DISPLAY control As needed

FORWARD PANEL brightness controlsMid position

Instrument source select panel..... Set

NAVIGATION source switchOff

DISPLAY CONTROL source switch.....Off

AIR DATA/ATTITUDE source switch.....Off

Clock..... Set

Time/date selector..... UTC

INBOARD DISPLAY selector..... MFD

HEADING REFERENCE switch..... 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
- 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.

ALTERNATE PITCH TRIM levers Neutral

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.

Note: Do not assume that the parking brake will prevent airplane movement.
Accumulator pressure can be insufficient.

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

Captain (First Officer's) audio control panel As needed

Electronic Charting App Set

- Select and sequence charting for the planned departure
- Select and sequence charting for contingency procedures.

CAUTION: Distraction or excessive workload may occur if charting app is not correctly configured before critical flight phases.

CAUTION: Crews should consider the possibility of a non-normal event, e.g. airborne return when setting up the chart clip, in order to minimise the potential for distraction during times of high workload.

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

BAV Merlin.....Confirm

Press the Green Tick to advance to ACARS tab

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
CDU display.....	Set	Both
Normally the PF selects the TAKEOFF REF page		
Normally the PM selects the LEGS page		

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

Exterior doors.....	Verify closed	P2
Flight deck windows	Closed and locked	Both
Verify that the WINDOW NOT CLOSED decal does not show.		
Verify that the orange indicator does not show.		
Ground crew clearance	Obtain	P1
Obtain a clearance to pressurise hydraulic systems.		
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.

Note: Pressurise the right system first to prevent fluid transfer between systems.

RIGHT ELECTRIC DEMAND pump selector AUTO
Verify that FAULT light is extinguished.

Center 1 and Center 2
ELECTRIC PRIMARY Pump switchesON
Verify that the FAULT lights are extinguished.
The Center 2 FAULT light may stay illuminated until after engine start because of load shedding.

LEFT ELECTRIC DEMAND pump selector AUTO
Verify that the FAULT light is extinguished.

Center 1 and Center 2
AIR DEMAND pump selectors AUTO
Verify that the FAULT lights are extinguished.

FUEL panel.....	Set	P2
LEFT and RIGHT FUEL PUMP switches	ON	
Verify that the PRESS lights are extinguished.		

If the FUEL IN CENTER message shows:

CENTER FUEL PUMP switchesON

One or both PRESS lights may stay illuminated until after engine start because of load shedding.

BEACON light switchON P2

CANCEL/RECALL switchPush P2
Verify that only the expected alert messages are shown.

CANCEL/RECALL switchPush P2
Verify that the messages cancel

Transponder.....XPNDR 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

Stabilizer trim__ UNITS
Set the trim for takeoff
Verify that the trim is in the greenband.

Aileron trim.....0 units

Rudder trim0 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

If there is no oil pressure indication after the EGT increases, do the ABORTED ENGINE START checklist.

Select the secondary engine display. P2

Start sequence..... Announce P1

G-YMMA – G-YMMU

The engines may be started at the same time.

Call “START ___ ENGINE” P1

G-RAES, G-VIIA - G-VIIY

Engine START/IGNITION selector.....START P2

G-STBA - G-STBP, G-YMMA - G-YMMU

Engine START selector.....START P2

FUEL CONTROL switch.....RUN P2

Verify that the oil pressure increases P1, P2

G-RAES - G-VIIY

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

G-YMMA - G-YMMU

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.**

APU selector..... OFF P2

ENGINE ANTI-ICE selectors.....As needed P2

Flap lever.....	Select takeoff flaps	P2
Recall.....	Check	P2
Verify that only expected alert messages are shown.		
Ground Crew clearance.....	Seen	P1
Verify that Ground Crew and equipment are clear and 'all clear' signal has been seen.		
Flight controls	Check	P1
Make slow and deliberate inputs, one direction at a time.		
WARNING: Only carry out this step once the Ground Crew have given the 'all clear' signal.		
Note: To avoid nuisance FLIGHT CONTROLS faults, a complete cycle of the control wheel during the flight control check should be done slowly (more than approximately 6 seconds) and not combined with the check of the pitch controls.		
Move the control wheel and the control column to full travel in both directions and verify:		
<ul style="list-style-type: none"> • 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:		
<ul style="list-style-type: none"> • freedom of movement • that the rudder pedals return to center 		
Call "BEFORE TAXI CHECKLIST"		P1
Do the BEFORE TAXI checklist		P2

