

Preface
Chapter Table of Contents

Chapter P1
Section 0

Volume 1

Title Page	0
Preface	P1
Model Identification	P1.1
Introduction	P1.2
Abbreviations	P1.3
Revision Record	P1.4
List of Effective Pages - FAA Approved	P1.5
Limitations	L
Normal Procedures.	NP
Normal Operational Information	NOI
Supplementary Procedures.	SP
Differences.	DF

Intentionally
Blank



747-400

Operations Manual

Volume 1

Delta Air Lines, Inc.

Revision Number: 21
Revision Date: September 23, 2016
© 2016 Delta Air Lines, Inc



Intentionally
Blank

September 23, 2016

Preface

Model Identification

Chapter P1

Section 1

General

The aircraft listed in the table below are covered in the operations manual. The numbers are used to distinguish data peculiar to one or more, but not all of the aircraft. Where data applies to all aircraft listed, no reference is made to individual aircraft numbers.

The table permits flight crew correlation of configuration differences by Registry Number in alpha/numeric order within an operator's fleet for aircraft covered in this manual. Configuration data reflects the aircraft as delivered configuration and is updated for service bulletin incorporations in conformance with the policy stated in the introduction section of this chapter.

The procedures and information contained in this manual also apply to aircraft acquired by Delta Air Lines subsequent to the current revision; however, this document may not address all pertinent information for these aircraft. In such instances, specific operating procedures and systems information can be found in appropriate Differences Chapter(s) and/or Fleet Bulletin(s) prior to their incorporation in the next scheduled revision.

Ship number is supplied by the operator. Registry number is supplied by the national regulatory agency. Serial and tabulation numbers are supplied by Boeing.

Ship Number	Registry Number	Serial Number	Tabulation Number
6301	N661US	23719	RT401
6302	N662US	23720	RT402
6303	N663US	23818	RT403
6304	N664US	23819	RT404
6305	N665US	23820	RT405
6306	N666US	23821	RT406
6307	N667US	24222	RT407
6308	N668US	24223	RT408
6309	N669US	24224	RT409
6310	N670US	24225	RT410
6311	N671US	26477	RM241

 DELTA
747-400 Operations Manual

Ship Number	Registry Number	Serial Number	Tabulation Number
6312	N672US	30267	RM242
6313	N673US	30268	RM243
6314	N674US	30269	RM244
6315	N675NW	33001	RM245
6316	N676NW	33002	RM246

Preface

Introduction

Chapter P1

Section 2

General

The manufacturer has developed normal and non-normal procedures for the B747-400 aircraft. Delta Air Lines, Inc. has modified some of these procedures for simplification and standardization, when appropriate, with other aircraft operated by Delta Air Lines, Inc. Finally, the FAA has approved the procedures presented in this Operations Manual.

These procedures are intended to be followed during normal ground operations and in flight. Deviations from these procedures should be made only with good cause and based on the safest course of action. The captain's best judgment must be applied if an abnormality occurs that is not covered by these procedures.

Manual Rights

The B747-400 Operations Manual has been prepared for the exclusive use of Delta Air Lines, Inc. Flight Operations personnel under the direction and authority of Delta and shall, at all times, remain the property of Delta. The holder hereof acknowledges and agrees that this manual contains or may contain trade secrets, copyrighted material and commercial and proprietary information, privileged and confidential, to the interest of Delta, and the holder hereof further agrees that this manual may not be reproduced, distributed or copied, in whole or in part, without the express prior written consent of Delta.

In the event this B747-400 Operating Manual is sold or distributed to any other party, no warranty or guarantee, expressed or implied, is made as to the accuracy, sufficiency or suitability of the materials contained herein or of any revision, supplement or bulletin hereto. It is understood and agreed to by such other party that it shall release, indemnify, and hold Delta Air Lines, Inc., its officers, employees and agents harmless against any and all claims or actions of whatever nature which may arise or claim to arise from the use hereof.

Corrections to the Manual

Log on to the Delta Flight Operations Portal, <http://deltanet.delta.com> and submit a Publications Change Request (PCR) to correct any errors or discrepancies discovered in this manual, or to submit a suggested change to any Aircraft Operating Manual, Volume 1, Volume 2, Quick Reference Handbook (QRH), Flight Crew Training Manual (FCTM), Normal Checklist, Airway Manual (AM), Flight Operations Manual (FOM), Operating Experience (OE/TOE) Guide, Fleet Bulletin (FB), or All Pilot Bulletin (APB).

There is a link to the PCR form at Deltanet > My Division > Pilot Support > Forms and Reports. Once submitted, the PCR is automatically routed to the applicable Fleet Technical Manager and Technical Writer for that manual.

Organization

The operations manual is organized in the following manner.

Volume 1

- Preface - Contains general information regarding the manual's purpose, structure, and content. It also contains lists of abbreviations, a record of revisions and a list of effective pages.
- Limitations - Covers operational limitations.
- Normal Procedures - Covers all amplified normal operating procedures and are based on a thorough analysis of crew activity required to operate the aircraft, and reflect the latest knowledge and experience available.
- Normal Operational Information - Contains reference material used to support normal procedures.
- Supplementary Procedures is organized by system and covers:
 - any procedure that is non-routine in nature,
 - any first-flight-of-the-day test or other systems test,
 - guidance on lengthy operating procedures, and
 - adverse weather procedures and guidance.
- Differences - Notes differences between aircraft models and variants.

Volume 2

- Preface - Contains general information regarding the manual's purpose, structure, and content. It also contains lists of abbreviations, a record of revisions and a list of effective pages.
- Contains general aircraft and systems information. These chapters are generally subdivided into sections covering controls and indicators and systems descriptions.

QRH

- Non-normal checklists - Contains checklists used to manage non-normal situations.
- Non-Normal Operational Information - Contains reference material used to support non-normal procedures.
- Non-Normal Checklist Instructions - Contains non-normal checklist instructions and evacuation flow/philosophy.
- Revision Record - Contains general information regarding the manual's purpose, structure, and content. It also contains lists of abbreviations, a record of revisions and a list of effective pages.

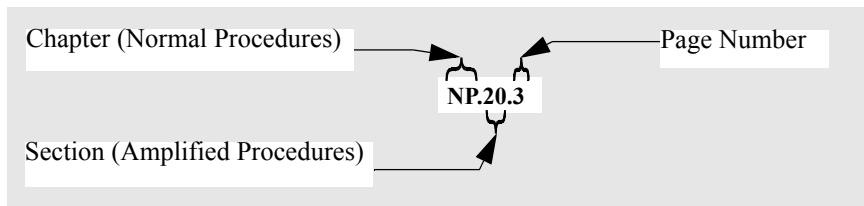
FCTM

- Preface - Contains general information regarding the manual's purpose, structure, and content. It also contains lists of abbreviations, a record of revisions and a list of effective pages.
- Provides information and recommendations on aircraft operations, maneuvers, techniques, and human factors.

Page Numbering

This manual uses a decimal page numbering system. The page number is divided into three fields; chapter, section, and page. An example of a page number for the Normal Procedures chapter follows:

Example Page Number



Warnings, Cautions, and Notes

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

Warning - A warning is an instruction about a hazard that if ignored could result in injury, loss of aircraft control, or loss of life. A warning will appear prior to the applicable step or item.

WARNING: Do not pressurize any hydraulic or pneumatic system until clearance is obtained from Maintenance.

Caution - A caution is an instruction concerning a hazard that if ignored could result in damage to equipment. A caution will appear prior to the applicable step or item.

CAUTION: Do not set takeoff thrust until oil temperature is above 50°C.

Note - A note provides amplified information, instruction, or emphasis. A note will appear after the applicable step or item.

Note: The checklist must not be modified in any way.

Aircraft Effectivities

Differences in aircraft configuration are shown by use of aircraft effectivities throughout Volumes 1 and 2, QRH, and the FCTM. The following rules are used to express aircraft effectivities:

- Aircraft effectivities are listed by model and/or ship number. A range of aircraft is defined by a dash, e.g. 6301 - 6308. A comma in the effectivity range indicates a break in the range, e.g. 6301 - 6305, 6307- 6309; aircraft 6306 is excluded from the range. Aircraft introduced to the fleet following manual publication are effective as subsequent ships, e.g. 6301 & Subsequent.
- Aircraft effectivities are listed in bold text throughout the manual, except in the Limitations chapter. In the Limitations chapter, aircraft effectivities are listed in bold when the effectivity applies to the entire section or subsection. When the effectivity applies only to a step within a section, it is listed in normal text.
- Aircraft effectivities apply only to the paragraph, illustration, operational note, procedural step, etc. and to subordinate items (if any). Refer to the examples below.

Example (with subordinate items):

9951 – 9961	
CTR TK PUMP (affected).....	OFF
Do not open the WING X FEED valve.	
OUTR TK XFR.....	ON

In this example, the effectivity 9951 - 9961 applies to the first procedural step (CTR TK PUMP.....) and the further indented/subordinate step (Do not...). The effectivity does not apply to the next equivalently indented step (OUTR TK XFR.....).

Example (without subordinate items):

Using ship number:

9951 – 9961	
CTR TK PUMP (affected).....	ON
OUTR TK XFR.....	OFF

In this example, the effectivity 9951 - 9961 applies to the first procedural step (CTR TK PUMP.....) only. The effectivity does not apply to the next procedural step (OUTR TK XFR.....).

Using model number:

767-300	
EQUIPMENT COOLING mode selector.....	AUTO

In this example, the 767-300 will have the selector in the AUTO position.

When aircraft effectivities are centered immediately below a checklist title, the entire checklist applies to the listed aircraft. In the following example, the FUEL L + R CTR PUMPS LO PR checklist is applicable to 9951-9961 only:

FUEL L + R CTR PUMPS LO PR
9951-9961

Preface

Abbreviations

Chapter P1

Section 3

General

The following abbreviations may be found throughout the manual. Some abbreviations may also appear in lowercase letters. Abbreviations having very limited use are explained in the chapter where they are used. This list is common across several fleets and some abbreviations may not apply to this specific fleet.

A	
ABV	Above
A/C	Aircraft
AC	Alternating Current or Aircraft
ACARS	Aircraft Communications Addressing and Reporting System
ACE	Actuator Control Electronics
ACP	Audio Control Panel
ACT	Active
ADC	Air Data Computer
ADF	Automatic Direction Finder
ADI	Attitude Director Indicator
ADIRS	Air Data Inertial Reference System
ADIRU	Air Data Inertial Reference Unit
ADM	Air Data Module
ADR	Air Data Reference
AED	Automated External Defibrillator

AFDC	Autopilot Flight Director Computer
AFDS	Autopilot Flight Director System
AFE	Above Field Elevation
AFM	Airplane Flight Manual (FAA approved)
AFM - DPI	Airplane Flight Manual - Digital Performance Information
AFS	Automatic Flight System (Autopilot or Autothrottle)
A/G	Air/Ground
AGL	Above Ground Level
AH	Alert Height
AHRS	Attitude Heading Reference System
AI	Anti-Ice
AIL	Aileron
AIMS	Airplane Information Management System
ALFA	Safe Stall Margin Speed
ALT	Altitude
ALT ACQ	Altitude Acquire
ALT HOLD	Altitude Hold

ALTN	Alternate
AM	Amplitude Modulation
AMI	Airline Modifiable Information
ANP	Actual Navigation Performance
ANT	Antenna
ANU	Aircraft Nose Up
AOA	Angle of Attack
AOC	Airline Operational Communication Data Link
A/P	Autopilot
APB	All Pilots Bulletin
APL	Airplane
APP or APPR	Approach
APU	Auxiliary Power Unit
ARINC	Aeronautical Radio, Incorporated
ARM	Aircraft Restrictions Manual
ARPT	Airport
ARR	Arrival
ART	Automatic Reserve Thrust
ASA	Autoland Status Annunciator
ASAP	As Soon As Possible
ASI	Airspeed Indicator
A/SKID	Anti-Skid
ASR	Airport Surveillance Radar
ASYM	Asymmetry

A/T	Autothrottle
ATA	Actual Time of Arrival
ATC	Air Traffic Control
A/THR	Auto Thrust Function
ATIS	Automated Terminal Information Service
ATM	Assumed Temperature Method
ATT	Attitude
AUTO	Automatic
AUTO-THROT	Autothrottle
AUX	Auxiliary
AVAIL	Available
AWABS	Automated Weight and Balance System
AWI	Altitude Warning Indicator
AWY	Airway
B	
BARO	Barometric
BAT	Battery
B/C or B/CRS or BAC or BCS	Back Course
BCL	Battery Charge Limiter
BFO	Beat Frequency Oscillator
BITE	Built-In Test Equipment
BKR	Breaker
BLD	Bleed
BLW	Below

▲ DELTA
747-400 Operations Manual

BMC	Bleed Air Monitoring Computer
BRG	Bearing
BRT	Bright
BSCU	Braking Steering Control Unit
BTC	Bus Tie Contactor
BTL	Bottle
BTL DISCH	Bottle Discharge (fire extinguisher)
BTMS	Brake Temperature Monitoring System
C	
C	Captain or Celsius or Center or Cool
CAA	Civil Aviation Authority
CADC	Central Air Data Computer
CALSEL	Call Select
CANC/RCL	Cancel/Recall
CANPA	Constant Angle Non-Precision Approach
CAP	Capture
CAPT	Captain
CAS	Calibrated Airspeed
CAWS	Central Aural Warning System
CB or C/B	Circuit Breaker
CCD	Cursor Control Device
CDI	Course Deviation Indicator

CDL	Configuration Deviation List
CDS	Common Display System
CDU	Control Display Unit
CDFS	Centralized Fault Display System
CFIT	Controlled Flight Into Terrain
CG	Center of Gravity
CHKL	Checklist
CHR	Chronograph
CIDS	Cabin Intercommunication Data System
CKD	Checked
CKT	Circuit
CL	Close
CLB	Climb
CLMP	Computer Lockout Manual Power
CLR	Clear
CMD	Command
CO	Company
COMM	Communication
COMP	Comparator
COMPT	Compartment
CON	Continuous
CONFIG	Configuration
CONT	Control
COOL	Cooling
CO RTE	Company Route
CRC	Continuous Repetitive Chime

CRS	Course
CRT	Cathode Ray Tube
CRZ	Cruise
CSM/G	Constant Speed Motor/Generator
CSTR	Constraint
CTL	Control
CTR	Center
CVR	Cockpit Voice Recorder
CWS	Control Wheel Steering
D	
DA	Decision Altitude
DA(H)	Decision Altitude (Height)
DC	Direct Current
DCL	Departure Clearance
DCU	Display Concentrator Unit
D/D	Direct Descent
DDG	Dispatch Deviations Guide
DDRMI	Digital Distance & Radio Magnetic Indicator
DEL	Delete
DEP	Departure
DEP ARR	Departure Arrival
DEPR	Depressurize
DES	Descent
DEST	Destination
DEU	Display Electronic Unit
DFDR	Digital Flight Data Recorder

DFGS	Digital Flight Guidance System
DH	Decision Height
DIFF	Differential
DIR	Direct
DIR TO	Direct To
DISC	Disconnect
DISCH	Discharge
DIST	Distance
DK	Deck
DMC	Display Management Computer
DME	Distance Measuring Equipment
DN	Down
DPC	Display Processing Computer
DSP	Display Select Panel
DSPL	Display
DTG	Distance to Go
DTW	Distance to Waypoint
DU	Display Unit
E	
EADI	Electronic Attitude Director Indicator
ECAM	Electronic Centralized Aircraft Monitor
ECB	Electronic Control Box (APU)
ECU	Electronic Control Unit
ECON	Economy
E/D	End of Descent
EDP	Engine Driven Pump

▲ DELTA
747-400 Operations Manual

E/E	Electrical/Electronic
EEC	Electronic Engine Control
EFB	Electronic Flight Bag
EFI	Electronic Flight Instruments
EFIS	Electronic Flight Instrument System
EFOB	Estimated Fuel On Board
EGPWS	Enhanced Ground Proximity Warning System
EGT	Exhaust Gas Temperature
EHSI	Electronic Horizontal Situation Indicator
EICAS	Engine Indication and Crew Alerting System
EIS	Electronic Instrument System
EIU	Engine Interface Unit
ELAC	Elevator Aileron Computer
ELEC	Electrical
ELEV	Elevator
EMER	Emergency
EMER GEN	Emergency Generator
ENG	Engine
ENG OUT	Engine Out
ENT	Entry
EO or E/O	Engine Out
EOAP	Electronic Overhead Annunciation Panel
EPR	Engine Pressure Ratio

EQPT or EQUIP	Equipment
ER	Extended Range
ETOPS	Extended Operations
EVAC	Evacuation
EVMU	Engine Vibration Monitoring Unit
E/WD	Engine/Warning Display
EXEC	Execute
EXT	Extend or External
F	
F	Fahrenheit or First Officer
FAC	Final Approach Course or Flight Augmentation Computer
FAA	Federal Aviation Administration
FADEC	Full Authority Digital Engine Control
FAF	Final Approach Fix
FAR	Federal Aviation Regulation
FB	Fleet Bulletin
FCC	Flight Control Computer
FCTL	Flight Control
FCU	Flight Control Unit
FD, F/D or FLT DIR	Flight Director
FF	Fuel Flow
FFM	Flight Force Monitor
FGCP	Flight Guidance Control Panel
FGS	Flight Guidance System

FILT	Filter
FIR	Flight Information Region
FL	Flight Level
FLCH or flch	Flight Level Change
FLT	Flight
FLT CTRL or F/CTL	Flight Control
FLPRN	Flaperon
FMA	Flight Mode Annunciator
FMC	Flight Management Computer
FMGC	Flight Management Guidance Envelope Computer
FMGS	Flight Management Guidance Envelope System
FMS	Flight Management System
F/O or FO	First Officer
FOB	Fuel On Board
FOM	Flight Operations Manual
FPA	Flight Path Angle
F-PLN	Flight Plan
FPM	Feet Per Minute
FPV	Flight Path Vector
FREQ	Frequency
F/S	Fast/Slow
FT	Feet
FWC	Flight Warning Computer
FWD	Forward

FWSOV	Fire Wall Shut Off Valve
FX	Fix
G	
GA	Go-Around
GCU	Generator Control Unit
GE	General Electric
GEN	Generator
GLC	Generator Line Contactor
GLS	GPS Landing System
GMT	Greenwich Mean Time
GND	Ground
GNSS	Global Navigation Satellite System
GP or G/P	Glide Path
GPS	Global Positioning System
GPWS	Ground Proximity Warning System
G/S	Glide Slope
GS	Ground Speed
GW	Gross Weight
H	
HAA	Height Above Airport
HAT	Height Above Touchdown
HDG	Heading
HDG REF	Heading Reference
HDG SEL	Heading Select
HF	High Frequency
HGS	Head-Up Guidance System (HGS® is a registered trademark of Flight Dynamics)

▲ DELTA
747-400 Operations Manual

HI	High
HLD	Hold
HMU	Hydrau-Mechanical Unit
HP	High Pressure
HPA	Hectopascals
HPSOV	High Pressure Shut Off Valve
HPV	High Pressure Valve
HSI	Horizontal Situation Indicator
HUD	Head Up Display
HYD	Hydraulic
HZ	Hertz
I	
IAF	Initial Approach Fix
IAN	Integrated Approach Navigation
IAS	Indicated Airspeed
ICAO	International Civil Aviation Organization
IDENT	Identification
IDG	Integrated Drive Generator
IFE	In-Flight Entertainment System
IFR	Instrument Flight Rules
IGN	Ignition
IGS	Instrument Guidance System
ILS	Instrument Landing System
IM	Inner Marker

IMC	Instrument Meteorological Conditions
IN	Inches
INBD	Inboard
IND	Indicator
IND LTS	Indicator Lights
INOP	Inoperative
INIT	Initialization
INSTR	Instrument
INT or INTPH	Interphone
INTC	Intercept
INTC CRS	Intercept Course
IP	Instructor Pilot or Intermediate Pressure
IRS	Inertial Reference System
IRU	Inertial Reference Unit
ISA	International Standard Atmosphere
ISDU	Inertial System Display Unit
ISFD	Integrated Standby Flight Display
ISLN or ISOL	Isolation
J	
JAA	Joint Aviation Authority
K	
K or KT or KTS	Knots
KCAS	Knots Calibrated Airspeed
KGS	Kilograms

KLAS	Knots Indicated Airspeed
L	
L	Left
LAT	Latitude
LAF	Load Alleviation Function
LAT REV	Lateral Revision
LAV	Lavatory
LBS	Pounds
LD	Load
LDA	Localizer-type Directional Aid
LDG	Landing
LDG ALT	Landing Altitude
LE	Leading Edge
L/G	Landing Gear
LIM	Limit
LIM SPD	Limit Speed
LKD	Locked
L NAV or LNAV	Lateral Navigation
LOC	Localizer
LOC-BC	Localizer Back Course
LOM	Locator Outer Marker
LON or LONG	Longitude
LP	Low Pressure
LR	Long Range
LRC	Long Range Cruise
LRU	Line Replaceable Unit
LSK	Line Select Key

LT	Light
LVL	Level
LVL/CH	Level Change
LWR CTR	Lower Center
LWR DSPLY or LWR DSPL	Lower Display
M	
M	Mach
MAC	Mean Aerodynamic Chord
MAG	Magnetic
MAHP	Missed Approach Holding Point
MAN	Manual
MAP	Missed Approach Point
MASI	Mach/Airspeed Indicator
MAX	Maximum
MB	Millibar
MCC	Maintenance Control Center
MCDU	Multi-purpose Control and Display Unit or Multi-function Control and Display Unit
MCO	Maintenance Carry Over
MCP	Mode Control Panel
MCT	Maximum Continuous Thrust
MDA	Minimum Descent Altitude
MDA(H)	Minimum Descent Altitude (Height)

▲ DELTA
747-400 Operations Manual

MDM	Mechanical Dispatch Manual
MEA	Minimum Enroute Altitude
MEL	Minimum Equipment List
MFD	Multifunction Display
MHZ	Megahertz
MIC	Microphone
MIN	Minimum
MKR	Marker
MLS	Microwave Landing System
MM	Middle Marker
MMO	Maximum Mach Operating Speed
MNPS	Minimum Navigation Performance Specification
MOCA	Minimum Obstruction Clearance Altitude
MOD	Modify
MORA	Minimum Off Route Altitude
MSA	Minimum Safe Altitude
MSG	Message
MSGS RCVD	Messages Received
MSL	Mean Sea Level
MTOW	Maximum Take-Off Weight
MTRS	Meters
MUH	Minimum Use Height
MZFW	Maximum Zero Fuel Weight

N	
N	Normal
NADP	Noise Abatement Departure Procedures
NAR	North America Route
NAV	Navigation
NAV RAD	Navigation Radio
ND	Navigation Display
NDB	Non Directional Beacon
NGS	Nitrogen Generating System
NLT	No Later Than
NM	Nautical Mile(s)
NNC	Non-Normal Checklist
NNM	Non-Normal Maneuver
NPS	Navigation Performance Scales
NORM	Normal
NW	Nose Wheel
N1	Low Pressure Rotor Speed
N2	High Pressure Rotor Speed (Pratt & Whitney and GE engines) or Intermediate Pressure Rotor Speed (Rolls Royce Engines)
N3	High Pressure Rotor Speed (Rolls Royce Engines)
O	
OAP	Overhead Annunciator Panel (a.k.a. EOAP)
OAT	Outside Air Temperature

OCC	Operations Control Center
ODM	Operational Data Manual
OFST	Offset
OHU	Overhead Unit
OM	Outer Marker
OP	Open
OUTBD DSPL	Outboard Display
OVHD	Overhead
OVHT	Overheat
OVRD	Override
OXY or O2	Oxygen
OVSPD	Overspeed
P	
PA	Passenger Address
PAPI	Precision Approach Path Indicator
PAR	Precision Approach Radar
pb	Push-Button
PBE	Protective Breathing Equipment
PCP	Pilot Call Panel
PDC	Pitch Data Computer or Performance Data Computer or Pre-Departure Clearance
PERF	Performance
PERF INIT	Performance Initialization

PES	Pitch Enhancement System
PF	Pilot Flying
PFAF	Precision Final Approach Fix
PFD	Primary Flight Display
PI	Performance Inflight
PIP	Product Improvement Package
PLI	Pitch Limit Indicator
PM	Pilot Monitoring
PMC	Power Management Control
PNL	Panel
POS	Position
POS INIT	Position Initialization
POS REF	Position Reference
PPI	Planned Position Indicator
PPOS	Present Position
PRES or PRESS	Pressure
PRED	Prediction
PREV	Previous
PRI	Primary
PROC T	Procedure Turn
PROG	Progress
PROX	Proximity
PRSOV	Pressure Regulating Shutoff Valve
P/RST	Push To Reset
PRV	Pressure Regulating Valve

▲ DELTA
747-400 Operations Manual

PSI	Pounds Per Square Inch
PTH	Path
PTT	Push To Talk
PTU	Power Transfer Unit
PWR	Power
PWS	Predictive Windshear System
Q	
Q	Quantity
QFE	Local Station Pressure
QNH	Altimeter Setting
QRH	Quick Reference Handbook
QT	Quart
QTY	Quantity
R	
R	Right
RA	Radio Altitude or Resolution Advisory
RAAC	Rotor Active Clearance Control
RAD	Radio
RAIM	Receiver Autonomous Integrity Monitoring
RAT	Ram Air Turbine or Ram Air Temperature
RCDR or REC	Recorder
RCL	Request for Clearance
RDMI	Radio Distance Magnetic Indicator
RECIR or RECIRC	Recirculation

REF	Reference
RET	Retract
REV	Reverse
RF	Radius-to-Fix (RF) Legs or Refill
RMI	Radio Magnetic Indicator
RMP	Radio Management Panel
RNAV or RNV	Area Navigation
RNP	Required Navigation Performance
RPL	Rudder Pressure Limiter
RPM	Revolutions Per Minute
RPR	Rudder Pressure Reducer
RR	Rolls Royce
RSEP	Rudder System Enhancement Program
RST	Reset
RSV	Reserves
RSVR	Reservoir
R/T	Radio Transmit
RTE	Route
RTO	Rejected Takeoff
RTP	Radio Tuning Panel
RUD	Rudder
RVR	Runway Visual Range
RVSM	Reduced Vertical Separation Minimum
RWY	Runway
S	
SAARU	Secondary Attitude Air Data Reference Unit

SAT	Static Air Temperature
SB	Service Bulletin
S/B	Speedbrake
SC	Single Chime
S/C	Step Climb
SCL	Secure Content Locker
SD	System Display
S/D	Step Descent
SDAC	System Data Acquisition Concentrator
SDCU	Smoke Detection Control Unit
SDF	Simplified Directional Facility
SEC	Spoiler Elevator Computer
SEI	Standby Engine Indicator
SEL	Select
SELCAL	Selective Calling
SMGCS	Surface Movement & Guidance Control System
SENS	Sensitivity
SERV	Service
SFCC	Slat/Flap Control Computer
SG	Symbol Generator
SID	Standard Instrument Departure
SPD	Speed
SPDBRK	Speedbrake
SPD LIM	Speed Limit
SPLR	Spoiler
SRS	Speed Reference System

STA	Station
STAB	Stabilizer
STAR	Standard Terminal Arrival Route
STAT or STS	Status
STAT INV	Static Inverter
STBY	Standby
STD	Standard
STRG	Steering
SW	Switch
SWTG	Switching
SYS	System
T	
T or TRU	True
T or TK or TRK	Track (to a Navaid)
TA	Traffic Advisory
TAA	Terminal Arrival Area
TACAN	Tactical Air Navigation
TAC	Thrust Asymmetry Compensation
TAI	Thermal Anti-Ice
TAS	True Airspeed
TAT	Total Air Temperature
T/C	Top of Climb
TCA	Terminal Control Area
TCAS	Traffic Alert and Collision Avoidance System
TCI	Thrust Computer Indicator
T/D	Top of Descent

▲ DELTA
747-400 Operations Manual

TDZ	Touch Down Zone
TDZE	Touch Down Zone Elevation
TE	Trailing Edge
TEMP	Temperature
TERR	Terrain
TFC	Traffic
TFR	Transfer
THR	Throttle or Thrust
THR HOLD	Throttle Hold
THS	Trimmable Horizontal Stabilizer
TK	Tank
TLA	Throttle Lever Angle
TMC	Thrust Management Computer
TMI	Track Message Identifier
TMSP	Thrust Mode Select Panel
TO or T/O	Takeoff
TOC	Top of Climb
TOD	Top of Descent
TOGA or TO/GA	Takeoff /Go-Around
TOGW	Takeoff Gross Weight
T-P	Turn Point
TPR	Turbine Pressure Ratio
TR	Traffic Resolution
TRP	Thrust Rating Panel
TRU	Transformer Rectifier Unit
TURB	Turbine or Turbulence

U	
UNLK	Unlock
UNLKD	Unlocked
UNSCHD or UNSCHED	Unscheduled
UPR DSPL	Upper Display
U.S.	United States
USB	Upper Side Band
UTC	Universal Time Coordinated
UTIL	Utility
V	
V	Volt
VA	Design maneuvering speed
VAL	Valve
VANP	Vertical Actual Navigational Performance
VASI	Visual Approach Slope Indicator
VDP	Visual Descent Point
VEF	Speed at Engine Failure
VERT	Vertical
VFE	Maximum Velocity Flaps Extended
VFR	Visual Flight Rules
VG	Vertical Gyro
VHF	Very High Frequency
VIB	Vibration
VLV	Valve

VMC	Visual Meteorological Conditions
VMCA	Minimum Control Airspeed or Single Engine Minimum Control Airspeed
VMCG	Minimum Control Speed Ground
VMO	Maximum Operating Speed
V NAV or VNAV	Vertical Navigation
VOR	VHF Omnidirectional Range
VR	Rotation Speed
VREF	Reference Speed
VRNP	Vertical Required Navigation Performance
V/S	Vertical Speed
VSCF	Variable Speed Constant Frequency
VSD	Vertical Situation Display
VSI	Vertical Speed Indicator
VSID	Vertical Speed Indicator Display
VTK	Vertical Track
V1	Takeoff Decision Speed or Critical Engine Failure Speed
V1 (MCG)	Minimum for Control on the Ground
V2	Takeoff Safety Speed
W	
W	Warm

WATRS	Western Atlantic Route System
WDR	Weight Data Record
WGS-84	World Geodetic system of 1984
WHC	Window Heat Computer
WHL	Wheel
WPT	Waypoint
WTB	Wing Tip Brake
WXR	Weather Radar
X	
X-FEED	Crossfeed
XFR	Transfer
FMGC	Flight Management Guidance Envelope Computer
XMTR	Transmitter
XPDR or XPNDR	Transponder
XTK	Cross Track
Z	
ZFCG	Zero Fuel Center of Gravity
ZFW	Zero Fuel Weight

Preface

Revision Record

Chapter P1

Section 4

Revision Notification Transmittal Letter

To: All holders of Delta Air Lines, Inc. Operations Manuals.

Subject: Operations Manual Revision.

This revision reflects the most current information available to Delta Air Lines, Inc. through the subject revision date. General information below explains the use of revision bars to identify new or revised information.

Revision Record

No.	Revision Date	Date Filed
0	January 1, 2010	
2	May 24, 2010	
4	November 8, 2010	
6	July 7, 2011	
8	December 22, 2011	
10	November 7, 2012	
12	May 9, 2013	
14	December 19, 2013	
16	September 25, 2014	
18	March 12, 2015	
20	March 25, 2016	

No.	Revision Date	Date Filed
1	April 11, 2010	
3	July 24, 2010	
5	March 17, 2011	
7	September 1, 2011	
9	April 12, 2012	
11	March 14, 2013	
13	August 13, 2013	
15	July 31, 2014	
17	November 20, 2014	
19	August 27, 2015	
21	September 23, 2016	

General

Delta Air Lines, Inc. issues operations manual revisions to provide new or revised procedures and information. Formal revisions also incorporate appropriate information from previously issued Fleet Bulletins.

The revision date is the date the revision material is distributed and considered current. EFB revision downloads and/or flight deck distribution should be accomplished as soon as possible, but may take as much as 21 days after the revision date for completion.

Revisions include a Transmittal Letter, Revision Record, Revision Highlights, and a List of Effective Pages. Use the information on the new Revision Record to review the revised operations manual content.

Revision Highlights

Pages containing revised technical and non-technical material have revision bars associated with the changed text or illustration.

Chapter P1 - Preface

Section 2 - Introduction

Corrections to the Manual

P1.2.2 - Updated the web address for logging on to the Delta Flight Operations Portal.

P1.2.2 - Updated the path for submitting PCR's.

Organization

P1.2.3 - Added human factors to list of topics covered in the FCTM.

Section 3 - Abbreviations

P1.3.4 - Added DCL - Departure Clearance.

P1.3.5 - Added First Officer as a definition for the abbreviation F.

Section 4 - Revision Record

P1.4.1 - Removed extraneous sentence.

P1.4.2 - Revised to match the electronic-only methodology.

P1.4.2 - Removed Filing Instructions section.

P1.4.2 - Updated language for cross-fleet standardization.

Chapter L - Limitations

Section 10 - Operating Limitations

Operational Limitations

L.10.1 - Changed Delta Special Pages to Company Pages.

L.10.2 - Updated the SP.16 reference.

Chapter NP - Normal Procedures

Section 11 - Normal Checklist Instructions

Normal Checklist Instructions

NP.11.1 - Grammar correction.

Section 12 - Operational Procedures

Standard Callouts

NP.12.5 - In Non-ILS, CAT I, & CAT II APPROACHES table, added Captain callout: "(If using autoland procedures) "LAND 2" or "LAND 3"").

Section 20 - Amplified Procedures

Interior Inspection - First Officer or Relief Pilot

NP.20.2 - Removed: differential is no greater than 15 psi on the tires paired on the same axle; tire pressures no longer have a 15 psi differential on shared axles.

Preflight Procedure - Pilot Flying

NP.20.15 - Changed Delta Special Pages to Company Pages.

Preflight Procedure - Captain

NP.20.26 - Changed Delta Special Pages to Company Pages.

Preflight Procedure - First Officer

NP.20.30 - Changed Delta Special Pages to Company Pages.

Before Takeoff Procedure

NP.20.50 - Added the following to the First Officer column: (On augmented crews, the following should be accomplished by the relief pilot.)

Climb Procedure

NP.20.54 - Changed to "Altimeters - Set to standard and verbalize."

NP.20.54 - Added comment to the Climb Checklist to verbalize the altimeter setting after altimeters are correctly set.

Cruise Procedure

NP.20.57-58 - Changed Delta Special Pages to Company Pages.

Descent Procedure

NP.20.59 - Added the following: (On augmented crews, the following should be accomplished by the relief pilot.)

NP.20.59 - Changed to "Altimeters - Set local altimeter setting and verbalize."

Approach Procedure

NP.20.61 - Changed to "Altimeters - Set local altimeter setting and verbalize."

Shutdown Procedure

NP.20.71 - Added bullet stating that autoland attempts must be recorded.
Formatting corrections.

Chapter NOI - Normal Operational Information

Section 3 - Approach Guidance

Using VNAV to Meet Altitude Constraints Prior to the Published
FAF/PFAF/FAP

NOI.3.3 - Added “/FAP” to section title.

NOI.3.3 - Added “,cleared for the approach,” and first bullet regarding
STAR/RNAV STAR.

ILS CAT I, LDA with GS - Approach Guide APP Mode

NOI.3.5 - Updated FMS approach procedure step to verify waypoints, altitude
constraints, courses (within 3°), and descent angle.

ILS CAT II or SA ILS CAT II - Approach Guide APP Mode

NOI.3.9 - Updated FMS approach procedure step to verify waypoints, altitude
constraints, courses (within 3°), and descent angle.

NOI.3.10 - Under Callouts. . .Review, added information for LAND 2 or
LAND 3.

ILS CAT III - Approach Guide APP Mode

NOI.3.11 - Updated FMS approach procedure step to verify waypoints,
altitude constraints, courses (within 3°), and descent angle.

NOI.3.11 - Reversed order of the RADIO and BARO settings so the last thing
the CA sets is RADIO 100 for the approaching minimums auto callout.

GPS, RNAV (GPS), or RNAV (GNSS) - Approach Guide LNAV &
VNAV Modes

NOI.3.13 - Updated FMS approach procedure step to verify waypoints,
altitude constraints, courses (within 3°), and descent angle.

NOI.3.14 - Added first bullet regarding STAR/RNAV STAR.

ILS (GS Out), LOC, LDA, or VOR - Approach Guide LNAV or LOC &
VNAV Modes

NOI.3.17 - Changed Delta Special Pages to Company Pages.

NOI.3.17 - Updated FMS approach procedure step to verify waypoints,
altitude constraints, courses (within 3°), and descent angle.

NOI.3.18 - Added first bullet regarding STAR/RNAV STAR.

Charted Visual Approach Guide (Procedure in FMS Database) LNAV &
VNAV Modes

NOI.3.19 - Changed Delta Special Pages to Company Pages.

NOI.3.19 - Updated FMS approach procedure step to verify waypoints, altitude constraints, courses (within 3°), and descent angle.

Chapter SP - Supplementary Procedures

Section 5 - Communications

Aircraft Communications Addressing and Reporting System (ACARS)

SP.5.14-17 - Added new section.

Section 16 - Adverse Weather

Cold Weather Operation

SP.16.8 - Changed Delta Special Pages to Company Pages.

SP.16.8 - Updated reference.

Remote (Engines Running)

SP.16.27 - Changed Delta Special Pages to Company Pages.

Preface

List of Effective Pages - FAA Approved

Chapter P1

Section 5

Page	Date
Volume 1	
* Title Page	September 23, 2016
* Blank	September 23, 2016
* P1.TOC.0.1-2	September 23, 2016
* P1.1.1-2	September 23, 2016
* P1.2.1-6	September 23, 2016
* P1.3.1-14	September 23, 2016
* P1.4.1-6	September 23, 2016
* P1.5.1-2	September 23, 2016
Limitations (tab)	
* L.TOC.0.1-2	September 23, 2016
* L.10.1-10	September 23, 2016
Normal Procedures (tab)	
* NP.TOC.0.1-4	September 23, 2016
* NP.10.1-8	September 23, 2016
* NP.11.1-8	September 23, 2016
* NP.12.1-10	September 23, 2016
* NP.20.1-74	September 23, 2016
Normal Operational Information (tab)	
* NOI.TOC.0.1-2	September 23, 2016
* NOI.1.1-2	September 23, 2016
* NOI.2.1-2	September 23, 2016
* NOI.3.1-24	September 23, 2016
Supplementary Procedures (tab)	
* SP.TOC.0.1-8	September 23, 2016
* SP.05.1-2	September 23, 2016
* SP.1.1-8	September 23, 2016

Page	Date
Supplementary Procedures (cont)	
* SP.2.1-2	September 23, 2016
* SP.3.1-2	September 23, 2016
* SP.4.1-6	September 23, 2016
* SP.5.1-98	September 23, 2016
* SP.6.1-2	September 23, 2016
* SP.7.1-6	September 23, 2016
* SP.8.1-2	September 23, 2016
* SP.10.1-4	September 23, 2016
* SP.11.1-56	September 23, 2016
* SP.12.1-6	September 23, 2016
* SP.15.1-2	September 23, 2016
* SP.16.1-42	September 23, 2016
Differences (tab)	
* DF.TOC.0.1-2	September 23, 2016
* DF.10.1-2	September 23, 2016

* = Revised, Added, or Deleted

Copyright © Delta Air Lines, Inc. See title page for details.

Intentionally
Blank

Limitations
Table of Contents

Chapter L
Section 0

Operating Limitations	L.10
General	L.10.1
Airplane General	L.10.1
Operational Limitations	L.10.1
Weight Limitations	L.10.2
Doors	L.10.2
Air Systems	L.10.3
Cabin Pressurization	L.10.3
Anti-ice, Rain	L.10.3
Autopilot/Flight Director System	L.10.3
AFDS	L.10.3
Automatic Landing	L.10.4
Communications	L.10.4
VHF Radios	L.10.4
VHF Frequency Limitation	L.10.4
ACARS	L.10.4
HF Communications	L.10.5
Engines, APU	L.10.5
Engine Limit Display Markings	L.10.5
Engine Oil System	L.10.5
Engine Ignition	L.10.5
Reverse Thrust	L.10.5
APU Duty Cycle Restrictions - Non-AFM Operational Information	L.10.6
Flight Controls	L.10.6
Flap Operation	L.10.6
Flight Management, Navigation	L.10.6
Weather Radar	L.10.6
Flight Instruments, Displays	L.10.7
RVSM Operations	L.10.7

Fuel System	L.10.7
Fuel Limitations	L.10.7
Fuel Loading	L.10.8
Fuel Temperature	L.10.8
Oxygen	L.10.9
Warning Systems	L.10.9
GPWS - Look-Ahead Terrain Alerting	L.10.9

Limitations

Operating Limitations

Chapter L

Section 10

General

747-400 aircraft must be operated in compliance with Certificate Limitations of the applicable FAA Approved Airplane Flight Manual (AFM). This chapter contains Airplane Flight Manual (AFM) limitations and manufacturer recommended non-AFM operating limitations.

Limitations that are obvious, shown on displays or placards, or incorporated within an operating procedure or flight plan/performance documents are not published in this chapter.

Those AFM limitations that are incorporated into other chapters of this manual, into the Vol. 2, or into the QRH are identified with an [AFM] tag.

Note: The symbol (#) indicates recall limitations. Recall limitations are those operationally significant limitations that must be committed to memory. Memorization is necessary because there are no placards, display indications, or markings indicating a limitation exists.

Note: A logbook entry is required any time an aircraft limitation is exceeded; e.g., overweight landing, engine exceedance, etc.

Airplane General

Operational Limitations

Runway slope	+/- 2%
# Maximum Operating Altitude	45,100 feet pressure altitude
#Maximum Takeoff and Landing Altitude	10,000 feet pressure altitude
Maximum Field Elevation	9,500 feet pressure altitude
Maximum Speed Operating in Reduced Vertical Separation Minimum (RVSM) Airspace	0.90 Mach
# Maximum Takeoff and Landing Tailwind Component	10 knots or as permitted by Company Pages

Note: For operations in Reduced Vertical Separation Minimum (RVSM) airspace, 0.90 Mach is not to be exceeded. The maximum speed, V_{mo} on the airspeed display and the audible warning will not reflect this restriction.

Non-AFM Operational Information

Turbulent air penetration speed is 290 to 310 KIAS/.82 to .85 Mach, whichever is lower.

Do not operate the weather radar in a hangar or within 50 feet of any fuel spill.

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

Crosswind

The Delta 747-400 crosswind limit is 30 knots for takeoff or landing, including gusts.

Note: The crosswind component may be further limited by low visibility approaches, autolands, or contamination.

Note: Refer to SP.16, Guidelines for Takeoff on Contaminated Runways or Landing with Braking Action Less than Good.

Weight Limitations

Weights	Pounds
Maximum Taxi Weight	873,000
Maximum Takeoff Weight	870,000
Maximum Landing Weight	630,000
Maximum Zero Fuel Weight	535,000

Doors

Door Mounted Power Assists and Escape Slides

Main door emergency evacuation slide/raft and pneumatic door opening systems must be armed with the mode select handle in the automatic position prior to taxi, takeoff and landing whenever passengers are carried.

Upper Deck Doors

The emergency evacuation slide must be in the AUTOMATIC mode, and the engagement of each escape slide pack extractor must be verified by a check that the knob is visible in the AUTOMATIC viewing port prior to taxi, takeoff and landing whenever passengers occupy the upper deck cabin.

Flight Deck Security Door

Verify that an operational check of the Flight Deck Access System has been accomplished according to approved procedures once each flight day.

Non-AFM Operational Information

Due to the overwing location of doors 3L and 3R, they must remain closed during the refueling process. Added fuel weight can cause fuselage flexing, which may require defueling to close these doors, if open. After the aircraft is refueled, doors 3L and 3R should only be opened in emergency circumstances.

Air Systems

Cabin Pressurization

Maximum differential pressure (relief valves)	9.4 psi
Maximum allowable cabin pressure differential for takeoff and landing	0.11 psi

Anti-ice, Rain

Non-AFM Operational Information

Engine anti-ice must be ON during all ground and flight operations if icing conditions exist or are anticipated, except when temperature is below -40°C SAT (referenced on PROG page 2). Engine anti-ice must be on prior to and during descent in icing conditions, including temperatures below -40°C SAT.

During ground operations when nacelle anti-ice is required and OAT is 3°C or below, the engines must be run up momentarily to a minimum of 50% N1 at intervals, not to exceed 15 minutes.

Do not use anti-ice if OAT or TAT exceeds 10°C .

Autopilot/Flight Director System

AFDS

The autopilot must not be engaged on takeoff until the minimum altitude of 250 feet AGL.

The autopilot must be disengaged before the airplane descends more than 50 feet below the DA/DDA unless it is coupled to an ILS glideslope and localizer or in the go-around mode.

For single autopilot ILS approaches, the autopilot must be disengaged before the aircraft descends below 100 feet on the glideslope.

Use of aileron trim with the autopilot engaged is prohibited.

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

Automatic Landing

Maximum allowable wind speeds when landing weather minima are predicated on autoland operations:

# Headwind	25 knots
# Tailwind	10 knots
# Crosswind	25 knots Note: CAT II/III crosswind limits are 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 25 or 30 only.

Communications

Non-AFM Operational Information

VHF Radios

6301 - 6310

With an operational ACARS system, the use of center VHF radio is not approved for ATC voice communications.

VHF Frequency Limitation

6311 - 6314

Do not use the center VHF radio on 120.000 MHz or 120.005 MHz as the required means of communication. If frequencies 120.000 MHz or 120.005 MHz are required, left VHF radio and right VHF radio communication systems must be operational for dispatch.

ACARS

With an operational ACARS system, the center VHF radio is not approved for ATC voice communications.

The datalink from the COMPANY format 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 & Balance, and Takeoff Data messages can be transmitted and received via the COMPANY format if they are verified per approved operational procedures.

HF Communications

Do not operate HF radios during refueling operations.

Engines, APU

Engine Limit Display Markings

Maximum and minimum limits are red.

Caution limits are amber.

Engine Oil System

Oil temperature must be greater than 50° C before advancing thrust levers to takeoff power.

Engine Ignition

Continuous ignition must be ON encountering:

- Heavy rain
- Severe turbulence
- Volcanic ash
- Icing conditions
- Standing water or slush on runway

Note: Continuous ignition is automatically provided when nacelle anti-ice is ON.

Reverse Thrust

Reverse thrust is for ground use only.

Backing the airplane with use of reverse thrust is prohibited.

APU Duty Cycle Restrictions - Non-AFM Operational Information

Observe the following starter duty cycle restrictions:

Between Starts	Wait
1 and 2	1 minute
2 and 3	5 minutes
3 and 4	1 minute
4 and 5	20 minutes
5 and 6	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 (design maneuvering speed).

Flap Operation

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

Do not extend or retract flaps between positions 1 and 5 during fuel jettison.

Non-AFM Operational Information

6301 - 6310

Use of speed brakes in flight with flaps extended past 10 is not recommended.

6311 - 6316

Use of speed brakes in flight with flaps extended past 20 is not recommended.

Flight Management, Navigation

Weather Radar

Do not operate weather radar in a hangar or within 50 feet of any personnel or a fuel spill.

Note: The hangar and personnel restrictions do not apply to the weather radar test mode.

Flight Instruments, Displays

RVSM Operations

Non-AFM Operational Information

The standby altimeter does not meet altimeter accuracy requirements of RVSM airspace.

The maximum allowable in-flight difference between captain and first officer altitude displays for RVSM operations is 200 feet.

The maximum allowable on-the-ground altitude display differences for RVSM operations are:

Field Elevation	Max Difference Between Captain & F/O	Max Difference Between Captain or F/O & Field Elevation
SEA LEVEL	40 feet	75 feet
5,000 feet	45 feet	75 feet
9,500 feet	50 feet	75 feet

Fuel System

Fuel Limitations

The use of JP-4 and Jet B fuels are prohibited in all B747-400 revenue operations.

Center Wing tank:

The center wing tank (CWT) fuel quantity indication system must be operative to dispatch with CWT mission fuel.

If the FUEL LOW CTR L or R message is displayed, both CWT override/jettison pump(s) must be selected OFF.

If the FUEL PRESS CTR L or R message is displayed, the corresponding CWT override/jettison pump must be selected OFF.

Horizontal Stabilizer Tank:

The following additional limitations must be followed if the horizontal stabilizer tank (HST) is fueled and used:

The HST fuel quantity indication system must be operative to dispatch with HST mission fuel.

If either the FUEL PMP STB L or R message is displayed while on the ground, both HST pumps must be selected OFF.

If either the FUEL PRES STB L or R message is displayed, both HST pumps must be selected OFF.

Defueling:

Prior to defueling any fuel tanks, perform a lamp test of the respective Fuel Pump Low Pressure indication lights. When defueling, the Fuel Pump Low Pressure indication lights must be monitored and the fuel pumps positioned to OFF at the first indication of fuel pump low pressure. When defueling with passengers on board, fuel pump switches must be selected OFF at or above approximately 7,000 pounds (3,200 kilograms) for the CWT, 3,000 pounds (1,400 kilograms) for main tanks, and 2,100 pounds (1,000 kilograms) for the HST. (These requirements apply for defueling or transferring between tanks.)

WARNING: Do not reset a tripped fuel pump circuit breaker.

WARNING: Do not cycle CWT and HST pump switches from ON to OFF to ON with any continuous low pressure indication present.

Note: In a low fuel situation, both CWT override/jettison pumps may be selected ON and all CWT fuel may be used.

Note: In a low fuel situation, both HST transfer pumps may be selected ON and all HST fuel may be used.

Fuel Loading

Non-AFM Operational Information

The minimum fuel quantity for departure is 50,000 pounds.

For lateral fuel imbalance (on the ground) in excess of 1,000 pounds between symmetrical fuel tanks or 1,000 pounds wing to wing, contact Flight Control.

Fuel Temperature

The maximum tank fuel temperature for Jet A, Jet A-1, or JP-5 is 54°C (130°F).

Tank fuel temperature prior to takeoff must not be less than -43°C (-46°F) or 3°C above the fuel freezing point temperature, whichever is higher. In-flight tank fuel temperature must be maintained at least 3°C above the fuel freezing point of the fuel being used. The use of Fuel System Icing Inhibitor additives does not change the minimum fuel tank temperature limit.

The maximum tank fuel temperature is 54°C (130°F), except when using JP-4 or Jet B the maximum is 43°C (110°F).

Oxygen

Non-AFM Operational Information

The base crew and passenger oxygen bottle pressure for dispatch is 1,400 PSI at 21°C (70°F).

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 is prohibited within 15 NM of takeoff, approach or landing at an airport or runway not contained in the GPWS terrain database. For airports and runways not contained in the installed GPWS terrain database, crews will be notified via Electronic Flight Crew Bulletin (EFCB) or flight plan remarks.