Before Takeoff Procedure

G-RAES - G-VIIY

Engine warm up requirements:

- engine oil temperature must be above the bottom of the temperature scale

Engine warm up recommendations:

- run the engines for at least 3 minutes
- use a thrust setting normally used for taxi operations

G-YMMA - G-YMMU

Engine warm up requirements:

- engine oil temperature must be above the lower amber band before takeoff

Engine warm up recommendations:

- when the engines have been shut down more than 1.5 hours:
 - run the engines for at least 5 minutes
- when the engines have been shut down 1.5 hours or less:
 - run the engines for at least 3 minutes
- use a thrust setting normally used for the taxi operations

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

WARNING: If new take-off data is required do the Critical Data Procedure. This will be checked in the conditional statement for Critical Data Changes of the BEFORE TAKEOFF checklist.

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

Pilot Flying	Pilot Monitoring
	Acknowledge Final Loadsheet.
State MACTOW. Review SP.CG if appropriate.	
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.	
G-STBA – G-STBP Verify that the RAAS runway alert corresponds with the departure runway.	
	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.	
G-RAES - G-VIHY Advance the thrust levers to approximately 55% N1.	
G-YMMA - G-YMMU Advance the thrust levers to approximately 1.05 EPR.	
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 P1’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.	At VR, call “ROTATE”.
After liftoff, follow F/D commands.	Monitor airspeed and vertical speed.
Establish a positive rate of climb.	
	Verify a positive rate of climb on the altimeter and call “POSITIVE RATE”.

Pilot Flying	Pilot Monitoring
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.	
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.

Takeoff Flap Retraction Speed Schedule

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

Climb and Cruise Procedure

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

Note: Maintain at least 15 knots above minimum maneuver speed when climbing through FL200 to prevent the EICAS caution message, “AIRSPEED LOW” from occurring.

G-YMMA - G-YMMU

Note: Use of VNAV or maximum climb thrust is recommended when performing all step climbs.

Pilot Flying	Pilot Monitoring
	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 passenger 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
	If the FUEL IN CENTER message shows, set both CENTER FUEL PUMP switches to ON When the FUEL LOW CENTER message shows, set both CENTER FUEL PUMP switches to OFF
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”
Optimise flight using FMC.	
	Before the top of descent, modify the active route as needed for the arrival and approach.

Descent Procedure

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

Pilot Flying	Pilot Monitoring
	During descent, verify the RNP as needed.
Set Standby Altimeter to arrival airport pressure setting.	
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

Pilot Flying	Pilot Monitoring
	During arrival and approach, verify the RNP as needed.
	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. Monitor aircraft position and energy against briefed gates.	
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

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 mode.	
WARNING: When using LNAV to intercept the final approach course, LNAV might parallel the localizer without capturing it.	
Use 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	
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 radio altitude.	

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 or GPS approach use LNAV • for a LOC-BC, VOR or NDB approach use LNAV. • for a LOC, SDF or LDA approach use LNAV or LOC. 	
When on the final approach course intercept heading for LOC, LOC-BC, SDF, or LDA approaches: <ul style="list-style-type: none"> • verify that the localizer is tuned and identified G-RAES, G-VIIA - G-YMMP • verify that the LOC pointer is shown G-STBA - G-STBP, G-YMMR-G-YMMU • verify that the anticipation cue or 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 VNAV path 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.	
Verify the crossing altitude matches the charted value within 100 feet	
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 “POSITIVE RATE”
Verify a positive rate of climb on the altimeter and call “GEAR UP”	Set the Landing Gear lever to UP.
Limit bank angle to 15 degrees if airspeed is below minimum maneuver speed.	
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	
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
Call “AFTER TAKEOFF CHECKLIST”	Do the AFTER TAKEOFF checklist.

Landing Roll Procedure

Pilot Flying	Pilot Monitoring
Verify that the thrust levers are closed. Verify that the SPEEDBRAKE lever is UP.	Verify the speedbrakes are extended, if not manually select speedbrake lever UP and call "SPEEDBRAKES UP". If the speedbrake lever cannot be selected up call "SPEEDBRAKES NOT UP".
Monitor the rollout progress.	
Verify correct autobrake operation.	
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.	
If reverse thrust greater than idle is required call "FULL/PARTIAL REVERSE" as required.	Apply reverse thrust as needed.
	Verify that the forward thrust levers are closed. Without delay, raise the reverse thrust levers to the interlocks and hold light pressure until the interlocks release. When both REV indications are green, call "REVERSERS NORMAL." 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".
If full reverse thrust is needed call "FULL REVERSE"	Apply reverse thrust as directed.
When speed is decreasing below 60 knots call "REVERSE IDLE".	Call "60 KNOTS." By 60 KIAS, start movement of the reverse thrust levers to reach the reverse idle detent by taxi speed.
Safe stop assured and taxi speed reached call "FORWARD IDLE".	After the engines are at reverse idle, move the reverse thrust levers full down.
Before taxi speed, disarm the autobrake. Use manual braking as needed. Call "MANUAL BRAKES".	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.