Intentionally
Blank

Normal Procedures

Chapter NP

Table of Contents

Section 0

Philosophy and Assumptions	NP.10
General	NP.10.1
Philosophy and Compliance with Normal Procedures	NP.10.1
Normal Procedures and CRM/TEM	NP.10.2
Terminology	NP.10.2
Crew Duties and Responsibilities	NP.10.3
Tasks Excluded from Normal Procedures	NP.10.3
Aircraft Configuration Changes During Normal Procedures	NP.10.4
Sequence, Flow and Responsibility for Tasks	NP.10.4
Use of Triggers	NP.10.4
Aircraft Limitations in Normal Procedures	NP.10.5
Relationship Between Procedures and Checklists	NP.10.5
Normal Procedures Construction	NP.10.6
System Discrepancies during Ground Operations	NP.10.8
Normal Checklist Instructions	NP.11
General	NP.11.1
Checklist Content	NP.11.1
Normal Checklist Use Policy	NP.11.1
Normal Checklist Instructions	NP.11.1
Procedure versus Checklist	NP.11.2
Procedural Errors or Omissions	NP.11.2
Checklist Initiation and Completion	NP.11.3
First Flight of the Day and After Shutdown Reminders	NP.11.4
Checklist Response Designators	NP.11.4
Checklist Challenges	NP.11.4
Checklist Responses	NP.11.5
Verification of Checklist Items	NP.11.6

Runway, Intersection, Departure, Performance Data, Approach Changes, or Go-Around.	NP.11.6
Operational Procedures	NP.12
Multi-Purpose Control Display Unit (MCDU)	NP.12.1
Automation Guidelines.	NP.12.1
Normal VHF Radio Management	NP.12.2
Stabilized Approach.	NP.12.2
Standard Callouts	NP.12.3
Clearance Verification Procedures.	NP.12.6
Lights Usage.	NP.12.8
Amplified Procedures	NP.20
Interior Inspection - First Officer or Relief Pilot	NP.20.1
Exterior Inspection - Captain or First Officer or Relief Pilot. . .	NP.20.5
Preflight Procedure - Pilot Flying	NP.20.12
Preflight Procedure - Pilot Monitoring.	NP.20.16
Preflight Procedure - Captain	NP.20.25
Preflight Procedure - First Officer	NP.20.30
Pushback Procedure	NP.20.37
Engine Start Procedure.	NP.20.41
After Start Procedure	NP.20.43
Taxi Procedure	NP.20.44
Delayed Start Procedure.	NP.20.49
Before Takeoff Procedure	NP.20.50
Takeoff Procedure	NP.20.52
Climb Procedure.	NP.20.54
Cruise Procedure	NP.20.55
Descent Procedure	NP.20.59
Approach Procedure.	NP.20.61
Landing Procedure	NP.20.63
Go-Around Procedure	NP.20.65

Landing Roll Procedure	NP.20.67
After Landing Procedure	NP.20.68
Shutdown Procedure	NP.20.69
Secure Procedure	NP.20.72

Intentionally
Blank

Normal Procedures

Philosophy and Assumptions

Chapter NP

Section 10

General

A procedure, as used in this manual, is a series of tasks that are required during a particular phase of flight. Normal procedures are routinely performed on most flights and are outlined in Section 20 of this chapter. The procedures are arranged in chronological order.

Normal procedures assume:

- All aircraft systems are operating normally
- The flight deck configuration is correct before the procedure commences
- The pilot is employing the use of autoflight systems
- The pilot has knowledge and understanding of aircraft systems and limitations

The above assumptions allow normal procedures to be written to the appropriate level of detail. For additional details including recommendations and techniques, refer to the Flight Crew Training Manual (FCTM).

Philosophy and Compliance with Normal Procedures

Normal procedures provide Delta pilots with the fundamental guidance to operate a flight safely and efficiently. As such, pilots are expected to:

- have a sound knowledge and understanding of normal procedures, and
- routinely use and comply with the procedures on every flight.

Procedures are written considering a normal operating environment. The captain may authorize a deviation from normal procedures when considered in the best interest of safety and/or in the event of a non-normal operating environment.

Normal Procedures and CRM/TEM

Normal procedures are designed to embrace the principles of Delta Air Lines' Crew Resource Management (CRM) and Threat and Error Management (TEM) strategies. For example, embedded in normal procedures are the requirements to provide briefings at key times during the flight. It is not practical, however, to include all aspects of CRM/TEM into normal procedures. Pilots must have a comprehensive understanding of Delta's CRM/TEM philosophy and use it in conjunction with normal procedures.

Terminology

May - The word "may" is used in a permissive sense to state authority or permission. Compliance is not mandatory.

Should - The word "should" is used to indicate that compliance is expected. Deviations are permitted only where an operational requirement exists.

Will, Shall, and Must - The words "will", "shall", and "must" are used in an imperative sense to state the requirement to accomplish the act prescribed. Compliance is mandatory unless an emergency situation exists where compliance would not be in the interest of safety.

Guide - A "guide" is a document that assists the pilot in conducting a normal procedure. The use of a guide is not mandatory.

Crew Duties and Responsibilities

The captain retains final authority for all actions directed and performed.

Crew duties are divided between the pilot flying (PF), pilot monitoring (PM), captain (C), and first officer (F).

The captain's general responsibilities during ground operations include:

- calling for checklists, and
- taxiing.

The first officer's general responsibilities during ground operations include:

- monitoring taxi,
- checklist reading,
- communications, and
- tasks requested by the captain.

The captain is responsible for assigning the PF role. Normally the PF/PM roles remain unchanged throughout the flight but the captain may change the assignments at any time due to operational needs.

The PF's general responsibilities during flight are:

- flight path management and airspeed control,
- aircraft configuration,
- navigation, and
- calling for checklists.

The PM's general responsibilities during flight are:

- monitoring flight path, airspeed, aircraft configuration, and navigation,
- checklist reading,
- communications, and
- tasks requested by the PF.

Tasks Excluded from Normal Procedures

The following procedures are not addressed in NP.20:

- flight deck lighting,
- crew comfort tasks,
- exterior lighting (Refer to NP.12, Exterior Lights Usage), and
- communication procedures.

Aircraft Configuration Changes During Normal Procedures

Prior to taxi, the flaps will be selected to the takeoff or default position.

During flight, the PF will call for any gear or flap change; the PM will verify that the airspeed and bank angle are appropriate before accomplishing the change. If operational necessity requires an immediate configuration change and the PM is occupied with other duties, the PF may announce the change and move the appropriate control. This should be understood as the exception and not the rule.

After landing, no configuration changes shall be made until clear of the active runway, or until the aircraft has reached taxi speed when a 180° turn is required.

Sequence, Flow and Responsibility for Tasks

The specific tasks within a procedure are arranged in a logical order. The sequence of the tasks within a procedure may be changed as necessary.

Tasks are accomplished from memory (with the exception of the Secure Procedure). This sequence is referred to as a flow pattern. Flow pattern guides assist in learning the sequence and are located in the Flight Crew Training Manual (FCTM).

Tasks are assigned to and normally performed by a specific pilot. The other pilot may perform the task.

Use of Triggers

A “trigger,” is an event that initiates a procedure or task. Procedures start with a trigger statement. For example, the trigger used to commence the Pushback Procedure is:

When all exterior doors are closed and the cabin is ready for pushback.

Triggers are also used within a procedure to define when a task or a series of tasks are normally accomplished.

Operational flexibility may dictate adjusting a particular trigger.

Aircraft Limitations in Normal Procedures

Aircraft limitations are generally found in the Limitations chapter of this manual and are not normally repeated in normal procedures. There are procedures, however, that are defined ideally when in context with a limitation. In these cases, the limitation will be referred to or embedded in the normal procedure. Pilots need to be aware that normal procedures do not always refer to limitations when they are applicable. Pilots must have a fundamental knowledge and understanding of aircraft limitations.

AFM limitations incorporated into a normal or supplementary procedure in the Volume 1, any section of the Volume 2, or any section of the QRH are identified with an [AFM] tag.

Relationship Between Procedures and Checklists

A normal checklist usually follows the completion of a normal procedure. The name of the checklist is either identical to the procedure that precedes it or is preceded with “After”. For example:

- After completing the Taxi Procedure, the captain calls for the Taxi Checklist.
- After completing the Takeoff Procedure, the PF calls for the After Takeoff Checklist.

Not all tasks within a procedure appear on the checklist that follows. Delta uses criteria that include input from human factor experts, FAA requirements, and fleet standardization to determine what tasks rise to the level that requires inclusion on a normal checklist.

Normal Procedures Construction

Table Header

Except for inspections and preflight procedures that are assigned to one crewmember, normal procedures are shown in a two-column table format. The column header indicates the crewmember responsible for each task. The pilot normally assigned the task is identified in the table header as follows:

- Pilot Flying,
- Pilot Monitoring,
- Captain,
- First Officer, or
- Any Crewmember (Secure Procedure only).

Table Cells

Each cell represents either:

- a single task;
- multiple related tasks;
- a Warning, Caution, or Note;
- clarifying information, or
- a trigger.

When the cell only appears in one column, the task is assigned to that pilot. When the table cell spans both columns, the task is applicable to both pilots. Due to space limitations and/or complexity, a task can span both columns but will be assigned to one pilot.

The following conventions are used to assign a task within a cell:

- (C) - captain,
- (F) - first officer,
- (PF) - pilot flying, or
- (PM) - pilot monitoring

Cell Content

Triggers appear across both columns in bold text and do not have a bullet. A task is identified with a bullet (●). When the task requires a control to be positioned, the name of the control device appears followed by the position in which it is to be placed. When either the control or position is labeled on the flight deck, the terms are capitalized. For example:

- **EMERGENCY LIGHTS** switch - OFF

Warnings and cautions appear before the task they affect. Notes will appear after the task they affect.

References

When it is deemed to be beneficial to refer the reader to another informational source, the notation “Refer to ____” is used.

Separate Tables within a Procedure

On some procedures a separate shaded table is used. The separate table contains tasks that are not part of the associated procedure and have one of the following characteristics:

- The tasks does not fit within the time-ordered flow of the procedure (e.g., transition altitude)
- The tasks are not required on every flight (e.g., runway change procedure)

System Discrepancies during Ground Operations

It is the crewmember's responsibility to verify correct system response.

Before engine start, if there is a discrepancy noted:

- Verify that the system controls are set correctly.
- Check the respective circuit breaker as required.
- Test the respective system light as required.
- Check the Mechanical Dispatch Manual (MDM) to decide if the condition has a dispatch effect.
- Decide if maintenance is needed.

During or after engine start, if there is a discrepancy noted:

- Complete the respective non-normal checklist (NNC).
- On the ground, check the MDM.

After engine start, the MASTER CAUTION system, annunciator lights and EICAS messages are the primary means of alerting the flight crew to non-normal conditions or incorrect configurations.

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

Normal Procedures

Chapter NP

Normal Checklist Instructions

Section 11

General

The primary purpose of the normal checklists is to ensure that the crew has properly configured the aircraft and to verify essential and critical items have been accomplished.

The explanation of each checklist is found in NP.20, Amplified Procedures section of this chapter.

Checklist Content

The checklist has the minimum items needed to operate the airplane safely.

Normal checklist items meet one or more of the following criteria:

- items essential to safety of flight that are not monitored by an alerting system;
- items essential to safety of flight that are monitored by an alerting system but if not accomplished, would likely result in a catastrophic event;
- items needed to meet regulatory requirements;
- items needed to maintain fleet commonality;
- items that enhance safety of flight and are not monitored by an alerting system;
- items that could result in injury to personnel or damage to equipment if not accomplished.

Normal Checklist Use Policy

The crew will use the checklist on every flight and for every phase of flight for which a checklist has been established.

Normal Checklist Instructions

In an event such as a taxi delay where all engines are shut down while off the gate, all procedures and checklists will be performed again starting with the Pushback checklist.

Procedure versus Checklist

Before accomplishing the checklist, each crewmember will configure all controls and systems in accordance with the associated normal procedure.

The checklist is then used to verify essential procedural tasks.

Additionally, when a checklist includes a challenge and response for a briefing, the associated briefing should be completed prior to calling for the checklist that contains the briefing. The checklist functions as a “check” list, not a “do” list.

The Secure Checklist is the only exception to this verification philosophy. Since these items are not performed on every flight, the Secure Checklist may be accomplished as a “read and do” checklist.

Procedural Errors or Omissions

If during the execution of a checklist the airplane configuration does not agree with the needed configuration:

- Stop the checklist,
- Complete the respective procedural steps, and
- Continue the checklist.

If it becomes apparent that an entire procedure was not accomplished:

- Stop the checklist,
- Complete the entire procedure, and
- Accomplish the entire checklist from the start.

Checklist Initiation and Completion

On the ground, the captain calls for the checklists and the first officer reads the checklists. In flight, the PF calls for the checklists and the PM reads the checklists. If a checklist is required but has not been called for, the other pilot should query the pilot responsible for calling for the checklist.

Whenever possible, accomplish checklists before or after high workload times.

Normally checklists are not called for until all associated procedural items are complete and there is an expectation that the checklist can be completed without interruption. The Preflight Checklist, however, may be initiated before the completion of the logbook and/or fuel required tasks. If either or both of these tasks are not complete, the checklist will be read up to the last completed task. When the remaining task(s) has been completed, the checklist will be continued. Additionally, when the transition level is below 10,000 feet, the approach checklist should be started, but will not be considered complete until the local altimeter is read.

Crewmembers may need to suspend a checklist for a short time to accomplish other tasks. The checklist should not be stowed prior to completion. If the interruption is short, continue the checklist with the next step. If a crewmember is not sure where the checklist was interrupted or the interruption is for an extended period of time, re-accomplish the checklist from the beginning.

After resuming the checklist, all checklist challenges and responses must be made by the designated pilot(s) before calling the checklist complete and stowing the checklist.

When all items of the checklist have been completed satisfactorily, the pilot reading the checklist shall announce “___ CHECKLIST COMPLETE” and may stow the checklist.

If all pilots vacate the flight deck after accomplishing the Preflight Checklist, the checklist must be re-accomplished.

First Flight of the Day and After Shutdown Reminders

The Normal Checklist (hardcard) includes first-flight-of-the-day and after shutdown reminders. They are on the hardcard as a convenient means to recall tasks that may have to be performed.

Checklist Response Designators

Located on the right side of specific checklist response items are designators indicating which crewmembers must verbalize a response. Items that do not have designators are to be accomplished silently.

The following designators are used:

- C - captain,
- F - first officer,
- C&F - captain and first officer,
- PM - pilot monitoring, and
- All - all flight deck crewmembers.

If a checklist item is identified with a C&F, a dual response is required. The first response will be made by the pilot being challenged, the challenger will then respond.

Checklist Challenges

Checklist challenges identify the control or task to be checked. The pilot reading the checklist shall read the specific challenge as written.

When a checklist challenge does not end with “switch” or “lever”, the challenge refers to system status. For example, “Landing Gear...”, refers to the status of the landing gear, not just the position of the lever.

When a checklist challenge ends with “switch” or “lever”, the challenge refers to the position of the switch or lever. For example, “Engine start levers...” refers to the position of the levers.

Checklist Responses

Checklist responses are spoken as written although some items may use abbreviations due to hardcard space limitations.

When a checklist response is shown in all capital letters it refers to switch or lever position. For example, “Engine start levers...CUTOFF.”

When a checklist response is written in lower case it refers to the status of the associated system. For example, “Landing gear...down.”

Tailored responses are included where appropriate.

When a checklist response does not allow the use of a specific switch position, the following terms are used as a response:

- A blank line “____” requires a unique response and is used when the response is a variable value; such as takeoff thrust, altimeters, bugs, flaps, slats, or stabilizer trim settings.
- as reqd means alternatives are available. Respond with the actual position of the control. For example, “Autobrakes.....3”.
- ckd means that controls or other systems have been evaluated/tested for proper system operation.
- complete indicates the associated procedure and/or procedural task in its entirety has been completed.
- entered indicates information, values or selections associated with the procedure have been correctly loaded in the appropriate location.
- set indicates panel switches, knobs, or bugs are verified to be in the correct position or the correct value has been entered.
- verified indicates the challenged items are correctly entered, annunciated, or have otherwise been confirmed to be correctly displayed.
- xckd indicates the associated value or setting has been confirmed to have been entered correctly at all locations, as specified.

An explanation of the checklist response appears in the Amplified Procedures section of this chapter when the response:

- is not obvious on how the procedure is verified and/or what needs to be verbalized,
- is not addressed at all in the procedure, or
- has a blank line “____.”

Verification of Checklist Items

When performing a checklist requiring verbalization, the crew will progress to the next item only after the response is confirmed by the crewmember being challenged.

The crewmember responding to a checklist challenge must confirm the task or procedure was completed by:

- visually verifying the checklist item, or
- observing the item was completed, or
- confirming completion with the crewmember who accomplished the procedure.

When responding to a checklist item, a visual verification must be accomplished, when possible.

Runway, Intersection, Departure, Performance Data, Approach Changes, or Go-Around

A■ indicates items that should be considered for re-accomplishment in the event of a runway, intersection, departure, performance data, approach change, or go-around.

Takeoff

In the event a runway, intersection, departure, or performance data change occurs after completing a checklist the captain should call for the runway/departure change items. After the necessary procedural steps are accomplished, the first officer will verbalize each change item by stating the challenge to the item. The designated crewmember(s) will respond with either:

- “NO CHANGE” for an item, or
- the appropriate checklist response for the item that changed.

Landing

In the event a runway or approach change occurs after completing a checklist the pilot flying (PF) should call for the runway/approach change items. After the necessary procedural steps are accomplished, the pilot monitoring (PM) will verbalize each change item (if not previously briefed) by stating the challenge to the item. The designated crewmember(s) will respond with either:

- “NO CHANGE” for an item, or
- the appropriate checklist response for the item that changed.

Note: If the landing runway assignment is changed and the captain determines the runway change can be accomplished visually, the captain may choose to waive the runway change items.

Intentionally
Blank

Normal Procedures

Operational Procedures

Chapter NP

Section 12

Multi-Purpose Control Display Unit (MCDU)

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

Make MCDU entries before taxi or when stopped, when possible. If MCDU entries must be made during taxi, the first officer makes the entries. The captain must verify the entries before they are executed.

In flight, MCDU entries will normally be made by the PF. When the autopilot is off, or when operating in a high workload environment, the PF should direct the PM to make MCDU entries. Both pilots should verify MCDU entries affecting lateral or vertical flight path.

Automation Guidelines

The automation policy is described in the FOM. The following guidelines are used to achieve these policies:

- Briefing should include any uncommon levels of automation and related monitoring expectations.
- VNAV should be used when available and appropriate during climb, cruise, and initial descent.
- Both pilots are responsible for comparing the performance of the autoflight system with the desired flight path of the aircraft.
- All pilot-induced lateral, vertical, and speed mode changes should be verbalized by the PF and, after referencing the FMA, the PM should verbally confirm the appropriate FMA status.
- Both pilots are responsible for monitoring the FMA and/or MCP whenever any component of the autoflight system is engaged and a flight mode change occurs.

Autopilot Guidelines

The PF will verbalize when the autopilot is engaged or disengaged.

When an autopilot is engaged:

- the PF should operate the MCP and
- the PM should verbalize that the proper selections have been set.

When an autopilot is not engaged:

- the PM should operate the MCP as directed by the PF and
- the PM should verbalize that the proper selections have been set.

Normal VHF Radio Management

VHF radios should normally be operated as follows:

- VHF L should be used for communications with ATC.
- VHF R should be used for communications with ramp control, station operations, and other company communications. When VHF R is not used for ramp or company communications, a listening watch on 121.5 should be maintained as conditions permit.
- VHF C should be used for ACARS datalink.

The first officer should clearly communicate to the captain the radio being used to receive taxi instructions.

Stabilized Approach

Delta defines a stabilized approach as maintaining a stable speed, descent rate, and lateral flight path while in the landing configuration.

WARNING: At any altitude, if the following stabilized approach criteria cannot be established and maintained, initiate a go-around. Do not attempt to land from an unstable approach.

No lower than 1000 feet AFE:

- Be fully configured for landing (gear and landing flaps extended).
- Maintain a stabilized descent rate not to exceed 1,000 fpm.
- Be aligned with the intended landing runway.

No lower than 500 feet AFE:

- Be on target airspeed.
- The engines are stabilized at the thrust setting required to maintain the desired airspeed and rate of descent.

Crossing the Runway Threshold:

- Positioned to make a normal landing in the touchdown zone.

Planned Deviations

- A circling maneuver and some published approaches (such as the River Visual at DCA) may require a planned deviation to the lateral stabilized approach criteria. Some published approaches require higher than standard descent rates. Verbalize all planned deviations during the approach briefing.

Unplanned Descent Rate Exceedance

- In the event of a momentary descent rate exceedance, crews may proceed as long as the descent rate exceedance is verbally acknowledged and corrective action is immediately initiated.

Standard Callouts

The following callouts will be verbalized by the appropriate crewmember.

Crews should focus on the aircraft state during the level-off period.

Some callouts are made automatically by aircraft aural systems. When a required callout is made automatically, it may be omitted by the appropriate crewmember.

On any approach, when the pilot flying (PF) can maintain visual contact with the runway, the “APPROACHING MINIMUMS” and “MINIMUMS” callouts are not required.

Note: If the Radio Altimeter is inoperative, reference the barometric altimeter for the “1,000” and “500” callouts.

TAKEOFF		
Condition	Crew Member	Callout
At 80 KIAS when HOLD annunciated	PM	“80 KNOTS, HOLD, THRUST NORMAL”
At V1	PM	“V1”
At VR	PM	“ROTATE”
At positive rate of climb	PM	“POSITIVE RATE”

CLIMB		
Condition	Crew Member	Callout
Approximately 1,000 feet below each assigned altitude	PM	“OUT OF __ FOR __”
Approaching transition altitude (if other than 18,000 feet)	PM	“TRANSITION ALTITUDE”

DESCENT		
Condition	Crew Member	Callout
Approximately 1,000 feet above each assigned altitude	PM	“OUT OF __ FOR __”
Approaching transition level (if other than FL 180)	PM	“TRANSITION LEVEL”

ALL APPROACHES		
Condition	Crew Member	Callout
Any significant deviation from planned flight path, airspeed or descent rate	PM	“SPEED +/- __” or “SINK __”, etc.
At approximately 1,000 AGL	PM	“1,000, CLEARED TO LAND” or “1,000, NO LANDING CLEARANCE”
Below 1,000 AGL: Any descent exceeding 1,000 feet per minute	PM	“SINK __”
At approximately 500 AGL	PM	“500”
Prior to descending below 100 feet above TDZE/Rwy Threshold Elevation: • With runway in sight (if not already called) • With runway not in sight	C	“RUNWAY IN SIGHT” (F must acknowledge) Note: This call not required on CAT III and visual approaches. “GO AROUND” (F must acknowledge)

CAT III APPROACHES		
Condition	Crew Member	Callout
Approximately 80 feet above alert height (AH)	PM	“APPROACHING MINIMUMS”
At alert height (AH)	PM	“MINIMUMS”
	C	“LAND 3” or “GO AROUND”

Non-ILS, CAT I, & CAT II APPROACHES		
Condition	Crew Member	Callout
Approximately 80 feet above minimums	PM	“APPROACHING MINIMUMS”
At or before minimums	C	“APPROACH LIGHTS IN SIGHT”, or “RUNWAY IN SIGHT” or “GO AROUND” (F must acknowledge)
At minimums	PM	“MINIMUMS”
	C	(If using autoland procedures) “LAND 2” or “LAND 3”

GO-AROUND ALL APPROACHES		
Condition	Crew Member	Callout
When a Go-Around is warranted	PF	“GO AROUND”
After proper FMA mode annunciation, announce pitch mode	PM	“TOGA VERIFIED”
	PF	“FLAPS ____”
At positive rate of climb	PM	“POSITIVE RATE”
	PF	“GEAR UP”

AFTER ALL LANDINGS		
Condition	Crew Member	Callout
Verify speedbrakes are up	PM	“SPEEDBRAKES UP”
If speedbrakes are not up	PM	“NO SPEEDBRAKES”
At 80 knots	PM	“80 KNOTS”

Clearance Verification Procedures

The pilot flying (PF) and pilot monitoring (PM) should monitor and confirm all issued ATC clearances, unless operational constraints (e.g., PAs or PM leaves flight deck) prohibit. If any pilot is unsure of the stated clearance, contact ATC to verify.

Note: If a clearance, departure procedure, or route is changed, reaccomplish the clearance verification procedure.

Clearance Type	Action	
	PF	PM
Pre-Departure Clearance (PDC)/Departure Clearance (DCL) via ACARS, CPDLC, or voice On voice clearances, both pilots should monitor and at least one pilot must write down the ATC clearance.		Referencing the departure clearance, verbalize the departure, route of flight, altitude, and any speed restriction to the PF.
	Referencing the FMS and MCP, verbalize the departure, route of flight, altitude, and any speed restriction to the PM.	
Taxi	The captain should repeat the taxi clearance after the first officer has read the clearance back to ATC. When issued complex and/or extensive taxi instructions, at least one pilot should write down, or enter into the FMS scratchpad, the taxi clearance.	
Takeoff	Acknowledge clearance items different than previously briefed.	
Altitude	Both pilots should verify the altitude specified by either an ATC clearance or a procedure has been set correctly by stating the altitude and pointing at the altitude display window. Ensure the proper altimeter reference - QNH, QNE, or QFE - is set.	

Clearance Type	Action	
	PF	PM
CPDLC	If any clearance is received via CPDLC, clearance must be reviewed by both PF and PM. Ensure the entire uplink is reviewed, referring to page numbers in order to assure the entire content is understood.	
Crossing Restrictions, Headings, and Airspeeds	Acknowledge the clearance received by repeating the new clearance.	
Class I or II Airspace	Refer to the Airway Manual, Airspace & Enroute Navigation, CDRC.	

Lights Usage

Exterior Lights Usage

Exterior lights should be used in accordance with the following:

Phase of Flight	Lights Usage
Aircraft is powered	Navigation/Position lights illuminated continuously. • NAV lights - ON • LOGO lights - ON
Engines running/aircraft moving	Anti-collision lights (beacons) illuminated immediately prior to aircraft movement or engine start, whichever occurs first. • BEACON - BOTH
Taxiing	Taxi light illuminated when moving or intending to move. • TAXI light - ON

Phase of Flight	Lights Usage
Crossing a runway	All exterior lights illuminated. Note: Avoid using LANDING and STROBE lights if they will adversely affect the vision of other pilots. • TAXI light - ON • RUNWAY TURNOFF lights - ON • LANDING lights - ON • WING lights - ON • STROBE lights - ON
Line up and wait	All exterior lights illuminated, except the landing lights. Note: Avoid using STROBE lights if they will adversely affect the vision of other pilots. • TAXI light - ON • RUNWAY TURNOFF lights - ON • WING lights - ON • STROBE lights - ON
Takeoff	All exterior lights illuminated. • LANDING lights - ON
In flight (above 18,000 feet)	Exterior lights extinguished, except the Anti-collision (beacon), logo, navigation/position, and strobe lights. • TAXI light - OFF • RUNWAY TURNOFF lights - OFF • LANDING lights - OFF • WING lights - OFF
In flight (below 18,000 feet)	All exterior lights illuminated. Note: The TAXI and RUNWAY TURNOFF lights may remain OFF until landing clearance has been received. • TAXI light - ON • RUNWAY TURNOFF lights - ON • LANDING lights - ON • WING lights - ON

Emergency Lights Usage

Emergency lights must be armed for taxi, takeoff, and landing. They are not required to be armed during either the boarding or deplaning process.