G-YMMA – G-YMMU

Engine cool down recommendations:

- run the engines for at least 1 minute
- use a thrust setting no higher than that normally used for taxi operations

G-RAES - G-VIIY

Engine cooldown recommendations:

- Run the engines for at least 3 minutes
- Use a thrust setting normally used for taxi operations

Pilot Flying	Pilot Monitoring
Position/verify the SPEEDBRAKE lever is DOWN.	
	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".

Carry out Engine Out Taxi In procedure unless there are overriding safety or operational restrictions.

Shutdown Procedure

Start the Shutdown Procedure when approaching the parking stand.

APU selector.....	START, then ON	P2
External Lights.....	As Required	P2
Cabin Doors	Initiate Disarm	P2
PA call: “CABIN CREW DOORS TO MANUAL AND CROSSCHECK.”		
Parking brake	Set	P1
Verify that the PARK BRAKE SET message is shown.		
Electrical power	Set	P2

If APU power is needed:

 Check that the APU RUNNING message is shown.

If external power is needed:

 Verify that the PRIMARY EXTERNAL POWER AVAIL light is illuminated.

 PRIMARY EXTERNAL POWER switch..... Push
 Verify that the ON light is illuminated.

If the SECONDARY EXTERNAL POWER AVAIL light is illuminated:

 SECONDARY
 EXTERNAL POWER switch..... Push
 Verify that the 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):	
SEAT BELTS selectorOFF	P2
CAUTION: Verify Passenger DOORS MANUAL EICAS before selecting SEATBELT selector OFF.	
HYDRAULIC panelSet	P2
Note: Depressurise the right system last to prevent fluid transfer between systems.	
Center 1 and Center 2	
AIR DEMAND pump selectorsOFF	
Left ELECTRIC DEMAND pump selector.....OFF	
Center 1 and Center 2	
ELECTRIC PRIMARY pump switchesOFF	
RIGHT ELECTRIC DEMAND pump selectorOFF	
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.	
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

ADIRU switch.....	OFF	P2
RECIRCULATION FANS.....	___	P2
At LHR, or where PCA is available downroute, set the RECIRC FANS off.		
EXTERNAL POWER switches	ON	P2
APU selector.....	OFF	P2
BATTERY switch	OFF	P2
FD ACCESS switch	OFF	P2
Call “SECURE CHECKLIST”		P1
Do the SECURE checklist.		P2

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.

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.

RECIRCULATION FANS switches (both) - OFF

Allows conditioned air unit to operate at maximum efficiency.

After disconnecting ground conditioned air:

PACK switches (both) - AUTO

LOWER RECIRC FAN switch – ON

Packs Off Takeoff

Before takeoff:

PACK switches (both).....OFF

Wait 30 seconds before setting takeoff thrust.

G-YMMA - G-YMMU

[This step allows packs to shut down and EECs time to recompute maximum EPR line and reference/target EPR indications.]

G-RAES - G-VIIY

[This step allows packs to shut down and EECs time to recompute maximum N1 line and reference/target N1 indications.]

After takeoff:

PACK switches (both).....AUTO

After engine thrust is reduced from takeoff to climb and before reaching 3000 feet above field elevation, position both pack switches to AUTO.

Note: At airfields where a THR REDUCTION height in excess of 3,000 feet above field elevation is used, crews can position both pack switches to AUTO after engine thrust is reduced.

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

HEADING/TRACK reference switchPush
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, 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, LOC-BC, VOR or NDB approach: LNAV, TRK SEL, or HDG SEL
- 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.

Pilot Flying	Pilot Monitoring
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).

Pilot Flying	Pilot Monitoring
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:

A/P Disengage switch.....Push

Disengage the autopilot in accordance with regulatory requirements.