Intentionally
Blank

Normal Procedures

Chapter NP

Amplified Procedures

Section 20

Interior Inspection - First Officer or Relief Pilot

Normally the first officer or relief pilot accomplishes this procedure. However, it does not preclude the captain from completing all or part of the procedure if time and conditions dictate.

It is the responsibility of the flight leader/purser to verify the cabin emergency equipment inspection is completed. For flights without flight attendants on board, refer to SP.1, Cabin Inspection-Flights without Flight Attendants.

The Interior Inspection procedure assumes that the Electrical Power Up procedure is complete. Refer to SP.6, Electrical Power Up, if required.

WARNING: If a red A/C OUT-OF-SERVICE tag is installed, personnel are not to activate any system, control, switch, or circuit breaker without obtaining verbal approval of maintenance personnel (preferably the mechanic performing the repairs).

First flight of the day items (if required) Check

These checks or tests need only be accomplished prior to the first departure of the calendar day as noted in the aircraft logbook. These system tests are covered in the Supplementary Procedures chapter of this manual.

Procedure	Location
Observer Oxygen Mask(s) Test	SP.1
Flight Deck Access System Test	SP.1
Fire Warning System Test	SP.8

Flight deck security search Complete

Refer to FOM, chapter 4, Sensitive Security Information, for information and timing requirements.

Logbook Check

All crewmembers must review the logbook to become familiar with the history and maintenance status of the aircraft.

If there is doubt concerning the status of the logbook, contact MCC via the dispatcher.

- Ensure the logbook matches the aircraft ship number.
- Ensure the Airworthiness Release has been signed by Maintenance.

Note: Airworthiness Release sign-off is not required at a Delta non-maintenance station when aircraft airworthiness discrepancies do not exist.

- Review any EP-19s for special equipment and/or operating instructions.
- Consult the MDM for any operating limitations or crew operating procedures as a result of existing MELs/CDLs.

STATUS Check

Verify that only acceptable messages are shown. [AFM]

Quantities Check

Check the following are sufficient for flight:

- minimum oxygen pressure: 1400 psi
- hydraulic quantities: No RFs or LOs displayed
- tire pressure minimum: 208 psi
- engine oil quantities: 12 quarts min (flights less than 4 hours) or 16 quarts (flights greater than 4 hours)

Required documents Check

- Aircraft Logbook
- Normal Checklists (2)
- Jeppesen Airside Flight Kits
- Quick Reference Handbook (QRH) (2)
- Mechanical Dispatch Manual (MDM)
- Quick Reference Card

EFB Mounts Check

Verify 3 EFB mounts on board.

Flight deck emergency equipment Check

- Fire extinguisher - Check and stowed
 - trigger safety pin in place

- seal intact
- pressure in green band
- properly stowed
- Crash axe - stowed
- PBE - check
 - Verify the PBE is in its stowage bracket and both plastic seals are intact.
- Five emergency escape inertial reels - stowed

6301-6314

- Smoke goggles
- Life vests - stowed
- Portable oxygen bottles - check

FLIGHT DECK ACCESS SYSTEM switch NORM (guard closed)

Flight deck overhead hatch Closed and latched

Smoke evacuation handle Check

Jumpseat(s) Secure

Ensure jumpseat(s) that will be unoccupied for the flight are secured and shoulder harnesses are retracted or secured. Lap belts should be fastened in non-folding jumpseats.

Crew luggage Secure

Printer paper Check

Verify printer paper quantity, including spare rolls, is sufficient for the duration of the flight.

Overhead maintenance panel Guards closed,
lights extinguished

The split system breaker OPEN light may be illuminated.

COCKPIT VOICE RECORDER - Check

Refer to SP.5, Cockpit Voice Recorder Test.

SQUIB TEST - Check

Refer to SP.8, Squib Test.

Circuit breakers Check

Verify circuit breakers are in or collared in compliance with dispatch requirements.

Pilot crew rest area	Check
Verify the security, integrity, and provisioning of the pilot crew rest area(s). Ensure bedding provisions for the pilot crew rest area(s) is sufficient for all flight deck crewmembers. The cabin crew is responsible for the preflight of the flight attendant rest area.	
Verify the following emergency equipment:	
• Portable oxygen bottle - Check • Life vest - Stowed	
Potable water and waste tanks	Check
Water quantity must indicate “F” (full) for Transpacific flights and no less than “3/4” full for the following flights:	
• Transatlantic • Asian Interport (e.g., NRT-TPE, NRT MNL) • U.S. mainland to/from Hawaii	
6301 - 6310	
The Lavatory Waste system indicates full by illumination of the INOP light on the respective lav switch.	
6311 - 6316	
The rotary switch must be selected to see individual tank quantities. Contact operations if waste quantities exceed 1/4 (outside of green band).	

Exterior Inspection - Captain or First Officer or Relief Pilot

Before each flight the captain must verify the airplane is in satisfactory condition for flight. Make a complete exterior inspection, and report any discrepancies to the captain and to maintenance as soon as possible. Emphasis should be placed on tire wear, airframe or control damage, and leaking fluids.

Be aware of security issues. Refer to FOM, chapter 4, Sensitive Security Information.

Following the route below, complete the preflight at the point where the inspection began, ensuring a complete circuit around the aircraft.

Items at each location may be checked in any sequence.

Ensure that:

- surfaces and structures are clear, undamaged, not missing parts, and there are no fluid leaks.

Note: assessing the condition of the upper wing surfaces may require viewing from inside the aircraft

- hydraulic lines and electrical wires are secure and undamaged.
- installed placards are readable.
- gear struts are not fully compressed.
- gear pins have been removed.
- engine inlets and tailpipes are clear, cowlings are secured and undamaged, and the reversers are stowed.
- doors and access panels that are not in use are latched.
- probes, sensors, ports, vents, and drains are unobstructed, clear, and undamaged.
- skin area adjacent to the pitot probes and static ports is not wrinkled.
- antennas are not damaged.
- light lenses are clean and not damaged.
- exterior lights are illuminated in accordance with NP.12, Lights Usage.

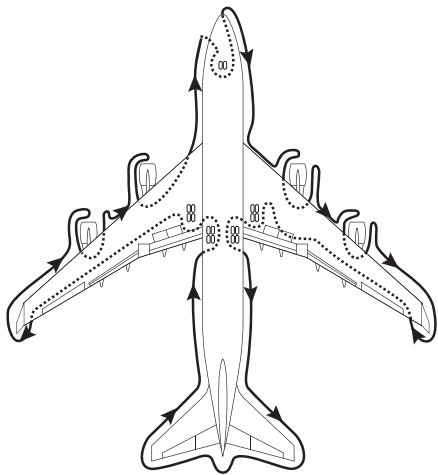
Notify maintenance if any:

- tread groove is worn completely around the tire,
- tires are worn beyond limits, damaged, or tread is separating,
- layer of cord is showing,
- questionable cut exists,
- tire shows appearance of improper inflation, or
- wheel through-bolt or nut is missing or damaged.

For Cold Weather Operation, refer to SP.16.

Check the following specific items during the exterior inspection:

Inspection Route



Left Forward Fuselage

- Probes, sensors, ports, vents and drains (as applicable)..... Check
- Doors and access panels (not in use)..... Latched

Nose

- Radome Check
- Diverter strips - Secure
- Doors and access panels (not in use)..... Latched
- Probes, sensors, ports, vents and drains (as applicable)..... Check
- Wipers and windshield Check

Nose Landing Gear and Wheel Well

Tires and wheels	Check
Gear strut and nose wheel steering assembly	Check
Gear doors	Check
Exterior lights	Check
Gear pin	Removed
Hydraulic lines and electrical wires	Check
Nose gear steering lockout pin	As required

If towbar is attached, towing lever set to bypass, pin installed.

Doors and access panels (not in use)	Latched

Right Forward Fuselage

Probes, sensors, ports, vents, and drains (as applicable)	Check
Doors and access panels (not in use)	Latched
Negative pressure relief doors	Check
Oxygen pressure relief green disc	In place
Exterior lights	Check

Right Inboard Wing and Lower Fuselage

Probes, sensors, ports, vents, and drains (as applicable)	Check
Doors and access panels (not in use)	Latched
Exterior lights	Check
Pack inlet	Check
Fuel sticks	Check
Leading edge flaps	Check

Number 3 & 4 Engines

Doors and access panels (not in use)	Latched
Probes, sensors, ports, vents, and drains (as applicable)	Check
Fan blades and spinner	Check
Thrust reverser	Stowed
Strut midspar fuse pins alignment stripes	Check
A minimum of 1/2 of each stripe must align. A stripe is on the inboard and outboard side of each strut.	
Exhaust area and tailcone	Check
Fuel sticks	Check

Right Wing and Leading Edge

Doors and access panels (not in use)	Latched
Probes, sensors, ports, vents, and drains (as applicable)	Check
Leading edge flaps	Check
Fuel sticks	Check

Right Wing Tip and Trailing Edge

Exterior lights	Check
Static discharge wicks	Check
Fuel jettison nozzle	Check
Control surfaces	Check
Flaps and fairings	Check

Right Landing Gear and Wheel Wells

Tires, brakes and wheels	Check
Gear strut, actuators, and doors	Check
Hydraulic lines and electrical wires	Check
Gear pins	Removed
APU FIRE CONTROL handle	In

Right Aft Fuselage and Upper Wing Surface

Doors and access panels (not in use)	Latched
Negative pressure relief doors	Check
The negative pressure relief doors may not be flush if the cargo door is not closed and locked.	
Probes, sensors, ports, vents, and drains (as applicable)	Check
Outflow valve	Check
Upper wing surface condition	Check

Tail

Vertical stabilizer and rudder	Check
Doors and access panels (not in use)	Latched
Probes, sensors, ports, vents, and drains (as applicable)	Check
Horizontal stabilizer and elevator	Check
The horizontal stabilizer should be set at the 3 index mark.	
Fuel measuring sticks	Check
Static discharge wicks	Check
Exterior lights	Check
Lower aft fuselage surface	Check
Check for evidence of tail strike damage.	

Left Aft Fuselage and Upper Wing Surface

Doors and access panels (not in use)	Latched
Probes, sensors, ports, vents, and drains (as applicable)	Check
Outflow valve	Check
Upper wing surface condition	Check

Left Landing Gear and Wheel Wells

Tires, brakes and wheels	Check
Gear strut, actuators, and doors	Check
Hydraulic lines and electrical wires	Check
Gear pins	Removed

Left Wing Tip and Trailing Edge

Exterior lights	Check
Static discharge wicks	Check
Fuel jettison nozzle	Check
Control surfaces	Check
Flaps and fairings	Check

Left Wing and Leading Edge

Doors and access panels (not in use)	Latched
Probes, sensors, ports, vents, and drains (as applicable)	Check
Leading edge flaps	Check
Fuel sticks	Check

Number 1 & 2 Engines

Doors and access panels (not in use)	Latched
Probes, sensors, ports, vents, and drains (as applicable)	Check
Fan blades and spinner	Check
Thrust reverser	Stowed
Strut midspar fuse pins alignment stripes	Check
A minimum of 1/2 of each stripe must align. A stripe is on the inboard and outboard side of each strut.	
Exhaust area and tailcone	Check
Fuel sticks	Check

Left Inboard Wing and Lower Fuselage

Probes, sensors, ports, vents, and drains (as applicable)	Check
Doors and access panels (not in use)	Latched
Exterior lights	Check
Pack inlet	Check
Fuel sticks	Check
Leading edge flaps	Check

Left Forward Fuselage

Probes, sensors, ports, vents, and drains (as applicable)	Check
Doors and access panels (not in use)	Latched
Positive pressure relief doors	Check

Preflight Procedure - Pilot Flying

Normally the pilot flying (PF) accomplishes this procedure. However, it does not preclude another crewmember from completing all or part of the procedure if time and conditions dictate. In all cases both the pilot flying (PF) and pilot monitoring (PM) must confirm the FMS preflight entries.

After completing this procedure, the pilot flying (PF) should accomplish a visual scan to ensure the pilot monitoring (PM) has accomplished the flight deck set-up.

WARNING: If a red A/C OUT-OF-SERVICE tag is installed, personnel are not to activate any system, control, switch, or circuit breaker without obtaining verbal approval of maintenance personnel (preferably the mechanic performing the repairs).

IRS Panel Set
Move the IRS selectors to OFF, then NAV. Refer to SP.11 for IRS Fast Realignment and IRS High Latitude Alignment instructions.

Note: The UNABLE RNP message may show until IRS alignment is complete.

ACARS Set
Complete ACARS initialization. Refer to SP.5.

Note: On datalink capable aircraft, do not initialize the ACARS until ready to upload and accept the flight plan and other associated data.

FMS Set
Enter data in blank boxes, blank dashed lines, or modify small font items as directed on the following MCDU pages. Enter or modify other items at the pilot’s discretion.

Initial Data Set

IDENT page:

- Verify that the MODEL is correct - 747-400
- Verify that the ENGINES are correct - PW4056
- Verify that the NAV DATA is correct - DL4

Verify that the current database is active based upon the local date of departure.

Verify that the FF (Fuel Flow factor) agrees with the Flight Plan.

If the FF does not agree, refer to SP.11, Modifying FMC Preflight Procedures - Modifying FMC Drag and Fuel Flow Factors.

POS INIT page:

Enter the airport ICAO identifier on the REF AIRPORT line.

Enter the gate identifier on the GATE line.

Verify that the UTC time is correct.

Enter the present position on the SET IRS POS line. Use the most accurate latitude and longitude (GPS if available).

Navigation Data Set

RTE 1 (page 1):

Enter the origin airport ICAO identifier on the ORIGIN line.

Enter the destination airport ICAO identifier on the DEST line.

Enter the flight number on the FLT NO line, (i.e., DAL72).

RTE 1 (page 2):

Enter and verify the route.

Refer to SP.11, Route Entry Procedures-Pilot Flying.

Activate and execute the route.

Note: For flights over restricted critical terrain, refer to SP.11, Critical Terrain Route Entry for guidance on RTE 2 entries.

RTE DATA page:

Enter altitude, wind, and temperature values on the WIND page for all cruise waypoints.

Refer to SP.11, Wind and Temperature Entries.

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

Performance Data Set

PERF INIT page:

When fueling is complete:

Verify the FUEL on the MCDU, BLOCK FUEL on the flight plan, and total fuel quantity on the Primary EICAS agree.

For normal operations, verify that CALC is the identified data source for FUEL.

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

Enter the ZERO FUEL WT from the flight plan on the ZFW line.

Enter FMS RESERVE FUEL from the flight plan on the RESERVES line.

Enter INITIAL COST INDEX from the flight plan on the COST INDEX line.

Enter the planned initial cruise altitude on the CRZ ALT line

Enter 2000 or 1000 (as appropriate) on the STEP SIZE line.

TAKEOFF REF page:

Verify acceleration altitude is set at 1000 (Normal NADP 2), or enter 3000 (Special NADP 1) on the FLAP ACCEL HT line.

Verify engine out acceleration is set at 1000, or enter the engine out acceleration height specified in the Company Pages on the E/O ACCEL HT line.

Enter the thrust reduction command point (FLAPS 5 for Normal NADP 2, 1500 for Special NADP 1) on the THR REDUCTION line.

Departure briefing..... Complete
Refer to FOM, chapter 3, Briefings.

Preflight Procedure - Pilot Monitoring

Normally the pilot monitoring (PM) accomplishes this procedure. However, this does not preclude another crewmember from completing all or part of the procedure if time and conditions dictate. In all cases, the pilot monitoring (PM) must confirm that the Preflight Procedure – Pilot Monitoring has been completed.

WARNING: If a red A/C OUT-OF-SERVICE tag is installed, personnel are not to activate any system, control, switch, or circuit breaker without obtaining verbal approval of maintenance personnel (preferably the mechanic performing the repairs).

ELEC ENG CONTROL switches NORM

Verify that the ALTN lights are extinguished.

Electrical panel Set

STANDBY POWER selector - AUTO

UTILITY power switches - ON

Verify that the OFF lights are extinguished

BATTERY switch – ON

Verify that the OFF light is extinguished.

BUS TIE switches - AUTO

Verify the ISLN lights are extinguished.

GEN CONT switches - ON

Verify that the OFF lights are illuminated.

Verify that the generator disconnect DRIVE lights are illuminated.

Hydraulic panel Set

DEMAND pump selectors - OFF

Verify that the hydraulic SYS FAULT lights are illuminated.

Verify that the demand pump PRESS lights are illuminated.

ENGINE pump switches - ON

Verify that the engine pump PRESS lights are illuminated.

Lighting panel Set

STORM light switch - As needed

CKT BKR OVHD PANEL light control - As needed

GLARESHIELD PANEL/FLOOD light controls - As needed

DOME light control - As needed

EMERGENCY LIGHTS switch ARMED (guard closed)

6301-6310

OBSERVER'S AUDIO SYSTEM switch NORM

6311-6316

CAPTAIN'S AUDIO SYSTEM switch NORM

SERVICE INTERPHONE switch OFF

FUEL TRANSFER MAIN 1 AND 4 switch Off

6302-6306

Verify that the VALVE light is extinguished.

Fire Panel Set

Engine fire switches - In

BTL A DISCH and BTL B DISCH lights - Extinguished

APU BTL DISCH light - Extinguished

APU fire switch - In

CARGO FIRE DISCH light - Extinguished

CARGO FIRE ARM switches - Off

Verify that the FWD and AFT lights are extinguished.

Engine START panel Set

START switches - In

Verify that the Engine start lights are extinguished.

STANDBY IGNITION selector - NORM

CONTINUOUS IGNITION switch - Off

AUTO IGNITION selector - 1

FUEL JETTISON panel Set

Fuel jettison selector - OFF

Fuel jettison NOZZLE valve switches - Off

Verify that the VALVE lights are extinguished.

Fuel panel Set

If the fuel quantity in MAIN tanks 2 and 3 is greater than the quantity in MAIN tanks 1 and 4:

All XFEED valve switches - On

Verify that the VALVE lights are extinguished.

If the fuel quantity in MAIN tanks 2 and 3 is equal or less than the quantity in MAIN tanks 1 and 4:

XFEED valves 1 and 4 - Off

All fuel pump switches – Off

Verify that the MAIN pump PRESS lights are illuminated.

6301 - 6310

Verify that the MAIN 2 aft pump PRESS light is extinguished when APU is running.

6311 - 6316

Verify that the MAIN 2 and 3 aft pump PRESS lights are extinguished when APU is running.

Verify that the OVRD 2 and 3 pump PRESS lights are extinguished.

Verify that the CTR pump PRESS lights are extinguished.

Verify that the STAB pump PRESS lights are extinguished.

Anti-ice panel	Set
NACELLE ANTI-ICE switches OFF	
Verify that the VALVE lights are extinguished.	
WING ANTI-ICE SWITCH - OFF	
Verify that the VALVE light is extinguished.	
Windshield protection panel	Set
WINDOW HEAT switches - ON	
Verify that the INOP lights are extinguished.	
Windshield WIPER selectors - OFF	
Lighting panel	Set
AISLE STAND PANEL/FLOOD controls - As needed	
LANDING light switches - OFF	
RUNWAY TURNOFF light switches - OFF	
TAXI lights switch - OFF	
PASSENGER OXYGEN switch	NORM (guard closed)
Note: Do not push the PASSENGER OXYGEN switch. The switch causes deployment of the passenger oxygen masks.	
YAW DAMPER switches	ON
INOP lights remain illuminated until first IRU aligns.	
CABIN ALTITUDE panel	Set
LANDING ALTITUDE switch - AUTO	
Outflow valve manual switches - Off	
Cabin Altitude AUTO SELECTOR - NORM	

ECS panel	Set
PASSENGER TEMPERATURE selector - AUTO	
FLIGHT DECK TEMPERATURE selector - AUTO	
ZONE SYS FAULT light - Extinguished	
TRIM AIR switch - ON	
UPPER and LOWER RECIRCULATION fan switches - ON	
AFT CARGO HEAT switch - ON	
EQUIPMENT COOLING selector - NORM	
HIGH FLOW switch - Off	
GASPER switch - ON	
Bleed air panel	Set
Pack SYS FAULT light - Extinguished	
PACK control selectors - NORM	
LEFT and RIGHT ISOLATION valve switches - On	
Verify that the VALVE lights are extinguished.	
Engine bleed air SYS FAULT lights - Extinguished	
APU bleed air switch - ON	
Verify that the VALVE light is extinguished.	
ENGINE BLEED air switches - ON	
Verify that the ENGINE BLEED Air OFF lights are illuminated.	

Lighting panel Set

BEACON light switch - OFF

NAVIGATION light switch - As needed

STROBE light switch - OFF

WING light switch - OFF

LOGO light switch - As needed

Note: Secondary images might occur on the flight deck windows during night operations.

IND LTS switch - TEST

Verify all flight deck indicator lights give proper indications..

IND LTS switch - As required

Mode Control Panel Set

Flight Director switches – ON

Autothrottle Arm switch – ARM

LNAV - Arm (as required)

VNAV - Arm

BANK LIMIT selector - AUTO

HDG window - Set initial heading (as required)

Altitude window - Set initial altitude (as required)

Autopilot DISENGAGE bar – Up

Standby instruments Check

Attitude indicator caging control – Pull and release

Verify that the attitude indicator is correct and no flags are shown.

APPROACH selector – OFF

Verify that the airspeed indications are correct.

Set the standby altimeter.

CRT brightness controls	Set
EIU selector	AUTO
HDG reference switch	NORM
FMC master selector	L
EICAS display	Check

Upper EICAS display – Check

Verify that the primary engine indications display existing conditions.

Verify that no exceedance is shown.

Check EICAS alert messages for applicability.

Lower EICAS display – Check

Verify that the secondary engine indications display existing conditions.

Verify that no exceedance is shown.

STATUS messages– Check

If any status message is displayed, refer to the MDM to determine if dispatch relief is available.

Refer to SP.15, EICAS STATUS Messages.

Landing gear panel	Set

Landing gear lever - Down

ALTERNATE FLAPS selector - Off

Alternate flaps ARM switch - Off

ALTERNATE GEAR EXTEND switches - Off

SPEED BRAKE lever	DN

Reverse thrust levers	Down

Forward thrust levers	Closed

**WARNING: Do not move flaps without appropriate clearance
from ground personnel.**

- Flap lever UP
Verify flap position is blank on the Primary EICAS.
- FUEL CONTROL switches CUTOFF
Verify that the FUEL CONTROL switch fire warning lights are
extinguished.
- STABILIZER TRIM cutout switches Guard closed
- ALTERNATE STABILIZER TRIM switches Neutral
- Center radio tuning panel Set
- VHF-C Radio Selection switch - Push
Verify DATA in active window for ACARS operations.
- HF-L Radio Selection switch - Push
Verify primary frequency in active window for HF/SELCAL
operations.
- HF-R Radio Selection switch - Push
Verify secondary frequency in active window for HF/SELCAL
operations.
- Observer audio control panel As required
- Passenger signs Set
- NO SMOKING selector - ON (RIGHT, two o'clock position)
- SEATBELTS selector - ON
- FLIGHT DECK DOOR selector AUTO

Weather radar panel	Set
Mode Select switch - TEST	
System Select switch - Select L or R	
AILERON and RUDDER TRIM	Zero
Flight ATTENDANT ADVISORY switch	OFF
Transponder panel	Set
Mode Select switch - STBY	
Transponder selector - Select L or R	
AUTOBRAKES selector	RTO
Verify that the AUTOBRAKES RTO message shows.	
Flight deck printer	Set
Verify the paper light is extinguished.	
FMS entries	Verify
Refer to SP.11, Route Verification Procedures-Pilot Monitoring.	

Preflight Procedure - Captain

Logbook Check

All crewmembers must review the logbook to become familiar with the history and maintenance status of the aircraft.

If there is doubt concerning the status of the logbook, contact MCC via the dispatcher.

- Ensure the logbook matches the aircraft ship number.
- Ensure the Airworthiness Release has been signed by Maintenance.

Note: Airworthiness Release sign-off is not required at a Delta non-maintenance station when airworthiness discrepancies do not exist.

- Review any EP-19s for special equipment and/or operating instructions.
- Consult the MDM for any operating limitations or crew operating procedures as a result of existing MELs/CDLs.

Electronic Flight Bag Set

Prior to the Pushback checklist, turn Airplane mode ON to ensure WiFi and Bluetooth® are turned off. The EFB must be operated in Airplane mode with WiFi disabled from the start of the Preflight checklist through the completion of the Shutdown checklist. Enabling Airplane mode with Bluetooth® off will also conserve battery life.

To turn Airplane mode ON, accomplish the following steps:

- Select SETTINGS
- Select Network icon
- Slide the Airplane mode ON/OFF switch to ON.

JEPPESEN application - Configure

The following steps are mandatory:

- Select the Jepp FliteDeck PRO tile
- Select the route icon.
- Select the down arrow to expand the route drawer
- Select New Flight, if necessary
 - In pop-up window, select OK
- Enter ORIGIN and DESTINATION airports

The following steps are optional:

- Enter ALTERNATE airport as desired
- Enter Navaids, Airways, and/or Waypoints, as desired
- Select SID
 - Select applicable departure procedure
- Select STAR
 - Select applicable arrival procedure
- Select Terminal Charts View (airplane) icon
- Select REF
 - Select applicable reference documents, e.g., local ramp procedures
- Select CO
 - Select applicable Company Pages, e.g., Engine Out Departure Procedure
- Select TAXI
 - Select applicable taxi charts
- Select enroute icon
 - Select appropriate HIGH/LOW portion of enroute charts and set an appropriate chart scale

Airwatch Secure Content Locker (SCL) - Configure

- Select the DELTA CONTENT LOCKER (Airwatch SCL) tile
- Open the appropriate documents/operating manuals as desired

Oxygen masks Check

Refer to SP.1, Oxygen Mask and Interphone System Test.