Circling Approach

CAUTION: If using ILS, 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

Landing Procedure – ILS PRM

These approaches differ from a conventional ILS in the following ways:

- Pilot qualification for generic PRM qualification
- An additional ‘secondary’ VHF ATC frequency which must be monitored by both pilots throughout the approach
- Airport-specific instructions published in the NAVTECH Aerochart
- The autopilot is recommended for the ILS portion.

If necessary the ‘Breakout’ instructions will be transmitted on the Secondary frequency. The Breakout Maneuver must be flown in the following way:

- Disengage the autopilot and switch off the Flight Director
- Do not press the TOGA Switches
- Immediate configuration changes are not necessary.

Breakout instructions will include one of the following instructions:

- “turn and climb”
- “turn and maintain altitude”
- “turn and descend”

In the event of a TCAS RA with simultaneous Breakout instructions issued:

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

Additional briefing items are:

- Autopilot breakout manually flown
- Go-around switches
- Workload during reconfiguration
- Autothrottle will provide speed control with Flight Directors off.

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

Pilot Flying	Pilot Monitoring
	Verify that the cabin is secure
Adjust vertical profile to ensure glideslope is joined from below.	
Call “FLAPS___” according to the flap extension schedule.	Set the flap lever as directed.
	Set L VHF to: <ul style="list-style-type: none"> • Tower frequency • Transmit and receive Set R VHF to: <ul style="list-style-type: none"> • ‘Approach Monitor’ frequency • Receive only
Monitor R VHF for breakout instructions. Ensure volume is the same as L VHF	
When on localizer intercept heading: <ul style="list-style-type: none"> • Verify that the ILS is tuned and identified • Verify that the LOC and G/S pointers are shown 	
Arm the 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 HDG SEL or HDG HOLD to intercept the final approach course as needed.	
Verify that the localizer is captured.	
Arm the APP mode.	
At glide slope active, 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 slope 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 or OM, verify the crossing altitude	
	Monitor the approach.
	Monitor auto callouts.

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.

Note: In order to display the AFTER TAKE OFF checklist it must first be reset. Select RESET AFTER TAKEOFF from the CHECKLIST RESET MENU.

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
- Go around and missed approach – PRM breakout

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.

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 otherwise it will cause ATC requests to be rejected.

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 PRIMARY pump switches	OFF
DEMAND pump selectors	OFF
WIPER selectors	OFF
Landing gear lever	DN
ALTN FLAPS selector	OFF
Electrical power	Establish
BUS TIE switches.....	AUTO

If external power desired:

PRIMARY EXTERNAL POWER AVAIL light	Illuminated
PRIMARY EXTERNAL POWER switch.....	Push

If the SECONDARY EXTERNAL POWER AVAIL light is illuminated:

SECONDARY EXTERNAL POWER switch.....	Push
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If APU power desired:

APU GENERATOR switch.....	ON
APU selector	START, then ON

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

Electrical Power Down

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

Before accomplishing the following steps, verify ADIRU, EMER LIGHTS and PACK switches are OFF and HYD PRESS SYS L+C+R message is displayed.

APU selector and/or EXTERNAL POWER switch(es) OFF

BATTERY switch OFF

Engines, APU

APU Ground Pneumatic Start

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

Duct Pressure..... Observe
Observe duct pressure is a minimum of 15 PSI (less 1 PSI per 1000 feet of pressure altitude)

Accomplish normal APU start.

Engine Battery Start

Accomplish the normal Exterior Inspection and the normal Preliminary Preflight Procedure – Captain or First Officer through “Circuit Breakers.....Check.”

BATTERY switchON

C1 and C2 PRIMARY pump switches OFF

DEMAND pump selectors OFF

WIPER selectors..... OFF

Landing gear lever.....DN

ALTERNATE FLAPS selector OFF

STANDBY POWER switch
(overhead maintenance panel)..... Push to BAT, release to AUTO

Center bleed ISOLATION switch OFF

Ground pneumatic source (if available) Connect

If the APU is required for pneumatic power:

 APU selector START, then ON

Speedbrake leverDown

Reverse thrust levers.....Down

Thrust levers Closed

Flap position indication and flap leverAgree

Parking brake..... Set

FUEL CONTROL switches CUTOFF

Captain’s audio control panel..... Set

Start the left engine using the normal Engine Start procedure. Bleed air is available only to the left engine.

Limit start attempts to one autostart or two manual start attempts.

After left engine is started:

Ground pneumatic source (if used)..... Disconnect

Center bleed ISOLATION switch AUTO

Complete the normal Preflight, Before Start and Engine Start procedures.

Engine Crossbleed Start

The APU must be shutdown or the APU Bleed switch must be turned off.

Verify the area behind the airplane is clear of equipment and personnel prior to increasing thrust on operating engine.

Thrust lever (operating engine) Advance

G-RAES – G-VIIY

Increase thrust until 5% N2 above idle (25 PSI minimum duct pressure)

G-YMMA – G-YMMU

Increase thrust until 5% N3 above idle (25 PSI minimum duct pressure.

Accomplish normal engine start.

Engine Ground Pneumatic Start

Duct pressure Observe

Accomplish normal engine start.

Manual Engine Start

Do the Aborted Engine Start checklist for the following abort start conditions:

- There is no oil pressure rise before selecting RUN
- EGT exceeds limits

G-RAES – G-VIIY

- The EGT does not increase by 20 seconds after the FUEL CONTROL switch is moved to run
- There is no N1 rotation indicated by 50% N2
- N2 does not reach idle within two minutes after selecting RUN

G-YMMA – G-YMMU

- The EGT does not increase by 30 seconds after the FUEL CONTROL switch is moved to run
- There is no N1 rotation indicated by 45% N3
- N3 does not reach idle within two minutes after selecting RUN

Select the secondary engine display.	P2
Start Sequence Announce	P1
AUTOSTART switch..... OFF	P2
Call “START ___ ENGINE”	P1

G-RAES, G-VIIA – G-VIIY

Engine START/IGNITION selector	START	P2
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G-STBA – G-STBP, G-YMMA – G-YMMU

Engine START selector	START	P2
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Verify that the oil pressure increases

G-YMMA – G-YMMU

Verify EGT less than 100 degrees C

G-RAES – G-VIIY

When at maximum motoring (less than 1% increase in N2 for approximately 5 seconds):

FUEL CONTROL switch	RUN	P2
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G-YMMA – G-YMMU

When at maximum motoring (less than 1% increase in N3 for approximately 5 seconds), or N3 greater than 25%, whichever occurs first:

FUEL CONTROL switch	RUN	P2
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Observe initial EGT rise and EGT within limits	P1, P2
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After the engine is stabilised at idle:

If AUTOSTART is operative:

AUTOSTART switch	ON	P2
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The AUTOSTART switch may stay OFF between manual starts when both engines are to be started manually.

After the engine is stable at idle, start the other 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 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 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:

Altimeters.....Set QNH

- 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**ADIRU Alignment/Position Update**

If an ADIRU 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.

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

ADIRU switch.....OFF 30 seconds, then ON

Wait an additional 30 seconds.

CDUSET

Enter the most accurate position in the boxes on the SET INERTIAL POS line of the POS INIT page.

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 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 Push

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 Push

Leave ORIGIN blank.

DEST Enter

Route..... Enter

LEGS key..... Push

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

ACTIVE and execute the route.

VNAV key Push
Shows the CLB page

TRANS ALT..... Enter

NAV RAD key..... Push

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, 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.

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..... Push

NEXT PAGE key Push

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 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 Push

NEXT PAGE key Push

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 Push

Destination navaid frequency and CRS (as needed) Enter

ND mode selector As needed
Select APP, VOR or MAP based on the type of approach to be flown.

FMS Position Update

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

POS REF page 2/3.....Select

POS REF 2/3 is the second page of POS INIT 1/3

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

Select the most appropriate source for FMC position updating.

UPDATE ARM.....Select

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

Appropriate source UPDATE NOW>.....Select

Navaid Inhibit or Enable

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.

To inhibit GPS:

INIT REF key Push

INDEX..... Select

POS Select

Displays the POS INIT page 1/3

PREV PAGE key Push

Displays the POS REF page 3/3

GPS NAV Select

Verify OFF displays in large font.

Note: the FMC uses inertial inputs only.

To enable radio updating:

INIT REF key Push

INDEX..... Select

NAV DATA..... Select

Note: the default state of RAD NAV INHIBIT is ON; all radio updating is inhibited. ON displays.

RAD NAV INHIBIT Select
 Selection enables all radio updating. Verify OFF displays.
 Second selection inhibits VOR/DME updating. Verify VOR displays.
 DME/DME updating is operable.
 Third selection inhibits all radio updating; ON displays.