Auxiliary weather radar display selector OFF

SOURCE SELECT panel	Check
FLT DIR source selector - L	
NAV source selector - FMC L	
EIU source selector - AUTO L	
IRS source selector - L	
AIR DATA source selector - L	
Clock	Set
Set the correct UTC time and date.	
RMI	Check
VOR/ADF selectors - As desired	
Lighting panel	Set
PFD and ND light controls - As required	
MAP control - As required	
PANEL controls - As required	
Note: Secondary images might occur on the flight deck windows during night operations.	
CRT select panel	Set
INBD CRT selector - NORM	
LWR CRT selector - NORM	
EFIS control panel	Set
MINS reference selector - RADIO	
Set the altitude below zero (0).	
MINS reference selector - BARO	
Set as desired.	
MTRS switch - As needed	
BARO reference selector - IN or HPA	
VOR/ADF switches - As required	
ND mode selector - MAP	
ND CTR switch - As required	
ND range selector - As required	

ND TFC switch - ON

Note: TCAS OFF will display on NDs until transponder is set for takeoff.

WXR switch - Off

Verify that the weather radar indication is not shown on the ND.

STA, WPT, ARPT, DATA, POS, TERR switches - As required

Altimeter Set

Set the local altimeter setting.

Verify RVSM and altimeter crosscheck are within limits. Refer to L.10, Flight Instruments, Displays.

Verify no flag displayed.

Flight and nav instruments Check

PFD - check

Verify the flight mode annunciations are correct:

- autothrottle mode is blank
- roll mode is TO/GA
- pitch mode is TO/GA
- AFDS status is FD

Verify flight instrument indications are correct and no amber flags are displayed

TCAS OFF is displayed on the ND

NO VSPD flag is displayed until takeoff V-speeds are selected

ND - check

Verify map mode displayed

Verify the displayed route is correct

Verify no amber flags are displayed

TCAS OFF flag is displayed until TA/RA is selected.

Fuel required Verify

Compare flight plan block fuel and actual fuel on board.

If actual fuel onboard is less than flight plan block fuel, ensure MIN FUEL FOR T/O plus flight plan TAXI FUEL is on board. Refer to FOM, chapter 5.

PARKING BRAKE Set

Verify that the PARK BRAKE SET message shows.

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

Radio tuning panel Set

Audio control panel Set

Weather radar Check

Accomplish Weather Radar test. Refer to SP.11, Weather Radar Test.

Seat Adjust

Adjust 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 the rudder pedals to allow for full rudder pedal and brake pedal movement.

Flight attendant briefing Complete

Accomplish a flight attendant briefing. Refer to FOM chapter 3, Operational Policy, Communications.

ATC clearance..... Verify

Refer to NP.12, Clearance Verification Procedures.

Call for the Preflight Checklist.

Preflight Procedure - First Officer

Logbook Check

Refer to Interior Inspection - First Officer or Relief Pilot.

Electronic Flight Bag Set

Prior to the Pushback checklist, turn Airplane mode ON to ensure WiFi and Bluetooth® are turned off. The EFB must be operated in Airplane mode with WiFi disabled from the start of the Preflight checklist through the completion of the Shutdown checklist.

Enabling Airplane mode with Bluetooth® off will also conserve battery life.

To turn Airplane mode ON, accomplish the following steps:

- Select SETTINGS
- Select Network icon
- Slide the Airplane mode ON/OFF switch to ON.

JEPPESEN application - Configure

The following steps are mandatory:

- Select the Jepp FliteDeck PRO tile
- Select the route icon.
- Select the down arrow to expand the route drawer
- Select New Flight, if necessary
 - In pop-up window, select OK
- Enter ORIGIN and DESTINATION airports

The following steps are optional:

- Enter ALTERNATE airport as desired
- Enter Nav aids, Airways, and/or Waypoints, as desired
- Select SID
 - Select applicable departure procedure
- Select STAR
 - Select applicable arrival procedure
- Select Terminal Charts View (airplane) icon
- Select REF
 - Select applicable reference documents, e.g., local ramp procedures
- Select CO
 - Select applicable Company Pages, e.g., Engine Out Departure Procedure

- Select TAXI
 - Select applicable taxi charts
- Select enroute icon
 - Select appropriate HIGH/LOW portion of enroute charts and set an appropriate chart scale

Airwatch Secure Content Locker (SCL) - Configure

- Select the DELTA CONTENT LOCKER (Airwatch SCL) tile
- Open the appropriate documents/operating manuals as desired

Oxygen masks Check
 Refer to SP.1, Oxygen Mask and Interphone System Test.

Auxiliary weather radar display selector OFF

SOURCE SELECT panel Check
 FLT DIR source selector - R
 NAV source selector - FMC R
 EIU source selector - AUTO R
 IRS source selector - R
 AIR DATA source selector - R

Clock Set
 Set the correct UTC time and date.

Lighting panel Set
 PFD and ND light controls - As required
 MAP control - As required
 PANEL controls - As required

Note: Secondary images might occur on the flight deck windows during night operations.

CRT select panel Set
 INBD CRT selector - NORM
 LWR CRT selector - NORM

EFIS control panel Set
 MINS reference selector - RADIO
 Set the altitude below zero (0).

MINS reference selector - BARO

Set as desired.

MTRS switch - As needed

BARO reference selector - IN or HPA

VOR/ADF switches - As required

ND mode selector - MAP

ND CTR switch - As required

ND range selector - As required

ND TFC switch - ON

Note: TCAS OFF will display on NDs until transponder is set for takeoff.

WXR switch - Off

Verify that the weather radar indication is not shown on the ND.

STA, WPT, ARPT, DATA, POS, TERR switches - As required

Altimeter Set

Set the local altimeter setting.

Verify RVSM and altimeter crosscheck are within limits. Refer to L.10, Flight Instruments, Displays.

Verify no flag displayed.

Flight and nav instruments Check

PFD - check

Verify the flight mode annunciations are correct:

- autothrottle mode is blank
- roll mode is TO/GA
- pitch mode is TO/GA
- AFDS status is FD

Verify flight instrument indications are correct and no amber flags are displayed.

TCAS OFF is displayed

NO VSPD flag is displayed until takeoff V-speeds are selected

- hr/>
- ND - check
- Verify map mode displayed
- Verify the displayed route is correct
- Verify no amber flags are displayed
- TCAS OFF flag is displayed until TA/RA is selected.
- Ground proximity panel Set
- G/S INHIBIT - Off
- FLAP OVRD switch - Off
- CONFIG GR OVRD switch - Off
- TERR OVRD switch - Off
- Fuel required Verify
- Compare flight plan block fuel and actual fuel on board.
- If actual fuel onboard is less than flight plan block fuel, ensure MIN FUEL FOR T/O plus flight plan TAXI FUEL is onboard. Refer to FOM, chapter 5.
- Radio tuning panel Set
- Audio control panel Set
- Weather radar Check
- Accomplish Weather Radar Test. Refer to SP.11, Weather Radar Test.
- Seat Adjust
- Adjust 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 the rudder pedals to allow for full rudder pedal and brake pedal movement.
- ATIS Obtain
- ATC clearance..... Obtain
- After receiving the clearance:
- Set the MCP, as required

- Set the transponder code
- Verify ATC clearance. Refer to NP.12, Clearance Verification Procedures.

Read the Preflight Checklist when requested.

Preflight Checklist

Interior & exterior inspection	complete	C
Captain ensures the interior and exterior inspections are complete.		
Circuit breakers.....	ckd	C
Oxygen mask	ckd	ALL
Refer to SP.1, Oxygen Mask and Interphone System Test.		
Instrument source selectors	ckd	C&F
Altimeters	__, xckd	C&F
Confirm the captain, first officer, and standby altimeter barometric settings and barometric reference (IN or HPA) are correctly set.		
Verbalize the altimeter setting.		
Flight & nav instruments	ckd	C&F
■ Mode control panel	set	C
EICAS	ckd	C
Parking brake	set	C
Thrust levers	closed	C
Fuel control switches	CUTOFF	C
■ Radios & transponder	set	C
Ensure the communication radios are set as appropriate.		
Ensure the transponder code is set as appropriate and the Transponder mode select switch is set to STBY.		
Radar	off	C
Ensure the EFIS WXR switches are off and the AUX Radar selectors are OFF.		
Passenger signs	ON	C
Flight attendant briefing	complete	C
■ Departure briefing	complete	C

Logbook and QRHs	onboard	C
Ensure the logbook is onboard and logbook review is complete. Ensure that each QRH is onboard.		
Fuel required	___ onboard ___	C&F
Compare and verbalize flight plan block fuel and actual fuel on board.		
If actual fuel onboard is less than flight plan block fuel, ensure MIN FUEL FOR T/O plus flight plan TAXI FUEL is onboard. Refer to FOM, chapter 5.		

Pushback Procedure

Captain	First Officer
Operate the APU in accordance with FOM chapter 3, Aircraft Operational Policy. • APU selector - START, then ON • Rotate the selector to the START position, then slowly release back to ON. Do not allow the APU selector to spring back to the ON position. • Establish APU power: • APU GEN 1 and APU GEN 2 AVAIL lights - Illuminated • APU GEN 1 switch - Push • Verify ON light illuminated. • APU GEN 2 switch - Push • Verify ON light illuminated.	
When all exterior doors are closed and the cabin is ready for pushback:	
• Verify all door EICAS Alert messages are extinguished on the upper EICAS. • Select the DRS synoptic switch and verify that the doors indicate closed and armed on the Lower EICAS. • Verify “CABIN READY 6P” is received.	• Fuel panel - Set

Captain	First Officer
(F) All MAIN tank pump switches – ON • Verify that the PRESS lights are extinguished. If the fuel quantity in tanks 2 and 3 is greater than the quantity in tanks 1 and 4: • OVRD pump 2 and 3 switches - ON • Verify that the PRESS lights are extinguished. • All XFEED valve switches - On • Verify that the VALVE lights are extinguished. If the fuel quantity in tanks 2 and 3 is equal to or less than the quantity in tanks 1 and 4: • OVRD pump 2 and 3 switches - Off • XFEED valve 1 and 4 switches - Off If there is 17,000 pounds or more of fuel in the center wing tank: [AFM] • CTR tank pump switches - ON • Verify that the PRESS lights are extinguished. Stabilizer tank STAB pump switches - Off	
• Hydraulic panel - Set	
(C) DEMAND pump 4 selector – AUX • Verify that the SYS FAULT light is extinguished. • Verify that the PRESS light stays illuminated. DEMAND pump 1 selector - AUTO • Verify that the SYS FAULT light is extinguished. • Verify that the PRESS light is extinguished. DEMAND pump 2, and 3 selectors - OFF • Verify that the SYS FAULT lights are illuminated. • Verify that the PRESS lights are illuminated. Note: Pressurize number 4 system first to prevent fluid transfer between systems 4 and 1.	
	• Flight deck door - Closed and locked • Transponder - XPNDR, or as required by local airport operating procedures
Call “PUSHBACK CHECKLIST.”	Accomplish the Pushback checklist.

Captain	First Officer
Note: Pushback checklist must be completed prior to aircraft movement.	
When advised the ground crew is ready for pushback:	
Direct the first officer to call for pushback or engine start clearance as appropriate.	When requested by the captain, call for pushback or engine start clearance.
When pushback clearance has been received:	
• BEACON - BOTH • Parking Brake - OFF Note: Do not turn the beacon on or release brakes until cleared for pushback or engine start.	•
Call "BEACON ON, BRAKES RELEASED, CLEARED TO PUSH."	
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 the brakes to stop the airplane during pushback or towing. This can damage the nose gear or the tow bar.	
With initial aircraft movement:	
If not immediately cleared for engine start, ask: "ARE WE CLEAR TO START ENGINE(S)?"	Plan engine start to be prepared to taxi upon ground crew salute.

Pushback Checklist

Doors	closed	F
Ensure all door EICAS alert messages are extinguished on the Upper EICAS.		
Ensure the doors indicate closed and armed on the lower EICAS.		
Ensure “CABIN READY 6P” is received.		
Fuel panel	set	F
Hydraulic panel	set	F
Flight deck door	closed & locked	F
Ensure the LOCK FAIL light is extinguished.		
Transponder	XPNDR	F

Engine Start Procedure

Captain	First Officer
Taxi out with all engines operating. The captain may elect to shutdown engine number 3 when clear of the ramp area, conditions permitting. The tug driver will advise the captain when it is clear to start engine(s).	
Note: One pilot will accomplish the engine start procedure while the other will monitor the pushback. Normally the first officer accomplishes the engine start procedure. Note: Normal starting sequence is engines three and four, followed by engines one and two.	
When cleared and ready to start:	
Announce the engine(s) to be started.	
	• ENG synoptic - Select • Air conditioning panel - Set • PACK control selectors - OFF • When using APU bleed air for engine start, allow approximately 2-3 seconds between PACK shutdown.
CAUTION: Re-engagement of starter with N2 in excess of 20% will result in serious damage to starter and engine.	
	• Engine START selectors - Pull • Verify N2 rotation and oil pressure increase for both engines.

Captain	First Officer
	At maximum motoring (N2 greater than or equal to the magenta fuel on indicator and no increase for 5-10 seconds): • FUEL CONTROL switches - RUN • Normal indications - monitor N1, N2, fuel flow, and oil pressure • EGT - verify increases and stays below EGT start limit • START selectors - verify release at 50% N2 and the START selector lights extinguish.
	After engines are stabilized at idle (the red maximum start EGT limit is not displayed and starting EGT peaks): • One PACK control selector - ON
	Repeat to start remaining engines.
Accomplish the Aborted Engine Start checklist, QRH, NNC.7 for one or more of the following abort start conditions: • EGT does not increase by 20 seconds after the FUEL CONTROL switch is moved to RUN. • EGT quickly nears or exceeds the start limit. • No N1 rotation by 40% N2. • N2 is not at idle by 2 minutes after the FUEL CONTROL switch is moved to RUN. • Oil pressure indication is not normal by the time the engine is stabilized at idle.	

After Start Procedure

Captain	First Officer
After starting engines:	
	• APU - OFF • Hydraulic panel - Set • DEMAND PUMP selectors - AUTO • Engine ANTI-ICE switches- As required • Refer to SP.16, Cold Weather Operations. • Air conditioning panel - Set • PACK control selectors - NORM • Recall - Check
Call "AFTER START CHECKLIST."	Accomplish the After Start checklist.
Receive and return the marshalling agent's taxi salute.	
Prior to aircraft movement:	
Call "SALUTE RECEIVED, FLAPS ____."	Select flaps as directed.
Note: If the WDR is not available, select flaps to the default setting of flaps 20.	

After Start Checklist

Engine anti-ice	as reqd	C
Ensure the anti-ice selectors are in the correct position for the current environmental conditions.		
APU	off	F
Ensure the APU selector is OFF and the APU RUNNING EICAS memo message is extinguished.		
Hydraulic panel.....	set	F
Air conditioning panel	set	F
Recall	ckd	F
Ensure only expected EICAS messages are shown.		
Autobrakes	RTO	F

Taxi Procedure

Captain	First Officer
After WDR has been received:	
Performance data may be loaded into the FMS at any point after receipt of the WDR but should not interfere with other critical crew duties and responsibilities. The captain's analysis of the WDR shall not be completed while the captain is taxiing the aircraft. The balance of the Taxi procedure and the reading of the Taxi checklist should be completed during low workload times.	
• Verify the header block for the correct: • flight number, • ship number, • date, and • release number. • Verify the performance data is available for the FMS entered takeoff runway/position • Perform a complete analysis of the following WDR blocks: • FMS, • weather, • performance, and • notes. Refer to FOM, chapter 5, Weight Data Record (WDR).	
For PACKS OFF takeoff, refer to SP.2, Packs Off Takeoff	
Referencing the WDR data:	
CAUTION: Do not enter the ZFW into the GR WT boxes. The FMS will calculate performance data with significant errors.	
	• Takeoff Ref page 1 • Verify FMS selected runway and WDR runway/takeoff position agree.

Captain	First Officer
	• FMS PERF INIT page - Select • Enter ZFWT into ZFW. • Verify RMWT with GR WT. • FMS THRUST LIM page - Select • Select TO or TO-1. Note: TO-2 is not authorized. • Enter Assumed Temperature into SEL as appropriate. Note: CLB2 will be automatically armed by default with a high Assumed Temperature entry. • Verify EICAS thrust setting.

Captain	First Officer
	• FMS TAKEOFF REF page - Select • Enter flap setting into FLAP. • Update ACCEL HT (AGL) as necessary. • Update EO ACCEL HT (AGL) as necessary. • Update THR REDUCTION altitude (AGL) as necessary. • Enter V1, VR, and V2. • Verify the takeoff V speeds on both FMS agree. If the V speed disagree, re-enter the takeoff V speeds. Note: If any changes are made to the FMS entries, verify the takeoff V speeds agree on each FMS and PFD. • Enter TOCG into CG. Note: Do not enter a POS SHIFT. This may inhibit the runway update function. • MCP - Set • Set V2 in IAS/MACH window.
	• Stabilizer trim - Set • Position STAB TRIM indicator to TRIM value. Note: If FMS computed trim and WDR trim are within 0.50 units, either value may be used.
When workload and conditions permit:	
	• ENGINES page - Select

Captain	First Officer
Rudder - Check • Move rudder pedals to full travel in both directions and verify: • Freedom of movement. • Rudder pedals return to center. • Correct flight control movement on the EICAS display. Note: Hold the nose wheel steering wheel during the rudder check to prevent nose wheel movement.	Aileron and elevator - Check • Move control wheel and column to full travel in both directions and verify: • Freedom of movement. • Controls return to center. • Correct flight control movement on the EICAS display.
EFBs - Set • Display applicable REF, CO, and Taxi page(s), as needed. • Select the planned assigned SID prior to Departure, as desired.	
Call "TAXI CHECKLIST."	Accomplish the Taxi checklist.

For extended ground time:

Consider shutting down engine 3. When departing from ramp areas where taxiing is restricted to all engines, consider shutdown of engine 3 after exiting the restricted area.

Taxi Checklist

- Flaps ____, ____, ____ C&F
Ensure the FMS and WDR flap values agree.
Confirm and verbalize:
 - FLAP lever position,
 - flap value from the FMS, and
 - indicated flap position.
- Takeoff speeds ____, ____, ____ set & xckd C&F
Referencing the FMS, confirm and verbalize V1, VR, and V2 speeds and ensure V2 set in the IAS/MACH window.
Ensure the takeoff speeds on the captain’s and first officer’s FMS TAKEOFF REF page agree.
- Thrust ____, ____ C&F
Referencing the upper EICAS, verbalize TO or TO1 for the first blank and, if applicable, assumed temperature for the second blank.
- Trim ____, 0, 0 C&F
Ensure the STAB TRIM is set to trim value from either the FMS or the WDR. The FMS computed value may be used in lieu of the WDR value if the difference is 0.50 or less.
“Zero, zero” indicates the rudder and aileron trim are verified '0'.
- Flight controls ckd C&F

Delayed Start Procedure

Captain	First Officer
Initiate the Delayed Start procedure to ensure proper engine warm up. If performing a crossbleed start, refer to SP.7, Engine Crossbleed Start.	
When ready to start:	
Announce engine start.	
	• Air conditioning panel - Set • PACK control selectors - OFF • Allow approximately 2-3 seconds between PACK shutdown. • Engine #3 ANTI-ICE selector - Off
	• Engine Start procedure - Accomplish
After engine start:	
	• Engine ANTI-ICE - As required • Refer to SP.16, Cold Weather Operations. • Air conditioning panel - Set • PACK control selectors - NORM • Recall - Check
Call "DELAYED AFTER START CHECKLIST."	Accomplish the Delayed After Start checklist.

Delayed After Start Checklist

Engine anti-ice	as reqd	C
Ensure the anti-ice selectors are in the correct position for the current environmental conditions.		
Air conditioning panel	set	F
Recall	ckd	F
Ensure only expected EICAS messages are shown.		
Autobrakes	RTO	F

Before Takeoff Procedure

Captain	First Officer
When a runway, intersection, departure, or performance change occurs prior to takeoff:	
- FMS data must be modified using the most recent WDR information. Refer to the Taxi Procedure for specifics. - After updating/verifying any changed items, complete the runway change boxed items and any associated procedural steps for all previously completed checklists. Note: Performance data for an intersection departure is also valid for all other takeoff positions on that runway that afford additional runway length.	

Captain	First Officer
Operate the engines for a minimum of 5 minutes before applying takeoff thrust. Engine oil temperature must be above the lower amber band (50°C) before applying takeoff thrust. [AFM]	
When in proximity to the departure runway:	
	(On augmented crews, the following should be accomplished by the relief pilot.) Notify the flight attendants to finalize preparations for takeoff with the following PA, “FLIGHT ATTENDANTS, PLEASE PREPARE THE CABIN FOR DEPARTURE.”
	Verify the CABIN READY 6P has been received.
Takeoff briefing - Complete The Pilot Flying (PF) will verify and verbalize: - runway - outside reference and ND/FMS runway - departure - first fix - H: heading mode - A: altitude constraints - A: airspeed constraints	
- Fuel - Check - Fuel quantity is equal to or greater than MIN FUEL FOR T/O	
	Transponder - TA/RA

Captain	First Officer
	Packs - As required • If a PACKS OFF takeoff is required, refer to SP.2, Packs Off Takeoff.
Call "BEFORE TAKEOFF CHECKLIST."	Accomplish the Before Takeoff checklist.
Manage the radar and terrain display as required.	
WARNING: Prior to crossing a runway hold short line to either take off from or cross a runway, both crewmembers should confirm their position by comparing taxiway and runway identification signs to the taxi chart.	

Before Takeoff Checklist

- Runway position __, __ C&F
 Verify and verbalize:
 - runway/intersection displayed in the MCDU, and
 - the actual runway takeoff position observed.
- Flaps __, __ C&F
 Confirm and verbalize:
 - flap position displayed in the MCDU, and
 - indicated flap position.
- Takeoff briefing complete C
 Ensure the takeoff briefing has been completed by the PF.
- Transponder TA/RA F
- Flight attendants notified & acknowledged F
- Packs as reqd F
 Ensure the pack selectors are in the correct position for takeoff. If performing a Packs Off Takeoff, refer to SP.2, Packs Off Takeoff.

Takeoff Procedure

Pilot Flying	Pilot Monitoring
When cleared for takeoff:	
Confirm alignment with the intended departure runway by reference to the ND.	
Verify brakes are released. Advance thrust levers to approximately: 1.10 EPR. Allow the engines to stabilize.	
Push the TO/GA switch prior to 50 knots.	
Verify takeoff thrust is set by approximately 80 knots. Adjust as necessary.	
	Monitor engine instruments throughout the takeoff.
After takeoff thrust is set, the captain's hand must be on the thrust levers until V1.	
Monitor airspeed.	
At 80 knots:	
Verify 80 knots.	Announce, "80 KNOTS, HOLD, THRUST NORMAL."
At V1:	
Verify V1 speed	Announce "V1."
At VR:	
Rotate to the takeoff pitch attitude.	Announce, "ROTATE."
	Monitor airspeed and vertical speed. Verify a positive rate of climb and announce "POSITIVE RATE."
Verify a positive rate of climb on the altimeter. Call "GEAR UP."	Position the landing gear lever to UP.

Pilot Flying	Pilot Monitoring
Above 400 feet AGL:	
Verify LNAV or call “HDG SELECT” as required.	Select or verify roll mode.
At thrust reduction height:	
Verify climb thrust is set.	
At the acceleration height:	
Reduce pitch attitude and begin acceleration. Verify acceleration. Call “FLAPS___” according to the flap retraction schedule.	Set the FLAPS as directed.
Note: At gross weights above 680,000 pounds, limit bank angle to 15° with the flaps up until the airspeed is 20 knots above the flaps up speed (“UP” bug + 20 knots).	
After flaps are selected up:	
	• Landing GEAR lever - OFF • WING ANTI-ICE switch - As required • Engine ANTI-ICE switches - As required
Call “AFTER TAKEOFF CHECKLIST.”	Accomplish the After Takeoff checklist.

After Takeoff Checklist

Flaps up

Ensure flaps up and indications normal.

Landing gear up & OFF

Ensure landing gear up indications normal and landing GEAR lever OFF.

Packs NORM

Verify pack selector position.

Climb Procedure

Pilot Flying	Pilot Monitoring
Approaching transition altitude:	
	If other than 18,000 feet, call “TRANSITION ALTITUDE.”
Altimeters - Set to standard and verbalize	

Pilot Flying	Pilot Monitoring
Anti-Ice - As required	
After climbing through approximately 10,000 feet AFE , signal the end of sterile cockpit environment by:	
(C) NO SMOKING sign selector - Cycle to sound cabin chime twice. OR, if conditions permit: (C) SEATBELTS sign - OFF (C) Ensure PA is made advising passengers to keep seat belts fastened while seated.	
Fuel management:	
	When the FUEL LOW CTR L or R message is shown and the tank quantity is approximately 7,000 pounds in climb (pitch 5° or greater): CTR L and R pump switches - OFF [AFM]
After passing 18,000 feet:	
Call “CLIMB CHECKLIST.”	Accomplish the Climb checklist.

Climb Checklist

Altimeters STD, xckd C&F

Ensure the captain, first officer, and standby altimeters are correctly set.

Verbalize the altimeter setting.

Cruise Procedure

Pilot Flying	Pilot Monitoring
• Anti-ice - As required	
After reaching top of climb:	
Enroute:	
• Apply Tactical Cost Index procedures as necessary per FOM. • Monitor fuel trend • Send turbulence report as necessary • Send position reports as necessary	
	• FMS downtrack winds/temperatures - Enter or update, as required.
Fuel management:	
	When the FUEL OVRD CTR L or R message is shown and the tank quantity is 4,000 pounds or more in cruise (pitch less than 5°): • CTR L and R pump switches - ON
	When the FUEL PMP STB L or R message is shown and the tank quantity is 1,000 pounds or more: • STAB L and R pump switches - ON
	When the FUEL PRES STB L or FUEL PRES STB R message is shown and tank quantity is 2,000 pounds or less: • STAB L and R pump switches - OFF Note: Under some conditions, fuel may be left in the stabilizer tank. If after approximately 5 minutes there is fuel still indicated in the stabilizer tank, the crew may turn the STAB L and R pumps back ON to transfer this fuel. Turn both pumps OFF at the first FUEL PRES STB message.

Pilot Flying	Pilot Monitoring
	When the FUEL LOW CTR L or R message is shown and the tank quantity is approximately 3,000 pounds in cruise (pitch less than 5°): • CTR L and R pump switches - OFF [AFM]
	When the FUEL TANK/ENG message is shown and the fuel quantity in tank 2 is less than or equal to tank 1 or tank 3 is less than or equal to tank 4: • OVRD 2 and 3 switches - Off • X FEED valve 1 and 4 switches - Off
• Automated Engine Reporting System - Accomplish. Refer to SP.7, Automated Engine Reporting System.	
• EFB - Manage: • Select enroute icon. • Select appropriate HIGH/LOW portion of enroute charts and set an appropriate chart scale. • Monitor the battery power indicator and connect the powered keyboard when necessary. Note: An electrical outlet in the flight deck is not an approved power source. If possible, charge EFBs on rest break in the cabin or crew rest facility. • Connect the powered keyboard when the EFB battery power indicator displays 20% or less. • Conserve battery power as much as possible. During extended cruise, consider shutting down an EFB to preserve battery life. Note: All EFBs may not be off simultaneously. Maintain at least one EFB in the sleep mode or ON mode to provide ready access to data when operational needs dictate.	

Pilot Flying	Pilot Monitoring
When approach procedure is known:	
• FMS ARRIVALS page - Select • Insert/modify the STAR, APPROACH, and TRANS as necessary • FMS LEGS page - Select • Verify correct waypoints and altitudes. • FMS NAV RAD page - Select • Manually tune radios as necessary • FMS APPROACH REF page - Select • Select FLAPS/VREF as desired	
• Set RADIO or BARO minimums as appropriate Note: Refer to NOI.3, Approach Selection Table.	
To ensure adequate obstacle clearance in conditions of extreme cold weather (-10°C or lower, or as specified in the Company Pages), refer to Airway Manual, Weather, Altimeter Corrections.	

Pilot Flying	Pilot Monitoring
EFB - Configure: • JEPPESEN application - Configure • Select the Jepp FliteDeck PRO tile. • Select the airport (airplane) icon. • Select DESTINATION airport. • Select REF. • Select applicable reference documents, e.g., local ramp procedures. • Select CO. • Select applicable Company Pages, e.g., Critical Performance procedures. • Select TAXI. • Select applicable taxi chart(s). • Select APP. • Select applicable approach chart(s). • Select STAR. • Select applicable arrival procedure charts. • Airwatch Secure Content Locker (SCL) - Configure • Select the DELTA CONTENT LOCKER (Airwatch SCL) tile. • Open the appropriate document/operating manual as desired. • Check the EFB mount for security. Pilots may hold their respective EFBs in their hands when conducting required briefings. Secure EFB in the mount after completing briefings. EFBs must be secured during critical phases of flight.	
After FMS data has been entered:	
	• FMS data - Verify
• Approach briefing - Accomplish. Refer to FOM, chapter 3.	• AUTOBRAKES - Select as briefed • Verify that the appropriate AUTOBRAKES message shows.

Descent Procedure

Pilot Flying	Pilot Monitoring
• Anti-Ice - As required	
At top of descent or approximately 20 minutes prior to landing:	
(On augmented crews, the following should be accomplished by the relief pilot.)	
Notify the flight attendants with a PA that includes “FLIGHT ATTENDANTS PLEASE PREPARE THE CABIN FOR ARRIVAL.”	
• (C) SEATBELTS sign - ON	
	• Recall - Check
Approaching transition level:	
	If other than FL 180, Call “TRANSITION LEVEL.”
• Altimeters - Set local altimeter setting and verbalize	
At FL180 or reaching top-of-descent, whichever occurs later:	
Call “DESCENT CHECKLIST.”	Accomplish the Descent checklist.

Descent Checklist

- Altimeters ____, xckd C&F
- Ensure the captain, first officer, and standby altimeter barometric settings and barometric reference (IN or HPA) are correctly set.
- Verbalize the altimeter setting (local or STD).
- Minimums ____, ____, xckd C&F
- Ensure the captain's and first officer's PFD minimums reference is set properly and minimums are set to the approach chart value.
- Verbalize “RADIO” or “BARO” for the first blank and the numeric value for the second blank.
- Landing data ____, ____ C&F
- Verbalize the displayed landing flap and Vref speed.
- Approach briefing complete PM
- Ensure the Approach Briefing has been completed by the PF.
- Autobrakes as reqd PM
- Seat belt signs ON PM
- Recall ckd PM
- Ensure only expected EICAS messages are shown.

Approach Procedure

Pilot Flying	Pilot Monitoring
Approaching transition level:	
	If other than FL180, call “TRANSITION LEVEL.”
• Altimeters - Set local altimeter setting and verbalize	

Pilot Flying	Pilot Monitoring
When arrival, approach, or runway changes prior to landing:	
• FMS data must be modified. • After updating/verifying any changed items, complete the Runway Change boxed items for the Descent and Approach checklists and their associated procedures. Note: If the landing runway assignment is changed and the captain determines the runway change can be accomplished visually, the captain may choose to waive the “runway change” items.	

Pilot Flying	Pilot Monitoring
• Anti-Ice - As required	
Before descending through approximately 10,000 feet AFE:	
• Flight and navigation instruments - Set • Verify correct arrival and approach selected in FMS.	
At approximately 10,000 feet AFE:	
• (C) NO SMOKING sign selector - Cycle to sound cabin chime twice.	
Call “APPROACH CHECKLIST.”	Accomplish the Approach checklist.

Approach Checklist

- Flight & nav instruments verified C&F
 Ensure correct arrival and approach procedures are entered.

- Cabin notification complete C
 Ensure that the cabin chime signal has been sounded twice.

- Altimeters ____, xckd C&F
 Ensure the captain, first officer, and standby altimeter barometric
 settings and barometric reference (IN or HPA) are correctly set.
 Verbalize the local altimeter setting.

Landing Procedure

Pilot Flying	Pilot Monitoring
When ready to configure the aircraft for landing:	
Call “FLAPS ____” according to the flap extension schedule.	Set the FLAP lever as directed.
When cleared for the approach:	
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.	
Manage the approach in accordance with the appropriate Approach Guide and Automation Guidelines.	
Call “GEAR DOWN, FLAPS 20.”	Set the landing gear lever to DN. Set the FLAP lever as directed.
Set the speed brake lever to ARM. Verify that the SPEEDBRAKE ARMED message shows.	
At vertical path capture:	
Call “FLAPS ____” as needed for landing.	Set the FLAP lever as directed.
Call “LANDING CHECKLIST.”	Accomplish the Landing checklist.

Pilot Flying	Pilot Monitoring
No later than 1,000 feet AFE:	
Verify missed approach altitude is set.	
Note: Provided stabilized approach criteria are observed, the timing of the configuration may be modified as necessary for a more fuel-efficient operation.	

Landing gear	down	C&F
Ensure landing gear lever is DN and DOWN appears on the EICAS.		
Flaps	____, ____	C&F
Confirm and verbalize:		
• FLAP lever position, and • indicated flap position.		
Speedbrake	ARMED	PM

Go-Around Procedure

Pilot Flying	Pilot Monitoring
When a go-around is warranted:	
Push either TOGA switch and announce "GO AROUND".	Verify FMA pitch, roll, and ATs. Announce pitch mode "TOGA VERIFIED"
Call "FLAPS 20."	Set FLAP lever as directed.
Verify: • Rotation to go-around attitude • Thrust increases • Proper FMA mode annunciation	
Verify thrust is sufficient for the go-around or adjust as needed.	
	Monitor rotation, pitch and vertical speed. Verify a positive rate of climb and announce "POSITIVE RATE."
Confirm a positive rate of climb on the altimeter.	
Call "GEAR UP."	Position the landing gear lever to UP.
	Verify missed approach altitude is set.
Above 400 feet RA:	
Verify or call for the appropriate roll mode.	Select or verify roll mode.
At acceleration height (normally 1,000 feet AFE):	
Call for "FLCH" or "VNAV."	Select "FLCH" or "VNAV" as directed.
Call "FLAPS ____" according to the flap retraction schedule.	Set the FLAP lever as directed.

Pilot Flying	Pilot Monitoring
If another approach is warranted at the destination airport:	
Consider leaving flaps at 5 and maintain appropriate maneuvering speed.	Verify flaps 5 and appropriate maneuvering speed as directed.
When at the planned flap configuration:	
Call “AFTER TAKEOFF CHECKLIST.”	Accomplish the After Takeoff checklist.

Landing Roll Procedure

Pilot Flying	Pilot Monitoring
At main gear touchdown:	
Verify thrust levers at idle.	
	Verify the SPEEDBRAKE lever is UP. Call “SPEEDBRAKES UP.”
WARNING: After reverse thrust is initiated, a full stop must be made.	
Without delay, move the reverse thrust levers to the interlocks and hold light pressure until the interlocks release. Then apply reverse thrust as needed.	Verify normal reverse thrust operation.
By 80 KIAS initiate movement of reverse thrust levers to reach reverse idle detent prior to taxi speed. Position levers full down (forward thrust) after engines have decelerated to reverse idle.	At 80 KIAS call “80 KNOTS.”
Prior to taxi speed: • Autobrakes - Disengage	

After Landing Procedure

Captain	First Officer
When clear of the active runway and workload permits:	
Note: Engine may be shutdown after cool down recommendations have been met.	
• SPEED BRAKE lever - DN detent • EFIS WXR switch - Off • AUX Radar - OFF	• FLAP lever - UP • Anti-ice - As required • Engine ANTI-ICE switches - As required (refer to SP.16, Cold Weather Operations) • WING ANTI-ICE switch - OFF • EFIS WXR switch - Off • AUX Radar - OFF • STAB TRIM - 6 units • APU - As required (refer to FOM 3.4, APU Policy) • Do not allow the APU selector to spring back to the ON position. • Transponder - XPNDR
Call “AFTER LANDING CHECKLIST.”	Accomplish the After Landing checklist.

After Landing Checklist

Flaps	up
Speedbrake	DOWN
Radar	off
Ensure the EFIS WXR switches are off and the AUX Radar selectors are OFF.	
Stabilizer	6

Shutdown Procedure

Captain	First Officer
A 5-minute engine cool down recommended prior to shutdown.	
After engine cool down recommendations have been met and three engine taxi is desired:	
Call for engine #3 shutdown.	
	• #3 FUEL CONTROL switch - CUTOFF
After stopping at the gate:	
• PARKING BRAKE - Set • Verify that the PARK BRAKE SET message shows. • Call for seat belts sign off. • Call for engine shutdown.	• SEAT BELTS selector - OFF, as directed • Establish APU power: • APU GEN 1 and APU GEN 2 AVAIL lights - Illuminated • APU GEN 1 switch - Push • Verify ON light illuminated. • APU GEN 2 switch - Push • Verify ON light illuminated. • FUEL CONTROL switches - CUTOFF
	• BEACON light switch - OFF • Fuel panel - Set • FUEL PUMP switches - Off • Engine ANTI-ICE and WING ANTI-ICE switches - Off • WINDOW HEAT switches - Off • F/D switches - OFF • WX RADAR mode selector - TEST • Transponder - STBY • AUTOBRAKES selector - OFF

Captain	First Officer
When engines are shut down:	
• PARKING BRAKE - As required After the chocks are inserted, the brakes should be released for cooling. Refer to FOM, 6.1, Parking, Brake Release. Refer to SP.16, Cold Weather Operations. • Hydraulic panel - Set • DEMAND pump selectors - OFF	
Call “SHUTDOWN CHECKLIST.”	Accomplish the Shutdown checklist.

Shutdown Checklist

Seat belt signs	OFF	C
Fuel control switches	CUTOFF	C
Fuel pump switches	OFF	C
Hydraulic panel	set	C
Engine anti-ice	OFF	C
Window heat	OFF	C
Beacon	OFF	C
Transponder	STBY	C
Parking brake	as reqd	C

Captain	First Officer
After the Shutdown Checklist is complete:	
When external power is available:	
• EXT PWR 1 switch – Push if AVAIL light is illuminated • EXT PWR 2 switch – Push if AVAIL light is illuminated • APU selector - OFF • Configure aircraft for ground air conditioning use. Refer to SP.2, Ground Air Conditioning Cart Use.	
• ACARS information - Enter • Complete ACARS Postflight procedures. • Autoland attempts must be recorded. Refer to SP.4. • Do not send FLT SUMMARY report, the report will auto-send after five minutes. • Status Messages - Check • Record messages in the aircraft logbook. • Engine oil, oxygen, and hydraulic quantities - Check • If quantities are less than the following values, make a logbook entry and notify maintenance as soon as possible. • Engine oil: 16 quarts • Oxygen: 1400 psi • Hydraulic fluid: RFs displayed • If the aircraft operated in Class II airspace for more than one hour: • IRS drift error rates - Check • Referencing the FMS: • INDEX page - Select MAINT • MAINT page - Select IRS MONITOR • Make a logbook entry if any IRS drift is greater than 2 nm per hour. • Logbook - Make required entries for maintenance discrepancies • Flight deck lights and electronic displays - Set as required	

After shutdown reminders:

- Enter appropriate ACARS information.
- Check oxygen, engine oil, and hydraulic quantities.
- Check status messages.
- Check IRS drift error (Class II greater than one hour).
- Make appropriate logbook entries.
- Shutdown the APU, unless required for environmental reasons.

Secure Procedure

Captain	Any Crewmember
After coordination with local maintenance or operations:	
Accomplish the Secure checklist only when the aircraft is to remain for two hours or more. The captain will designate a crewmember to accomplish the Secure checklist. When operating the last flight of any day into a limited or non-maintenance station, accomplish the following: • If a maintenance discrepancy is noted and entered in the logbook, the MCC must be contacted through the dispatcher as soon as possible to facilitate corrective action and avoid delays. If a flight crew placard is applicable, it should be installed prior to departing the aircraft. • Perform a complete exterior inspection, in accordance with the Exterior Inspection - Captain or First Officer or Relief Pilot. If the aircraft will layover in cold weather, ensure it is configured as described in SP.16, Cold Weather Operations.	
When ready to secure the aircraft:	
Call "SECURE CHECKLIST."	Accomplish the Secure checklist as a "read and do" checklist.
• IRS mode selectors - OFF • EMERGENCY LIGHTS switch - OFF • PACK control selectors - OFF • When using APU bleed air, allow approximately 2-3 seconds between PACK shutdown. • APU and External power - Set as required Note: Allow the APU automatic cool down cycle to complete prior to removing battery power. This process takes approximately two minutes. • If only ground service power is required: • Verify EXT PWR AVAIL light(s) illuminated • EXT PWR 1 and 2 switches - OFF • STANDBY POWER selector - OFF • BATTERY switch - OFF • GROUND SERVICE bus switch (located on the flight attendant panel at door 2L) - ON • If electrical power is not required: • APU selector and EXT PWR 1 and 2 switches - OFF • STANDBY POWER selector - OFF • BATTERY switch - OFF	

Secure Checklist

IRS mode selectors OFF
Emergency lights OFF
Packs OFF
APU & external power as reqd
Standby power OFF
Battery switch OFF

Intentionally
Blank

Normal Operational Information
Table of Contents

Chapter NOI
Section 0

Normal Ops Info	NOI.1
Normal Ops Info	NOI.1.1
Reserved	NOI.2
Approach Guidance	NOI.3
Approach Selection Table	NOI.3.1
Using VNAV to Meet Altitude Constraints Prior to the Published FAF/PFAF/FAP	NOI.3.3
ILS CAT I, LDA with GS - Approach Guide APP Mode	NOI.3.5
ILS Precision Runway Monitor (PRM) Considerations	NOI.3.7
ILS CAT II or SA ILS CAT II - Approach Guide APP Mode ..	NOI.3.9
ILS CAT III - Approach Guide APP Mode	NOI.3.11
GPS, RNAV (GPS), or RNAV (GNSS) - Approach Guide LNAV & VNAV Modes	NOI.3.13
ILS (GS Out), LOC, LDA, or VOR - Approach Guide LNAV or LOC & VNAV Modes	NOI.3.17
Charted Visual Approach Guide (Procedure in FMS Database) LNAV & VNAV Modes	NOI.3.19
Circling Maneuver	NOI.3.21
RADIO/BARO Minimums Chart	NOI.3.23

Intentionally
Blank

Normal Operational Information

Chapter NOI

Normal Ops Info

Section 1

Normal Ops Info

The Normal Ops Info section includes the Approach Guidance. This section provides quick reference tools for the experienced crew member. For more detailed information, refer to the Airway Manual, the FCTM, the ODM, and the FOM.

Approach Guidance

The approach guidance section begins with the Approach Selection Table. The table lists the approach type, any qualifiers for the approach, and the MCP selection(s). A page number will then direct the pilot to the recommended approach guide to be used.

Following the Approach Selection Table are the Approach Guides. The guides have been developed for each type of authorized approach and are intended to help the pilot prepare for, brief, and conduct the approach procedure. The use of an approach guide is recommended, but not required.

Following the Approach Guides is the RADIO/BARO Minimums Chart. The chart contains the landing minimum settings for all approaches.

Intentionally
Blank

Normal Operational Information
Reserved

Chapter NOI
Section 2

Reserved for future development.

Intentionally
Blank

Normal Operational Information

Approach Guidance

Chapter NOI

Section 3

Approach Selection Table

Approach Type	Qualifier	MCP Selection(s) Page
ILS	For PRM considerations also see NOI.3.7	APP CAT I NOI.3.5 CAT II NOI.3.9 SA CAT II NOI.3.9 CAT III NOI.3.11
LDA with GS	For PRM considerations also see NOI.3.7	APP NOI.3.5
RNAV (RNP)	GPS Required	NOT AUTHORIZED
RNAV (GPS) RNAV (GNSS) GPS	GPS Required	LNAV VNAV NOI.3.13
ILS (GS out) LOC LDA (no GS) VOR	Procedure in FMS Database	LNAV VNAV NOI.3.17
	NO Procedure in FMS Database	NOT AUTHORIZED
LOC (BACK CRS) NDB		NOT AUTHORIZED
Charted Visual Flight Procedures	Procedure in FMS Database	LNAV VNAV NOI.3.19
	NO Procedure in FMS Database	Fly using visual references
Circling Maneuver		NOI.3.21

Intentionally
Blank

Using VNAV to Meet Altitude Constraints Prior to the Published FAF/PFAF/FAP

If above the published FAF altitude and unsure all altitude constraints outside the FAF will be complied with, cleared for the approach, and:

- established on a STAR/RNAV STAR with common runway transition waypoint, or
- established on a published segment of the approach, or
- vectored to a final approach course intercept heading and level at the active waypoint altitude, or
- cleared direct to an approach waypoint and level at that waypoint altitude:

LNAV/LOC Select

MCP altitude Set as follows

 ILS Set Precision Final Approach Fix altitude

 Non-ILS Set DA/DDA/MDA rounded up to next 100'

VNAV Select or verify

Speed intervention Set as desired

If VNAV ALT is displayed AND aircraft more than 150 feet above the next constraint:

WARNING: : If within 150 feet of the next constraint altitude do not press the MCP altitude knob until reaching the constrained waypoint.

MCP altitude knob Push one time

Speed intervention Set as desired

Intentionally
Blank

ILS CAT I, LDA with GS - Approach Guide

APP Mode

For inoperative equipment, refer to the QRH, Non-Normal Ops Info tab, ILS Approach Equipment Requirements.

For any inoperative ground based equipment, refer to the Airway Manual, Ops Specs, IAP.

For ILS Precision Runway Monitor (PRM) Approach, refer to the ILS Precision Runway Monitor (PRM) Approach Breakout Procedures Approach Guide.

Note: Approach may continue to DA(H) if established on the final segment and the controlling visibility decreases below the authorized minimums. Specific foreign country exceptions may apply. For further information, refer to the Airway Manual, Ops Specs, IAP.

Airport diagram.....Review

Autopilot.....As required

If operable, both the Autopilot and Flight Director will be utilized for all ILS approaches when the reported weather is below 4,000 feet RVR or 3/4 mile.

FMS approach procedure Select

Verify waypoints, altitude constraints, courses (within 3°), and descent angle.

Minimums.....Set DA

When cleared for the approach:

APP Mode.....Select

Select when established on a published inbound segment of the approach or when on a final approach course intercept heading. Adhere to all published step down fix altitudes located outside the final approach segment.

No later than 1,000 feet AGL:

Missed approach altitude Set
Set lowest initial level off altitude on missed approach
procedure.

Execute a missed approach after the FAF with the approach lights or
runway environment not in sight if the following occurs:

- criteria listed in the Airway Manual, Ops Specs, IAP

ILS Precision Runway Monitor (PRM) Considerations

PRM procedure Brief Jeppesen 11-XX Pages

Primary and Monitor Frequencies - Briefed

Breakout procedure Briefed

“Breakout” Procedure

Note: All “Breakouts” must be hand flown.

Pilot Flying	Pilot Monitoring
If ATC calls “Traffic Alert” during a PRM approach:	
A/P - Disengage	F/D (both) - OFF
Maneuver as directed by ATC CAUTION: Do not exceed 15° of bank, if below VGA (Flaps 10 bug). Note: If ATC “breakout” instructions coincide with a TCAS RA, follow the vertical guidance of the RA and the lateral guidance directed by ATC. Note: If descending, vertical speed should not exceed 1,000 FPM.	Communicate with ATC as required.
	When established on the “breakout” heading: • F/D (both) - ON
When "breakout" is complete, reset automation to appropriate level.	

Intentionally
Blank

ILS CAT II or SA ILS CAT II - Approach Guide

APP Mode

For inoperative equipment, refer to the QRH, Non-Normal Ops Info tab, ILS Approach Equipment Requirements.

For any inoperative ground based equipment, refer to the Airway Manual, Ops Specs, IAP.

Note: Approach may continue to DA(H) if established on the final segment and the controlling RVR goes below minimums. Specific foreign country exceptions may apply. For further information, refer to the Airway Manual, Ops Specs, IAP.

Approaches must be flown using autoland procedures.

Autoland:

Must be accomplished using flaps 25 or 30.

Maximum reported wind component to initiate approach and land:

25 knots headwind, 15 knots crosswind, 10 knots tailwind

FMS approach procedure Select
Verify waypoints, altitude constraints, courses (within 3°), and descent angle.

Minimums Set

RA Authorized:

- Set barometric DA for situational awareness only.
- Set the published RA in the RADIO display (DH is determined by the CA's radio altimeter if BARO switch is set to RADIO).

RA Not Authorized:

- Set the published DA in the BARO display (DA is determined by the IM or the first officer's BARO Altimeter, whichever occurs first).

Marker beacon audio (RA Not Authorized) ON

Autobrakes Recommended

Airport diagram and SMGCS chart Review

Callouts Review

- captain announces “LAND 2” or “LAND 3” at DA(H).

Note: Runway environment must be in sight.

- Refer to Standard Callouts, Operational Guidelines, NP.12.

FMA Review

- LAND 2 or LAND 3 at 1500 feet RA
- FLARE at approximately 50 feet RA
- IDLE at approximately 25 feet RA
- ROLLOUT replaces LOC slightly above touchdown.

When cleared for the approach:

APP mode Select

Select when established on a published inbound segment of the approach or when on a final approach course intercept heading. Adhere to all published step down fix altitudes located outside the final approach segment.

No later than 1000 feet AGL:

Missed approach altitude Set

Set lowest initial level off altitude on missed approach procedure.

Execute a Missed Approach for any of the following:

- Criteria listed in the Airway Manual, Ops Specs, IAP
- Autopilot unintentionally disengaged,
- LAND 2 or LAND 3 is not annunciated on PFD below 1,500 feet RA, or
- NO AUTOLAND EICAS caution is annunciated

ILS CAT III - Approach Guide

APP Mode

For inoperative equipment, refer to the QRH, Non-Normal Ops Info tab, ILS Approach Equipment Requirements.

For any inoperative ground based equipment, refer to the Airway Manual, Ops Specs, IAP.

Note: Approach may continue to AH if established on the final segment and the controlling RVR goes below minimums. Specific foreign country exceptions may apply. For further information, refer to the Airway Manual, Ops Specs, IAP.

Approaches must be flown using autoland procedures.

Autoland:

Must be accomplished using flaps 25 or 30.

Maximum reported wind component to initiate approach and land:

25 knots headwind, 15 knots crosswind, 10 knots tailwind

Airport diagram and SMGCS chart Review

FMS approach procedure Select

Verify waypoints, altitude constraints, courses (within 3°), and descent angle.

Minimums Set

- Set 100 feet above touchdown zone elevation in BARO display for situational awareness only.
- Set 100 feet in the RADIO display.

Autobrakes Required, if operable

Callouts Review

- At alert height (AH) captain calls out “LAND 3” or “GO AROUND”.
- Refer to Standard Callouts, Operational Guidelines, NP.12.

FMA Review

- LAND 3 at 1500 feet RA
- FLARE at approximately 50 feet RA
- IDLE at approximately 25 feet RA
- ROLLOUT replaces LOC slightly above touchdown

When cleared for the approach:

APP mode Select
Select when established on a published inbound segment of the approach or when on a final approach course intercept heading. Adhere to all published step down fix altitudes located outside the final approach segment.

No later than 1000 feet AGL:

Missed approach altitude Set
Set lowest initial level off altitude on missed approach procedure.