To inhibit VORs, VOR/DMEs, VORTACs, or DMEs:

INIT REF key Push
 INDEX..... Select
 NAV DATA..... Select

To inhibit navaid data (up to two navaids):

 Navaid identifier (NAVAID INHIBIT line)Enter

To inhibit VOR ONLY data (up to two VORs):

 VOR identifier (VOR ONLY inhibit line).....Enter

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.

POS REF page 2/3.....Select
 POS REF 2/3 is the second page of POS INIT 1/3.

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:

 POS REF page 2/3.....Select
 RNP.....Delete

EGPWS

Airport Not in EGPWS Database

When operating to an aerodrome which is not in the EGPWS database complete the following steps:

Preflight Procedure – P2

Complete the procedure as normal except:

Terrain Override switch OVRD

Take-off Procedure

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

Terrain Override switch Normal

Approach Procedure

Complete the procedure as normal except before LOC capture:

Terrain Override switch OVRD

During Shutdown procedure:

Terrain Override switch (as installed)..... Normal

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
	Read and Acknowledge text ATC clearance. Accept ATC Uplink clearance.
Listen and transcribe voice ATC clearance	Listen and transcribe voice ATC clearance
	Validate and check clearance against FMC: <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)
	If needed, modify FMC, then check each waypoint (see CAUTIONS & Notes above) <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.
Independently validate and check FMC against clearance: <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
<p>Waypoint Crossing Procedure: Confirm:</p> <ul style="list-style-type: none"> • Active waypoint matches clearance • LNAV Roll FMA • Aircraft turns towards next waypoint 	
	<p>Check:</p> <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 CIRBUS. • Revise ETAs and advise ATC if required.

Fuel**Fuel Balancing**

If a fuel leak is suspected:

Accomplish the FUEL LEAK checklist.

If fuel balancing is desired prior to the display of the FUEL IMBALANCE alert message, accomplish the FUEL IMBALANCE non-normal checklist.

Warning Systems

G-STBA – G-STBP

Runway Awareness and Advisory System (RAAS) Override Operation

If one or more of the following exist:

- The airport is not in the GPWS database. This will be promulgated in NUBRF.
- A NOTAM applies to the intended runway
- Airline policy prohibits the use of RAAS for an airport or runway.

GROUND PROXIMITY RUNWAY OVERRIDE switch OVRD

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 (assumed temperature method) 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
- 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 4 inches (102mm).

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 (1500 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:

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.

Engine Start Procedure

Do the normal Engine Start Procedure with the following considerations:

G-STBA – G-STBP

- If the engine has been cold-soaked for more than four hours at ambient temperatures below -40°C , do not start or motor the engine. Maintenance personnel should do appropriate procedures for adverse weather heating of the fuel system components.
- 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 selectorsAUTO P2

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.

When engine anti-ice is required and the OAT is 3°C or below, do an engine run up as needed to minimise ice build-up. Use the following procedure:

Check that the area behind the airplane is clear. P1

G-RAES, G-VIIA – G-VIIY

Run-up to a minimum of 50% N1 for approximately 1 second duration at intervals no greater than 15 minutes.

G-STBA – G-STBP, G-YMMA – G-YMMU

Run-up to a minimum of 50% N1 for approximately 1 second duration at intervals no greater than 60 minutes.

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:

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

Wait approximately 10 seconds after pack switches are off before positioning bleed switches to off to reduce pack wear.

ENGINE bleed switches (engine running)..... OFF P2

Reduces the possibility of fumes entering the air conditioning system.

APU bleed switch (APU running) OFF P2

Reduces the possibility of fumes entering the air conditioning system.

After de-icing/anti-icing is completed:

APU.....As needed P2

Wait approximately one minute after de-icing is completed to restore engine and APU bleed air and pack operation to ensure all de-icing fluid has been cleared from the engines.

PACK switches.....	AUTO	P2
ENGINE bleed switches	ON	P2
APU bleed switvh.....	AUTO	P2

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.		
 G-YMMA – G-YMMU		
Engine oil temperature.....	Minimum 50°C	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:

G-YMMA – G-YMMU

Run-up to a minimum of 50% N1 and confirm stable engine operation before the start of the takeoff roll.

G-RAES – G-VIIY

Note: Operation in icing conditions may result in engine vibration indications above the normal operating range when ice shedding.

Run up to as high a thrust setting as practical (minimum of 50% N1), confirm stable engine operation, and if vibration indications are available, ensure engine vibration indications are below 4 units before the start of the takeoff roll.

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

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

WING ANTI-ICE switch Auto or OFF PM

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.