Execute a Missed Approach for any of the following:

- Criteria listed in the Airway Manual, Ops Specs, IAP
- Autopilot unintentionally disengaged,
- LAND 3 is not annunciated on PFD below 1,500 feet RA,
- NO LAND 3 EICAS caution is annunciated below 1500 feet RA, or
- NO AUTOLAND EICAS caution is annunciated.

GPS, RNAV (GPS), or RNAV (GNSS) - Approach Guide

LNAV & VNAV Modes

For approaches with inoperative equipment refer to QRH, Non-Normal Ops Info tab, RNAV Approach Equipment Requirements.

Airport temperature Confirm within limits

Local altimeter Verify available

Autopilot Required in IMC

FMS approach procedure Select
 Verify waypoints, altitude constraints, courses (within 3°), and
 descent angle.

Key Waypoint Enter
 FIX page.

Approach RNP Set 0.3
 POS REF page 2/3.

GPS updating Confirm
 POS REF page 2/3 or ND.

Minimums Set DA
 If LNAV/VNAV minimums are published, they must be used. LPV
 minimums are not authorized.

XTK error Monitor
 PROG page 2.

Note: Intervention with HDG SEL is NOT authorized.

VTK error Monitor by FAF
 PROG page 2.

Brief missed approach plan if approach is discontinued prior to DA due
 to loss of navigation capability.

Prior to beginning the approach:

VNAV Select or verify

Speed intervention Set

When cleared for the approach:

LNAV Select

When:

- established on a STAR/RNAV STAR with common runway transition waypoint, or
- established on a published segment of the approach, or
- vectored to a final approach course intercept heading and level at the active waypoint altitude, or
- cleared direct to an approach waypoint and level at that waypoint altitude:

MCP altitude Set

Set DA rounded up to the next highest 100 feet.

If VNAV ALT is displayed AND aircraft more than 150 feet above the next constraint:

WARNING: If within 150 feet of the next constraint altitude do not press the MCP altitude knob until reaching the constrained waypoint.

MCP Altitude knob Push one time

Altimeters Check within 100 feet by FAF

Inside the Key Waypoint, no later than 1,000 feet AGL and at least 300 feet below missed approach altitude:

Missed approach altitude Set

Set lowest initial level off altitude on missed approach procedure.

No later than 50 feet below DA:

Autopilot Disengage

Execute a missed approach with the approach lights or runway environment not in sight if any of the following occur:

- criteria listed in the Airway Manual, Ops Specs, IAP
- VERIFY POSITION FMS message,
- UNABLE RNP EICAS message,
- GPS EICAS message (dual failure only),
- XTK error greater than 0.3 (PROG page 2),
- dual FMS failure,
- additionally, after the FAF with approach lights or runway environment not in sight:
 - VTK error exceeds +100/-50 feet,
 - loss of VNAV PTH below 1,000 feet AGL,
 - either FMS fails, or
 - VNAV fails.

Intentionally
Blank

ILS (GS Out), LOC, LDA, or VOR - Approach Guide LNAV or LOC & VNAV Modes

If the ground based navaid is out of service or compatible avionics is either not installed or not operational, the NDB, NDB/DME, VOR, or VOR/DME approach may be flown using RNAV procedures as long as one GPS is operational and the approach is authorized on the Company Pages or flight plan remark.

Autopilot Required in IMC

FMS approach procedure Select
Verify waypoints, altitude constraints, courses (within 3°), and descent angle.

ILS (GS Out) approaches:

FAF Altitude - Modify, if necessary

Key Waypoint Enter
FIX page.

If GPS equipped and using LNAV:

Approach RNP Set 0.3
POS REF page 2/3.

Minimums Set DA/DDA

- Set approach chart MDA and use as a DA.
- Set a DDA (MDA + 50 feet) if flying a non-RNAV approach outside the United States and its associated territories.

Raw data and VTK error Monitor
VTK error - PROG page 2.

Prior to beginning the approach:

VNAV Select or verify
Speed intervention Set

When cleared for the approach:

LNAV or LOC Select

When:

- established on a STAR/RNAV STAR with common runway transition waypoint, or
- established on a published segment of the approach, or
- vectored to a final approach course intercept heading and level at the active waypoint altitude, or
- cleared direct to an approach waypoint and level at that waypoint altitude:

MCP altitude Set
Set DA/DDA rounded up to the next highest 100 feet.

If VNAV ALT is displayed AND aircraft more than 150 feet above the next constraint:

WARNING: If within 150 feet of the next constraint altitude do not press the MCP altitude knob until reaching the constrained waypoint.

MCP Altitude knob Push one time

Inside the Key Waypoint, no later than 1,000 feet AGL and at least 300 feet below missed approach alt:

Missed approach altitude Set
Set lowest initial level off altitude on missed approach procedure.

No later than 50 feet below DA or 100 feet below DDA:

Autopilot Disengage

Execute a missed approach after the FAF with the approach lights or runway environment not in sight if any of the following occur:

- criteria listed in the Airway Manual, Ops Specs, IAP
- loss of VNAV PTH below 1,000 feet AGL,
- vertical path deviation exceeds +/- 75 feet, or
- raw data limits exceeded.

Additional Considerations:

GPS equipped and using LNAV:

- UNABLE RNP EICAS message

Charted Visual Approach Guide (Procedure in FMS Database) LNAV & VNAV Modes

The following guidance supplements visual approach preparations. FMS guidance is an aid to promote more precise ground track and altitude control. Do not sacrifice outside visual vigilance while using FMS capabilities.

CAUTION: Do not use a RNAV visual approach that states “RF required.”

Note: All aircraft are equipped with DME/DME/IRU navigation. GPS receivers may be installed.

Company Pages
& Attention All Users page Reference as applicable

Autopilot As desired

FMS approach procedure Select

Verify waypoints, altitude constraints, courses (within 3°), and descent angle.

RNAV Visuals are normally coded in the FMS database as RNV.

Charted Visual Approaches may include waypoints or reference points which differ by name from FMS coded waypoints.

RNV Glidepath angles may exceed 3.0 degrees

Prior to beginning the approach:

VNAV Select or verify

Speed intervention As desired

When cleared for the approach:

LNAV Select

MCP Altitude Set

Set TDZE/Rwy Threshold Elevation rounded up to the next highest 100 feet.

If VNAV ALT is displayed AND aircraft more than 150 feet above the next constraint:

WARNING: If within 150 feet of the next constraint altitude do not press the MCP altitude knob until reaching the constrained waypoint.

MCP Altitude knob Push one time

No later than 1,000 feet AGL:

Missed approach altitude Set as desired

Additional information:

- If missed approach instructions are not published, straight-out guidance may be coded into the approach for crew convenience.

Circling Maneuver

Note: Do not use APP mode.

The following guidance supplements normal approach preparations and procedures for the type of approach to be flown.

Weather requirements Check

- Visibility - 3 miles (4800m) or published visibility for the highest circling speed category, whichever is higher.
- Ceiling - 1000 feet (300m) or the published HAA (height above airport) for the highest circling speed category, whichever is higher.

Autopilot Required in IMC

Minimums Set MDA

Set published MDA or airport elevation plus 1000 feet (300m),
whichever is higher.

Prior to beginning the approach:

VNAV Select or verify

Speed intervention Set

When cleared for the approach:

LNAV or LOC Select

When:

- established on a published segment of the approach, or
- vectored to a final approach course intercept heading and level at the active waypoint altitude, or
- cleared direct to an approach waypoint and level at that waypoint altitude:

Altitude Set

Set published MDA or airport elevation plus 1000 feet (300m),
rounded up to the next higher 100 feet.

If VNAV ALT is displayed AND aircraft more than 150 feet above the next constraint:

WARNING: If within 150 feet of the next constraint altitude do not press the MCP altitude knob until reaching the constrained waypoint.

MCP Altitude knob Push one time

At configuration point:

Landing gear and landing flaps Set

Aircraft should be fully configured for landing prior to FAF.

When level at the MDA (ALT or VNAV ALT):

Missed approach altitude Set

Set lowest initial level off altitude on missed approach procedure.

When needed to execute circling maneuver:

HDG SEL Select

No later than 50 feet below MDA:

Autopilot Disengage

Execute a missed approach if visual contact with the airport is lost.

Conducting a missed approach:

Use normal missed approach procedures except:

- Make the initial climbing turn towards the landing runway to reach the missed approach heading. Turn may be more than 180 degrees and not in the shortest direction.
- Maintain the missed approach flap setting until close in maneuvering is complete.
- Fly the published missed approach corresponding to the instrument approach procedure just flown until alternate instructions are received.

FMS utilization techniques:

- Utilize FIX page to display a 4nm circle around airport for lateral reference.

RADIO/BARO Minimums Chart

RADIO or BARO Minimums Chart		
APPROACH TYPE	BARO	RADIO
ILS TO CAT I	PUBLISHED DA	N/A
CAT II RA AUTHORIZED	PUBLISHED DA(1)	PUBLISHED RA
CAT II RA NOT AUTHORIZED	PUBLISHED DA	N/A
CAT III	TDZE + 100'(1)	100'
STRAIGHT-IN (NON-ILS)	PUBLISHED MDA/DA or DDA (MDA + 50')	N/A
CIRCLE TO LAND	HIGHER OF: PUBLISHED MDA OR FIELD ELEV + 1000'	N/A
VISUAL	APPROACH MINIMUMS(2)	N/A
(1) CAT II RA AUTHORIZED and CAT III DH will be made by reference to the radio altimeter (RA) only. BARO minimums are set for situational awareness only. (2) Set the approach minimums for the instrument approach used to back up the visual approach. If no instrument approach is available, set field elevation.		

Intentionally
Blank

Supplementary Procedures
Table of Contents

Chapter SP
Section 0

Introduction	SP.05
General	SP.05.1
Airplane General	SP.1
Cabin Inspection	SP.1.1
Oxygen Mask and Interphone System Test	SP.1.1
Electronic Flight Bag (EFB) Mount.	SP.1.3
Flight Deck Door Access System Test	SP.1.5
Interior Cabin Modifications	SP.1.7
Business Elite Class Seats	SP.1.7
Inflight Entertainment (IFE) System	SP.1.8
Inflight Entertainment (IFE) System Fault Guide	SP.1.8
Air Systems	SP.2
Air Conditioning Packs	SP.2.1
Ground Air Conditioning Cart Use.	SP.2.1
Packs Off Takeoff	SP.2.1
Landing Airport Elevation Between 8,000 Feet and 10,000 Feet	SP.2.2
Anti-Ice, Rain	SP.3
Anti-Ice Operation	SP.3.1
Windshield Wiper Use	SP.3.1
Automatic Flight	SP.4
AFDS	SP.4.1
AFDS Operation	SP.4.1
Heading Hold	SP.4.1
Heading Select	SP.4.1
Altitude Hold	SP.4.1
Flight Level Change, Climb or Descent	SP.4.2
Vertical Speed, Climb or Descent	SP.4.2
Intervention of FMC Altitude Constraints during VNAV Climb	SP.4.2

Intervention of FMC Cruise Altitude during VNAV Cruise	SP.4.3
Intervention of FMC Cruise Altitude during VNAV Descent.	SP.4.3
Intervention of FMC Airspeed Constraints during VNAV. . .	SP.4.3
Autothrottle Operation	SP.4.4

Communications SP.5

Cockpit Voice Recorder Test	SP.5.1
Aircraft Communications Addressing and Reporting	
System (ACARS).	SP.5.1
ACARS Fleet Migration Configuration	SP.5.1
AWABS/WDR (Aircraft Weight and Balance System/Weight Data Record)	SP.5.2
ACARS Control Through MCDU	SP.5.3
ACARS Chime Function.	SP.5.4
Advisory Messages	SP.5.6
ACARS Preflight	SP.5.8
ACARS Digital-Automatic Terminal Information Service (D-ATIS) Request.	SP.5.11
ACARS Pre-Departure Clearance (PDC) Request	SP.5.13
Requesting a Departure Clearance (DCL) via ACARS (Asia/Europe)	SP.5.14
ACARS Electronic Fuel Slip	SP.5.17
ACARS Load Data Request	SP.5.17
ACARS Takeoff Data Request/WDR Update	SP.5.18
Recording Full Thrust Takeoffs	SP.5.24
ACARS Oceanic Clearance Request	SP.5.25
ACARS Domestic and International Position Reports	SP.5.32
ACARS In-Range Data Report.	SP.5.39
ACARS Landing Performance Request - Override Options	SP.5.41
ACARS Taxi-In Delay Reasons	SP.5.42
ACARS Postflight.	SP.5.45
ACARS Initialization (Data Link Aircraft Only)	SP.5.48
FMC Data Link ACARS Messages	SP.5.56
Automatic Enroute Wind Update	SP.5.56
FMC Data Link Reset	SP.5.58
FMC RESET	SP.5.58

Satellite Communications (SATCOM) Operations	SP.5.59
SATCOM ACCESS	SP.5.60
Controller Pilot Data Link Communications and Automatic	
Dependent Surveillance (CPDLC/ADS-C)	SP.5.70
Equipment Requirements	SP.5.70
CPDLC/ADS-C Enroute Procedures	SP.5.70
Logon Procedure	SP.5.71
Procedures	SP.5.74
CPDLC/ADS Automatic Functions	SP.5.79
CPDLC and ADS Non-Normal Procedures	SP.5.81
CPDLC and ADS Emergency Modes	SP.5.81
CPDLC REQUEST Examples	SP.5.86
HF System	SP.5.92
FMC Worldwide Waypoint Position Reporting	
(FMC WPR)	SP.5.94
ABEAM Points	SP.5.94
Track Change	SP.5.94
WPR RESET	SP.5.95
FMC RESET	SP.5.96
Manual ACARS Position Reporting	SP.5.96
Turbulence Reporting	SP.5.96
Flights with Nontraditional Call Signs	SP.5.97
Electrical	SP.6
Electrical Power Up	SP.6.1
Electrical Power Down	SP.6.2
Transferring Electrical Power To or From the APU Power	SP.6.2
Engines, APU	SP.7
Engine Continuous Ignition	SP.7.1
Engine Ground Pneumatic Start	SP.7.1
Before Engine Start	SP.7.1
After Engine Start	SP.7.2
After Pushback	SP.7.2
Engine Crossbleed Start	SP.7.3
Manual Override Start	SP.7.3
Pratt & Whitney 4056 Engine Oil Indications	SP.7.4

Automated Engine Reporting System	SP.7.4
Assumed Temperature Thrust Rollback	SP.7.5
Fire Protection.....	SP.8
Engine/APU/Cargo Fire/Overheat Test (Fire Warning Test) . . .	SP.8.1
Squib Test	SP.8.2
Flight Instruments, Displays	SP.10
Heading Reference Switch Operation	SP.10.1
Operating Procedures in the QFE Environment	SP.10.2
Flight Management, Navigation	SP.11
Weather Radar Test	SP.11.1
Radar Operation	SP.11.2
Before Takeoff	SP.11.2
Takeoff	SP.11.2
Climb	SP.11.2
Cruise	SP.11.3
Descent	SP.11.4
Approach	SP.11.4
Radar Guidelines	SP.11.5
Tilt Accuracy Check	SP.11.5
Gain Control	SP.11.6
Attenuation	SP.11.6
Turbulence Avoidance	SP.11.7
IRS Fast Realignment	SP.11.8
IRS High Latitude Alignment	SP.11.8
FMC Preflight Procedures	SP.11.9
Modifying FMC Drag and Fuel Flow Factors	SP.11.9
Route Entry Procedures - Pilot Flying	SP.11.10
Route Verification Procedures - Pilot Monitoring	SP.11.11
Wind and Temperature Entries	SP.11.13
Restricted Critical Terrain Route Entry	SP.11.15
FMC Lateral Navigation Entries and Conventions	SP.11.16
Direct to a Waypoint	SP.11.16
Modifying the Route	SP.11.16
Creating a Course Offset	SP.11.17
Deleting a Course Offset	SP.11.17

Creating a Route Discontinuity	SP.11.17
Deleting a Waypoint	SP.11.18
Entering a Waypoint Not In The Data Base	SP.11.18
Intercepting a Course To a VOR/Waypoint	SP.11.20
Intercepting a Radial Outbound From a VOR/Waypoint	SP.11.21
Intercepting an Airway	SP.11.22
Creating Latitude/Longitude Reporting Points	SP.11.23
Changing a Destination	SP.11.23
Establishing Holding Pattern	SP.11.24
Exiting Holding Pattern	SP.11.25
Programming a SID and/or Departure Runway	SP.11.26
Programming a STAR and/or Approach	SP.11.27
Programming a Runway Dependant (R/D) STAR	SP.11.28
FMC Vertical Navigation Entries and Conventions	SP.11.30
Manually Changing a Climb, Cruise or Descent Speed	SP.11.30
Climbing or Descending Direct To MCP Altitude (Unrestricted Climb or Descent)	SP.11.30
Changing a Cruise Altitude - Recruising UP During Climb	SP.11.31
Changing a Cruise Altitude - Recruising Down During Climb	SP.11.31
Changing a Cruise Altitude - Recruising Down During Level Off	SP.11.32
Accomplishing a Cruise Climb or Descent	SP.11.32
Programming a Speed/Altitude Constraint at a Waypoint	SP.11.33
Programming a Speed/Altitude Transition	SP.11.34
Programming a Speed/Altitude Restriction	SP.11.34
Programming an Offpath Descent	SP.11.35
FMC Performance Data Entries	SP.11.36
Entering a Step Climb While in Flight	SP.11.36
Evaluating a Step Climb While in Cruise	SP.11.36
Descent Forecast Programming	SP.11.39
Programming Waypoint Winds and Temperatures	SP.11.39
Additional FMC Entries	SP.11.40
Fix Page Functions	SP.11.40
Inhibiting Navaid(s) From FMC Radio Updating	SP.11.42
Manual ILS Tuning	SP.11.43
Navigation Accuracy Checks	SP.11.44

Departure or Landing Airport Not in the FMC	
Navigation Database	SP.11.46
Alternate Navigation	SP.11.54
Fuel	SP.12
Fuel Balancing	SP.12.1
Fuel Quantity Indication System (FQIS) - Main Tank	
Indicator Inoperative Procedures and Considerations	SP.12.1
Prior to Engine Start	SP.12.1
In-flight	SP.12.1
Fuel Freeze Program	SP.12.5
Westbound Flights	SP.12.5
Eastbound Flights	SP.12.5
Operating Procedures	SP.12.5
After Departure	SP.12.6
All Flights	SP.12.6
Warning Systems	SP.15
EICAS STATUS Messages	SP.15.1
Preflight and Prior to Engine Start	SP.15.1
After Engine Start	SP.15.1
After Takeoff	SP.15.2
Logging STATUS Messages	SP.15.2
Event Record	SP.15.2
Adverse Weather	SP.16
Introduction	SP.16.1
Fuel Freeze Program	SP.16.1
Cold Weather Operation	SP.16.1
Preflight Procedure	SP.16.1
Engine Start Procedure	SP.16.3
Engine Nacelle Anti-ice Operation - On the Ground	SP.16.3
Taxi Procedure	SP.16.4
Before Takeoff Procedure	SP.16.5
Takeoff Procedure	SP.16.5
Climb, Cruise, and Descent Procedures	SP.16.6
Engine Nacelle Anti-Ice Operation – In Flight	SP.16.6
Wing Anti-Ice Operation – In Flight	SP.16.7

Cruise Procedure	SP.16.8
Approach and Landing Procedures	SP.16.8
After Landing Procedure	SP.16.8
Secure Procedure	SP.16.9
Guidelines for Takeoff on Contaminated Runways or	
Landing with Braking Action Less than Good	SP.16.10
Procedure Guidance	SP.16.10
Crosswind Guidance	SP.16.11
AWABS Determinations	SP.16.12
Category Definitions	SP.16.12
Takeoff Runway Contaminant Decision Tree	SP.16.14
Contaminant Millimeters to Inches Conversion	SP.16.16
Ground De/Anti-Icing Procedure	SP.16.17
Pre-Gate Departure Communication	SP.16.17
Aircraft Configuration and Communication	SP.16.18
At Gate or Off Gate (Prior to Engine Start)	SP.16.19
Remote (Engines Not Running)	SP.16.23
Remote (Engines Running)	SP.16.27
Hot Weather Operation	SP.16.31
Moderate to Heavy Rain, Hail or Sleet	SP.16.32
Operation in a Sandy or Dusty Environment	SP.16.33
Exterior Inspection	SP.16.33
Preflight Procedure - Pilot Monitoring	SP.16.35
Engine Start Procedure	SP.16.35
After Start Procedure	SP.16.36
Taxi-Out	SP.16.36
Takeoff	SP.16.37
Landing	SP.16.37
After Landing Procedure	SP.16.37
Taxi-In	SP.16.38
Shutdown Procedure	SP.16.38
Secure Procedure	SP.16.38
Turbulence	SP.16.39
Severe Turbulence	SP.16.40
Volcanic Ash Encounter	SP.16.42
Ground Operations	SP.16.42
In Flight	SP.16.42

Intentionally
Blank

Supplementary Procedures

Introduction

Chapter SP

Section 05

General

This chapter contains procedures that are organized by system and covers:

- Procedures (adverse weather operation, etc.) that are accomplished as required rather than routinely performed on each flight,
- Any first-flight-of-the-day test or other systems test,
- Guidance on lengthy operating procedures, and
- Adverse weather procedures and guidance.

Intentionally
Blank

Supplementary Procedures

Airplane General

Chapter SP

Section 1

Cabin Inspection

For a flight without a flight attendant staff (ferry flight, test flight, delivery flight, training flight, etc.) the pilots must secure the cabin.

- Doors - Secured and at least the 1L and 1R doors armed
- Galley (coffee pots, doors, and drawers, etc.) - Secured
- Beverage carts - Stowed and locked in position
- Overhead bins - Closed
- Closets - Closed and locked
- Lavatories - Inspect for general security; doors locked
- Polar Equipment - Inspect for security seal

After block-in, pilots should DISARM all doors and pass a thumbs up to the gate agent when the main entry door is ready to be opened.

Oxygen Mask and Interphone System Test

Note: Always transmit the intention to accomplish an oxygen mask test over the interphone to the ground crew.

FLIGHT INTERPHONE TRANSMITTER Selector MIC

L or R SPEAKER selector ON

STATUS DISPLAY Switch Push

Crew Oxygen Pressure Check EICAS

Note oxygen pressure.

Oxygen Mask Stowed

Verify doors closed.

NORMAL/100% Selector 100%

Leave N/100% selector in 100% position.

RESET/TEST Switch Push and Hold

Verify yellow cross appears momentarily in flow indicator.

EMERGENCY/TEST Selector Push and Hold

While continuing to hold the RESET/TEST switch, push the EMERGENCY/TEST selector for 10 seconds. Verify yellow cross appears continuously in flow indicator.

PUSH-TO-TALK Switch INT

Verify oxygen flow sound is heard through the flight deck speaker.

EMERGENCY/TEST Switch Release

RESET/TEST Switch Release

Verify yellow cross no longer appears in flow indicator.

Crew Oxygen Pressure Check EICAS

Verify pressure decreases no more than 100 psi during test and pressure adequate for dispatch.

Electronic Flight Bag (EFB) Mount

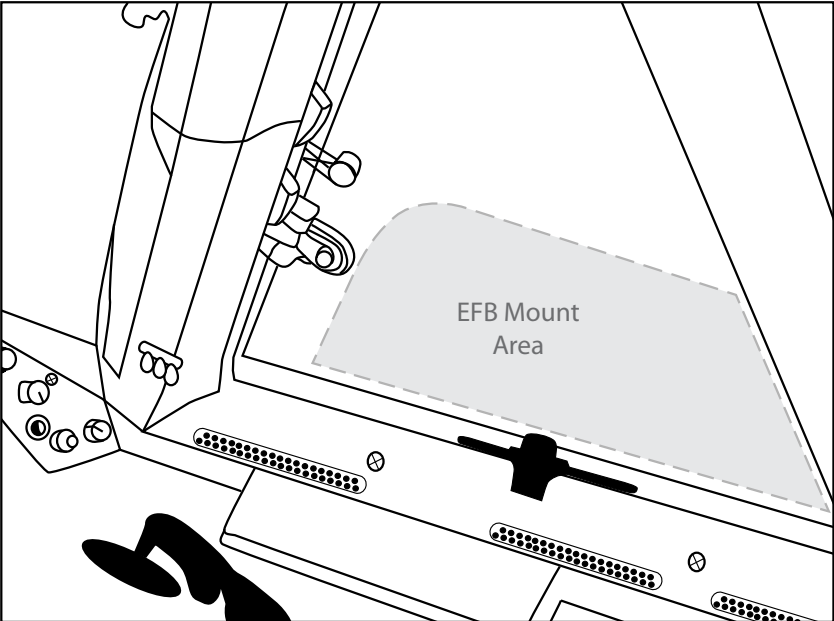
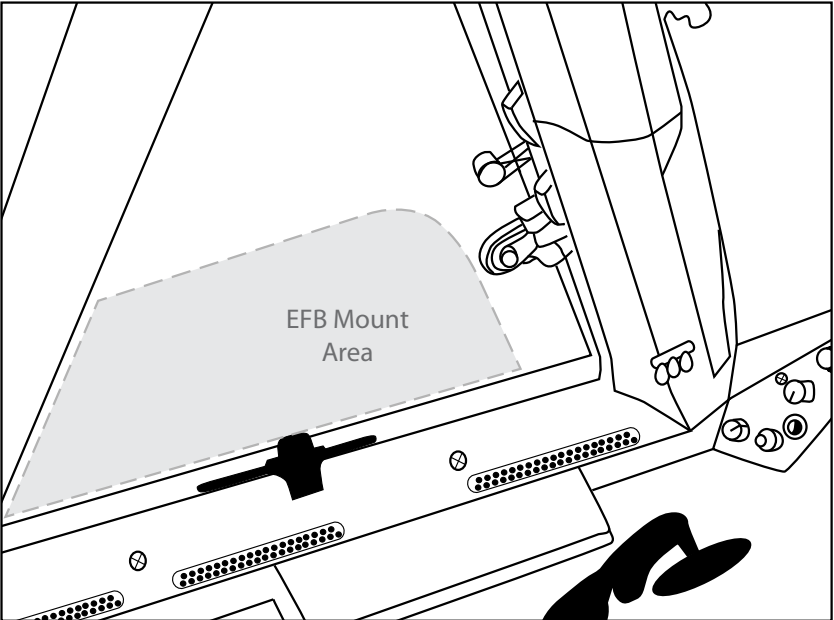
Note: Prior to the first flight of the day, the EFB mounting system must be installed/reinstalled to ensure the mount attachment is secure. During subsequent flights, mount security may be verified with a gentle tug. Reinstall the mount as required.