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

When engine anti-ice is no longer needed:

Nacelle anti-ice switches AUTO P2

When engine anti-ice is needed and OAT is 3°C or below, do an engine run-up, as needed, to minimise ice build-up. Use the following procedure:

Check that the area behind the airplane is clear. P1

G-RAES, G-VIIA – G-VIIY

Run-up to a minimum of 50% N1 for approximately 1 second duration at intervals no greater than 15 minutes.

G-STBA – G-STBP, G-YMMA – G-YMMU

Run-up to a minimum of 50% N1 for approximately 1 second duration at intervals no greater than 60 minutes.

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.

Note: If only cooling air from the ground air conditioning card is supplied (no pressurised air from the APU or ground external air) then the TAT probe is not aspirated. Because of high TAT probe temperatures the FMCs may not accept an assumed temperature derate. Delay selecting an assumed temperature derate until after bleed air is available.

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.

APU bleed air switch..... OFF P2

If APU bleed air will be used and the APU is not operating:

APU START, then ON P2

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

Note: Run the APU for one full minute before using it as a bleed air source.

ENG BLEED switches..... OFF P2

APU bleed switchAUTO P2

Engine Start Procedure

Do the normal Engine Start Procedure with the following modifications:

Note: Use a filtered ground cart for pneumatic air for engine start, if available.

G-STBA – G-STBP, G-YMMA – G-YMMU

Engine START selector..... START P2

G-RAES, G-VIIA – G-VIIY

Engine START/IGNITION selector.....	START	P2
Verify that the N2 RPM increases.....		BOTH
Allow maximum motoring for 2 minutes to help remove contaminants		

G-RAES – G-VIIY

Maximum motoring occurs when N2 acceleration is less than 1% in approximately 5 seconds.

G-YMMA – G-YMMU

Maximum motoring occurs when N3 acceleration is less than 1% in approximately 5 seconds.

FUEL CONTROL switch.....	RUN	P2
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Before Taxi Procedure

Do the normal Before Taxi Procedure with special emphasis on the following steps:

If bleed air is needed to maintain tolerable flight deck and cabin temperatures, use APU bleed air rather than engine bleed air during the taxi out. Limit APU bleed air use as much as possible to reduce sand and dust ingestion.

If APU bleed air will be used and the APU is not operating:

APU	START, then ON	P2
Do not allow the APU selector to spring back to the ON position.		

Note: Run the APU for one full minute before using it as a bleed source.

ENG BLEED switches.....	OFF	P2
APU bleed switch	AUTO	P2

Flight controls	Check	P1
Verify there is no increase in control forces due to sand or dust contaminants.		

Taxi-Out

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

G-YMMA – G-YMMU

- 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.

G-RAES – G-VIIY

- Use all engines during taxi and taxi at low speed. Limit ground speed to 10 knots and maintain thrust below 36% 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.

Before Takeoff Procedure

Do the normal Before Takeoff Procedure with the following modification:

If APU bleed air was used:

ENG BLEED switches.....	ON	PM
APU selector	As needed	PM

Takeoff

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

- Use the maximum fixed derate and/or assumed temperature thrust reduction that meets performance requirements.

G-RAES, G-VIIA – G-VIIN

- Avoid the use of 'bump thrust'
- 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.

After Landing

Do the normal After Landing Procedure with the following modifications:

If bleed air is needed to maintain tolerable flight deck and cabin temperatures, use APU bleed air rather than engine bleed air during the taxi out. Limit APU bleed air use as much as possible to reduce sand and dust ingestion.

If APU bleed air will be used and the APU is not operating:

APU START, then ON P2
 Do not allow the APU selector to spring back to the ON position.

Note: Run the APU for one full minute before using it as a bleed source.

ENG BLEED switches..... OFF P2
 APU bleed switchAUTO P2

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:

G-YMMA – G-YMMU

- Use all engines and taxi at low speed. Limit ground speed to 10knots and maintain thrust below 40% N1 whenever possible.

G-RAES – G-VIIY

- Use all engines and taxi at low speed. Limit ground speed to 10knots and maintain thrust below 36% 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.

G-YMMA – G-YMMU

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 EPR at or slightly above the magenta VNAV target EPR indication. Change thrust setting only if required to modify an unacceptable speed trend.

G-RAES – G-VIIY

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 N1 at or slightly above the magenta VNAV target N1 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

- 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
- Use the longest suitable runway provided it is clear of areas of known windshear.
- Use the flight director after takeoff.
- 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 20 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)

G-RAES – G-VIIO, G-YMMA – G-YMMU

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.

G-VIIP – G-VIIY

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. GE90-90 series engines have experienced several compressor damage events resulting from ice accumulation in the engine.

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:

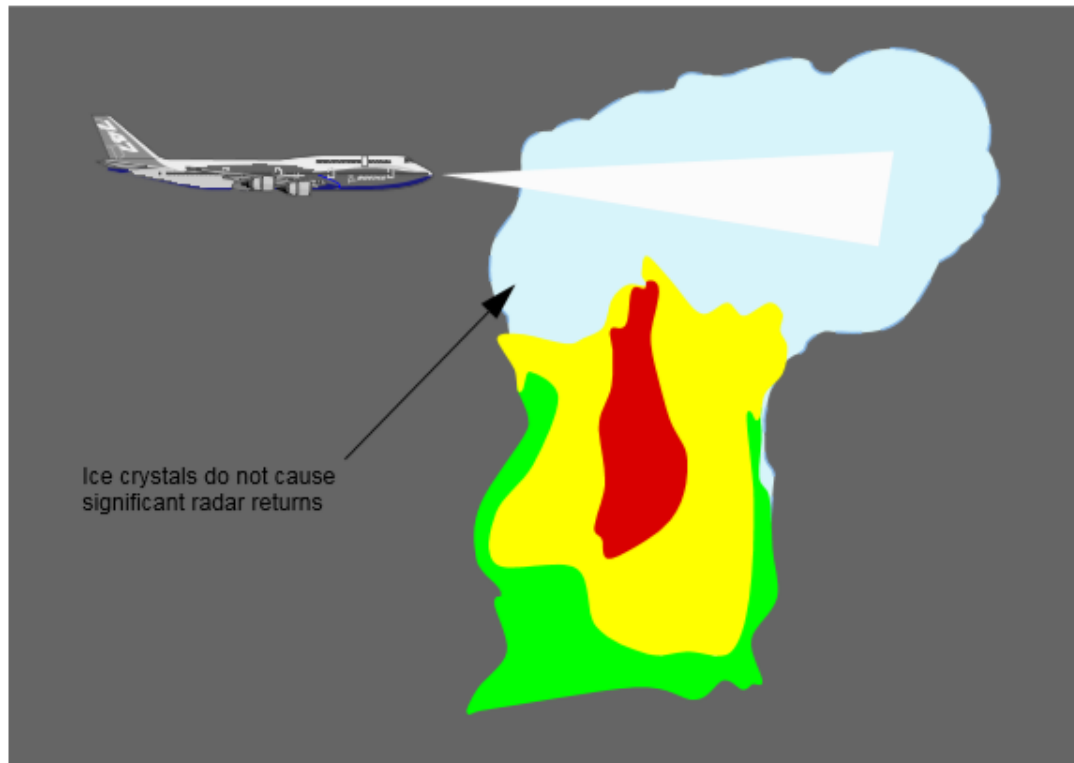
- Appearance of rain on the windshield at temperatures too cold for liquid water to exist. This is due to ice crystals melting on the heated windows (sounds different than rain)
- Airplane TAT indication remains near 0 degrees C due to TAT probe icing
- Areas of light to moderate turbulence
- In IMC 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

Changing CG in Cruise

CRZ CG is the furthest forward (lowest value) of the MACZFW and MACTOW found on the final loadsheet.

The furthest forward limit is 14%.

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: It is not necessary to start the APU before engine shutdown during taxi-in.

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:

ENGINE ANTI-ICE switch.....	AUTO	P2
FUEL CONTROL swtch	Confirm.....CUTOFF	P2

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 to ensure that power is supplied to the beacon lights

SEAT BELT SIGNS selector.....OFF

NO SMOKING 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, 1RDISARMED

Remote Hold

If REMOTE HOLD is required:

Before Taxi Procedure

Complete the Before Taxi procedure as normal except:

APU selectorOFF

When at remote holding point:

Parking brakeSET
Verify that the PARK BRAKE EICAS message is annunciated.

Electrical powerSET
Verify that the APU RUNNING memo is displayed on EICAS

ENGINE ANTI-ICE switches.....AUTO

Complete the shutdown procedure except:

FLAPSAs Required

Before Start Procedure

Complete the Before Start procedure as normal.

CAUTION: Take care with switch selections. Many switch positions will already be in the required position. Do not inadvertently deselect switches.

Complete the Before Taxi procedure as normal.