CAUTION: Do not place the EFB in direct sunlight on the glareshield.

Do not use any other mounting or securing system other than the provided approved system.

To secure the EFB mount in the aircraft:

- Ensure the side window and suction cups are clean. If necessary, wipe with pretreated lens/screen cloth or moist cloth.
- Sunshades (as installed) should be stowed prior to securing the mount.
- Ensure the locking levers are in the OFF position.
- Position the suction cups in the mounting zone indicated in the following diagrams.
- To remove trapped air, press each cup against the window until completely compressed.
- Move the locking levers to the ON position.
- Ensure the EFB and mount are free and clear of all flight controls, and do not restrict access to egress, tiller, oxygen mask, or line of sight.
- Squeeze the gray tabs together to expand the mounting tabs and insert the EFB into the mount.
 - If the EFB is in the portrait mode, the fixed tabs should be positioned at the bottom of the mount to prevent the EFB from slipping.
- Use caution when deploying sunshades with the EFB mount installed to avoid damage.



Flight Deck Door Access System Test

The following procedures must be accomplished prior to the first flight of the day:

Flight Deck Access System switch NORM (guard closed)

IND LTS TEST switch Push and hold to TEST

Verify the AUTO UNLK and LOCK FAIL lights on the door control panel illuminate.

IND LTS TEST switch Release

Flight Deck Door Open

Flight Deck Door Lock selector AUTO

Flight Deck Door Keypad Enter

Press the ENT key

Enter the access code in the keypad

Press the ENT key

Verify alert (continuous buzzer) sounds

Verify the keypad red light extinguishes

Verify the keypad amber light illuminates

Verify AUTO UNLK light extinguishes

Flight Deck Door Lock selector DENY

Verify alert (continuous buzzer) stops

Verify the keypad amber light extinguishes

Verify the keypad red light illuminates

Verify AUTO UNLK light extinguishes

Flight Deck Door Lock selector UNLKD

Verify alert (continuous buzzer) sounds

Verify the keypad red light extinguishes

Verify the keypad green light illuminates

Verify AUTO UNLK light extinguishes

Flight Deck Access System switch OFF

Verify the keypad red light illuminates

Verify LOCK FAIL light illuminates

Flight Deck Access System switch NORM (guard closed)

Verify the keypad red light remains illuminated

Verify LOCK FAIL light extinguishes

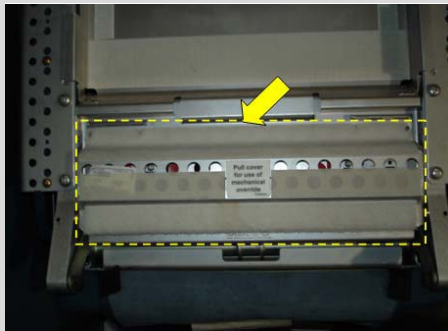
Note: If the Flight Deck Door Access system fails to test properly,
contact the MCC.

Interior Cabin Modifications

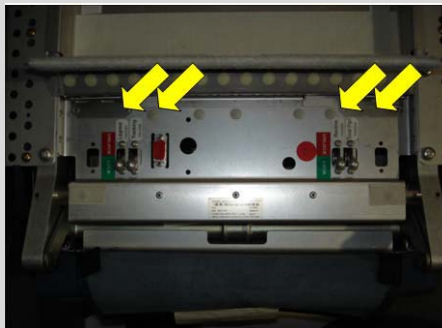
Business Elite Class Seats

Seat Position

Seat position is electrically controlled via individual seat controls. If the seat controls malfunction in flight, mechanical override switches may be used to reposition the seat for landing. To manually operate the seat, remove the main seat cushion, lift the aluminum guard panel, select the labeled switches as needed, and reposition the seat.



Lift the aluminum guard panel



Select the labeled switches and reposition the seat

Inflight Entertainment (IFE) System

The PED and IFE Video Control power is normally controlled by the SYS and PED PWR switches on the Video Control cabinet. If necessary, PED and IFE Video Control Cabinet power may also be controlled from the Flight Deck. Power can be removed by selecting the RT UTILITY switch to OFF.

Inflight Entertainment (IFE) System Fault Guide

The Inflight Entertainment Guide is located in the Equipment and Furnishings Manual (EFM). It may be found in the galley cabinet by door 2L.

Supplementary Procedures

Air Systems

Chapter SP

Section 2

Air Conditioning Packs

Ground Air Conditioning Cart Use

Before connecting ground air conditioning cart:

PACK Control selectors – OFF

Prevents pack operation if bleed air is supplied to the airplane.
The packs or pack components can be damaged if operated with conditioned air.

Recirculation Fan switches – As desired

Positioning the Recirculation Fan switches OFF allows the ground air unit to operate at maximum efficiency.

After disconnecting ground air conditioning cart:

PACK switches – NORM

Recirculation Fan switches – ON

Packs Off Takeoff

If the flight is designated for a no packs takeoff, “POF” will be annotated on the AWABS/WDR. When designated for a no packs takeoff, accomplish the following:

Before takeoff:

PACK Control selectors - OFF

After takeoff:

PACK Control selector (One only) - NORM

After the aircraft passes 1,000 feet and prior to reaching 3,000 feet HAA, position one Pack Control selector to NORM.

PACK Control selectors (Remaining packs) - NORM

Select the remaining Packs Control selectors to NORM in conjunction with the After Takeoff procedure.

Landing Airport Elevation Between 8,000 Feet and 10,000 Feet

Before start:

Landing Altitude switch MAN
Verify MAN displayed after landing altitude on Primary EICAS.

Landing Altitude selector 8,000 feet

Before descent:

Landing Altitude switch AUTO
Verify AUTO displayed after landing altitude on Primary EICAS.

Supplementary Procedures

Chapter SP

Anti-Ice, Rain

Section 3

Anti-Ice Operation

Requirements for use of anti-ice and operational procedures for engine and wing anti-ice are contained in Supplementary Procedures, Adverse Weather Section SP.16.

Windshield Wiper Use

CAUTION: Windshield scratching will occur if the windshield wipers are operated on a dry windshield.

Intentionally
Blank

Supplementary Procedures

Automatic Flight

Chapter SP

Section 4

AFDS

AFDS Operation

F/D switches ON

Verify that the flight director command bars display and that FD displays on the AFDS system status annunciator.

If the autopilot is desired:

A/P ARM switch Push

Verify CMD displays on the AFDS system status annunciator.

Heading Hold

If the airplane is operating in polar regions:

HDG reference switch TRUE

HDG HOLD switch Push

Verify HDG HOLD displays on the roll mode annunciator.

Heading Select

If the airplane is operating in polar regions:

HDG reference switch TRUE

HDG SEL switch Push

Verify HDG SEL displays on roll mode annunciator.

HDG selector Rotate

Set desired heading in the HDG window.

Altitude Hold

ALT HOLD switch Push

Verify ALT is displayed on the pitch mode annunciator.

Flight Level Change, Climb or Descent

ALT selector Rotate

Set the desired altitude in the MCP ALT window.

FLCH switch Push

Verify FLCH SPD is displayed on the pitch mode annunciator.

IAS/MACH selector Rotate

Set the desired speed in the MCP IAS/MACH window.

Vertical Speed, Climb or Descent

CAUTION: The vertical speed mode does not provide automatic overspeed protection and stall protection.

ALT selector Rotate

Set the desired altitude in MCP ALT window.

VERT SPD switch Push

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

VERT SPD selector Rotate

Set the desired vertical speed in the MCP VERT SPD window.

If a climb is desired:

Select climb thrust limit on the MCDU THRUST LIM page.

Intervention of FMC Altitude Constraints during VNAV Climb

ALT selector Rotate

Set the desired altitude in MCP ALT window

ALT selector Push (as required)

Each push of the ALT selector may delete a FMC altitude constraint.

CAUTION: Care must be taken when pushing the MCP Altitude selector to preclude inadvertently deleting waypoint altitude constraints.

Intervention of FMC Cruise Altitude during VNAV Cruise

ALT selector Rotate

Set the desired altitude in MCP ALT window.

ALT selector Push

If a higher altitude is selected, a CRZ climb will be initiated.

If a lower altitude is selected, a descent will be initiated.

Intervention of FMC Cruise Altitude during VNAV Descent

ALT selector Rotate

New altitude must be lower than the FMC altitude constraint(s) to be deleted.

ALT selector Push

Each push of the ALT selector may delete a FMC altitude constraint.

CAUTION: Care must be taken when pushing the MCP altitude selector to preclude inadvertently deleting waypoint altitude constraints.

If all FMC altitude constraints are deleted, the descent mode will revert to a VNAV SPD descent.

Intervention of FMC Airspeed Constraints during VNAV

IAS/MACH selector Push

MCP IAS/MACH display shows current FMC target speed.

IAS/MACH selector Rotate

Set the desired speed in the MCP IAS/MACH window.

VNAV remains engaged.

To resume former FMC speed:

IAS/MACH selector Push

MCP IAS/MACH display blanks and the FMC commanded VNAV speed is active.

Autothrottle Operation

To activate or reactivate an autothrottle mode:

A/T ARM switch ARM

If the pitch mode is TO/GA:

TO/GA switch Push

Verify that THR REF displays on the autothrottle mode annunciator. THR REF changes to HOLD at 80 knots.

If the pitch mode is ALT, V/S, G/S, or no pitch mode:

SPD switch Push

Verify that SPD is displayed on the autothrottle mode annunciation.

If a constant speed is desired:

IAS/MACH selector Rotate

Set the desired speed in the MCP IAS/MACH window.

If FLCH desired:

FLCH switch Push

Pitch mode changes unless G/S and LOC captured. Verify THR or HOLD displays on the autothrottle mode annunciator.

If VNAV is desired:

VNAV switch Push

Pitch mode changes when in V/S or ALT. Verify that THR REF, THR, SPD, IDLE, or HOLD displays as appropriate on the autothrottle mode annunciator.

If TO/GA is desired

TO/GA switch Push

Pitch and roll modes change to TO/GA. Verify that THR or THR REF displays on the autothrottle mode annunciator.

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

A/T ARM switch OFF, then ARM

Verify THR REF, THR, SPD, IDLE, or HOLD displays on the autothrottle mode annunciator.

Intentionally
Blank

Supplementary Procedures

Communications

Chapter SP

Section 5

Cockpit Voice Recorder Test

Voice Recorder Test switch Push and hold

6301-6314

Observe the indicator needle in the green band.

6315, 6316

Verify the status light illuminates.

Voice Recorder Test switch Release

Aircraft Communications Addressing and Reporting System (ACARS)

ACARS Fleet Migration Configuration

With fleet migration to the pre-merger Delta Aircraft Weight and Balance System/Weight Data Record (AWABS/WDR) and Flight Planning System 2 (FPS-2), the pre-merger Delta ACARS background processor will be used. This has not changed the pre-merger NWA ACARS hardware and screen format for the immediate future; however, ACARS functionality has changed. The paragraphs within this section describe which ACARS functions remain available, which functions are inactive, and which functions have revised entry requirements. Attempts to access inactive functions will result in a uplink message that identifies these functions as inactive/unavailable. Revised entries are necessary to satisfy screen logic and ACARS system logic for some functions.

Note: Some screens contain labels such as “NWA” and “FLEX” which are no longer used. These labels will continue to display until ACARS hardware and screens are migrated to the pre-merger Delta formats.

ACARS Data Message Verification

[AFM]

The following procedures are one means which may be used to verify Pre-Departure Clearance, Digital-Automatic Terminal Information Service, Oceanic Clearances, Weight and Balance and Takeoff Data messages transmitted over ACARS.

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.

Digital-Automatic Terminal Information Service

The flight crew shall verify the D-ATIS altimeter setting numeric and alphabetical values are identical. If the D-ATIS altimeter setting numeric and alphabetical values are different, the flight crew must not accept the D-ATIS altimeter setting.

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 the Weight and Balance numeric and alphabetical values are identical. If the Weight and Balance numeric and alphabetical values are different, the flight crew must not accept the Weight and Balance data.

Takeoff Data

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

AWABS/WDR (Aircraft Weight and Balance System/Weight Data Record)

The flight crew shall verify the flight number, date, and release number on the WDR match the corresponding information on the flight plan.

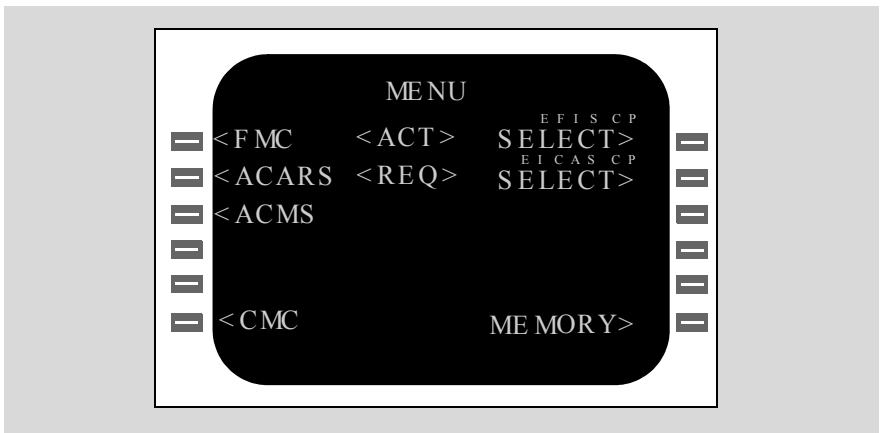
ACARS Control Through MCDU

The ACARS is accessed and all ACARS displays are viewed on the center MCDU.

Push the line select key adjacent to the <ACARS prompt to call up the ACARS Main Menu page. From this page ACARS functions may be accessed, such as pre-flight initialization, systems status checks, ACARS radio control, message status or display, printer functions, and ACARS configurations.

Menu Page

The MENU page allows access to systems which are controlled with the MCDU Menu Layout.



Menu Layout

This section provides general usage information and menu layouts for operating ACARS. The system is interactive, and methods for using it are consistent for all messages. With some experimentation and use, it will become simple to use each feature.

Ground support for some ACARS functions is still in development and therefore these functions should not be used. If in doubt about the status of an operational message, use normal company radio procedures.

Reports can be accessed through the ACARS MENU page below.



ACARS Chime Function

The ACARS alerting system incorporates four methods to alert the crew to a message awaiting review:

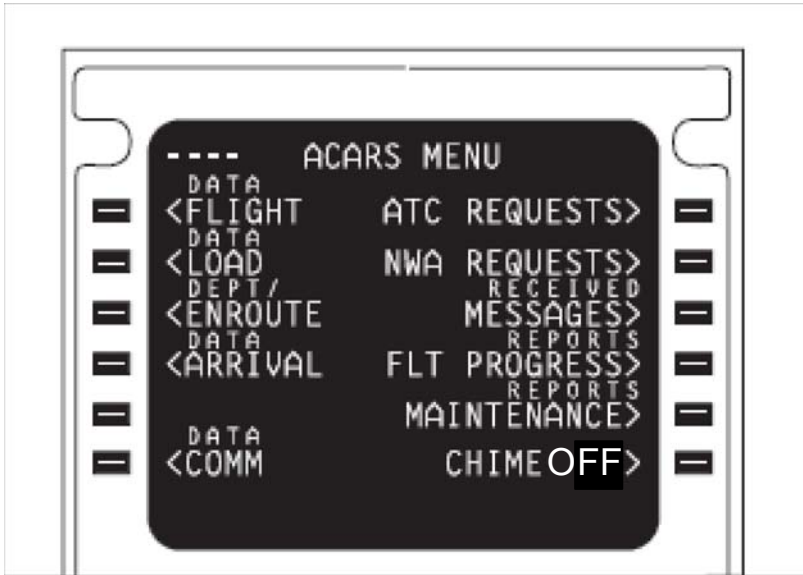
- EICAS MEMO message “ACARS MESSAGE” displays
- MCDU scratchpad advisory “ACARS UPLINK”
- single chime tone sounds (if activated)
- center VHF CALL lights illuminate (if chime is activated)

The chime is automatically selected to OFF after the thrust levers are advanced for takeoff until shortly after takeoff.

The chime may be manually selected to OFF for all other messages by performing the following steps:

From the ACARS MENU page:

CHIME OFF> Select
“CHIME OFF>” changes to “CHIME ON>”



To restore the chime:

CHIME ON> Select
 “CHIME ON>” changes to “CHIME OFF>”.

Advisory Messages

Alert Advisories

Alert advisories appear on the bottom line (scratchpad) of the MCDU. Advisories signify that either a condition requires attention, a function is available, or an uplink has been received. Selecting the advisory will access the required menu.

VHF LINK ARMED	A downlink has been manually initiated. Once the ground station receives the downlink, the page automatically reverts to the ACARS MENU.
READY TO SEND	A page prepared for a downlink message has all the required data fields loaded and pressing SEND transmits the message.
NO COMM	Appears if a link with a ground station can not be made. Messages will be stored in memory and automatically downlinked when in range of a ground station. The EICAS memo message “ACARS NO COMM” will be displayed.
ACARS VOICE	A message has been received requesting normal voice communications. View the message from the Received Messages Menu. The EICAS memo message “VHF DATA OFF” will be displayed.
VOICE SELECTED	VOICE mode has been selected from the COMM-DATA page or by changing the frequency of the VHF-C on the RTP. The EICAS Memo message “ACARS VOICE” will be displayed.
TEXT BUFFER FULL	No additional characters can be entered on the Free Text or Remarks page.
ACARS UPLINK	An uplink message has been received.

LOAD REVISION	A revision to the load advice has been uplinked to the aircraft.
FLT DISAGREE	The flight number, route, or date uplinked in the load advice disagrees with the Flight Data page.
ENTER FUEL DATA	Fuel on departure on the Flight Data page has not been loaded between the OUT event and OFF event. Also appears if the fuel remaining field on the Arrival Data page is not loaded between the IN event and the transmitting of the IN event data.
GATE REVISION	A revision to the gate assignment has been uplinked to the aircraft.
INVALID ENTRY	Attempting to load data that is out of range, entering numeric data into an alpha field, or alpha data into a numeric field.
MU FAILURE	Appears when an ACARS fault is detected in the airborne avionics of the ACARS system.
SEND TAXI DLY RPT + PA	Appears if taxi-out time has exceeded the scheduled taxi time by ten minutes without any update by the flight crew. Subsequent reminders appear every fifteen minutes without update by crew.
SEND GATE ETA RPT + PA	Appears if the taxi-in time exceeds the scheduled taxi time published on the flight plan by ten minutes without update. Subsequent reminders appear every fifteen minutes without update by crew.
FLIGHT DATA ERROR	Appears when Flight Data is entered in error during the preflight.

ACARS Preflight

From the ACARS MENU page select:

<DATA FLIGHT Select

Displays ACARS FLT DATA page 1/2

```

  ---- ACARS FLT DATA 1/2
  FLIGHT NO.          ETE
  ----              [ ][ ][ ][ ]
  FLT RLS DATE        UTC
  [ ][ ][ ][ ]       -- : -- : -- Z
  DEPT STN           FUEL BDD
  [ ][ ][ ][ ]       [ ][ ][ ][ ][ ]
  DEST STN           FOD
  [ ][ ][ ][ ]       LBS [ ][ ][ ][ ]
                      ID / RLS DATA
                      NEXT PAGE>
  <HELP              ACARS MENU>
  
```

Verify/complete the following data entries:

FLIGHT NO - Verify the appropriate flight number is displayed.

FLT RLS DATE - Enter the flight release date (e.g., type “06” for the 6th day of the month).

DEPT STN - Enter the four letter city code for the departure station (e.g., KDTW, RJAA).

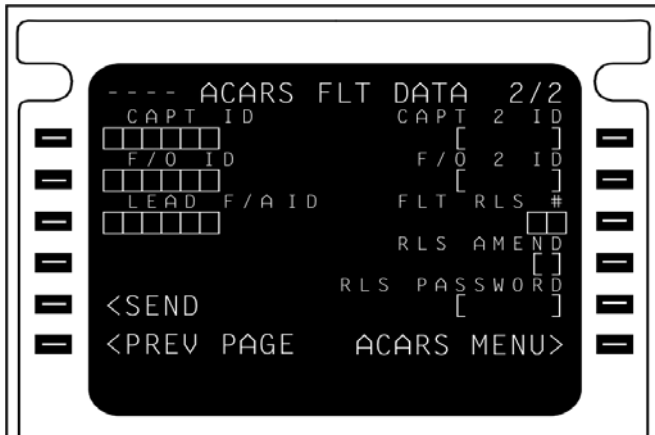
DEST STN - Enter the four letter city code for the arrival station (e.g., KDTW, RJAA).

ETE - Enter the estimated time enroute in hours and minutes (e.g., type “230” for 2 hours and 30 minutes).

FUEL BDD - To accommodate current ACARS functionality, enter zero (“0”).

FOD - Enter the total fuel before engine start at the gate (e.g., type “370.2” for 370,200 lbs.).

ID/RLS DATA NEXT PAGE> Select
 Displays ACARS FLT DATA page 2/2



The image shows a cockpit display screen for ACARS FLT DATA page 2/2. The screen is divided into several sections with input fields and labels. On the left side, there are three rows of six-digit input fields labeled CAPT ID, F/O ID, and LEAD F/A ID. Below these are two rows of input fields labeled <SEND and <PREV PAGE. On the right side, there are several input fields and labels: CAPT 2 ID, F/O 2 ID, FLT RLS #, RLS AMEND, and RLS PASSWORD. At the bottom right, there is a label ACARS MENU>. The screen is framed by a border with several small rectangular buttons or indicators on the sides.

Enter the following data:

CAPT ID - Enter the captain's six-digit DAL employee number (also enter the augmentee, if applicable).

F/O ID - Enter the first officer's six-digit DAL employee number (also enter the augmentee, if applicable).

LEAD F/A ID - Enter the purser/flight leader's six-digit NWA employee number if PMNW; enter six-digit DAL number if PMDL.

FLT RLS # - Enter the current flight release number.

Note: The RLS AMEND and RLS PASSWORD fields are not operational.

<SEND Select

<ACARS MENU Select

Displays ACARS MENU page.

RECEIVED MESSAGES> Select

Displays ACARS REC MSGS page 1

<DELETE ALL Select

<ACARS MENU Select

Displays ACARS MENU page.

<DATA COMM Select
Displays ACARS DATA FREQ page.



Verify/complete the following data entries:

AUTOMATIC is visible at 6R

ACARS Digital-Automatic Terminal Information Service (D-ATIS) Request

Note: Availability of digital ATIS is indicated on airport diagrams by “D-ATIS” in the communications block.

From the ACARS MENU page select:

<ATC REQUESTS Select
 Displays ACARS ATC REQUEST page.



In Japan:

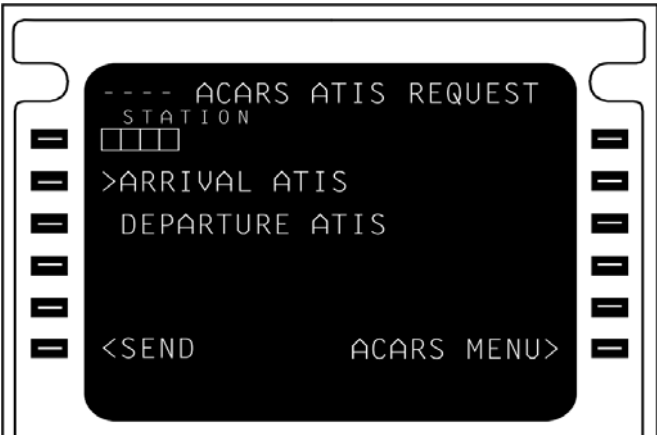
ATIS JAPAN> Select
 Displays the ACARS ATIS REQUEST page.



Manually enter the four letter city code (e.g., RJAA) into the STATION blocks.

US and other regions:

ATIS US/OTHER> Select
Displays the ACARS ATIS REQUEST page.



Note: The STATION is automatically filled in from the FLIGHT DATA page. If the STATION is not filled in, manually enter the four letter ICAO airport ID (e.g., KDTW).

<SEND prompt Select

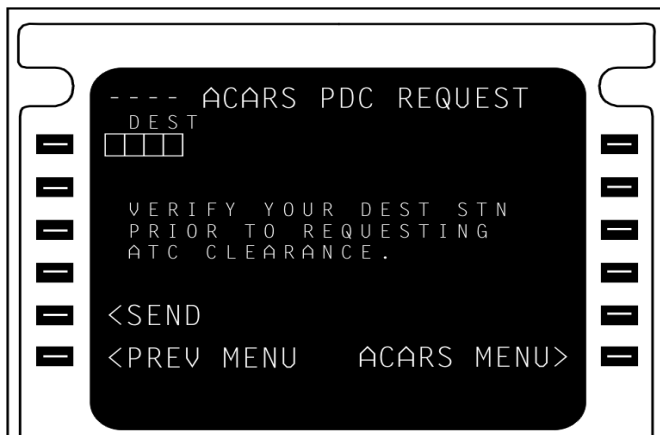
ACARS Pre-Departure Clearance (PDC) Request

From the ACARS MENU page select:

<ATC REQUEST Select
Displays ACARS ATC REQUEST page.



<CLEARANCE PREDEPARTURE Select
Displays ACARS PDC REQUEST page.



Note: The STATION is automatically filled in from the FLIGHT DATA page. If the STATION is not filled in, manually enter the four letter ICAO airport ID (e.g., KDTW).

<SEND Select

**Requesting a Departure Clearance (DCL) via ACARS
(Asia/Europe)**

The aircraft shall request a DCL at least 15 minutes prior to starting the engines. During this time, flight crews should monitor Clearance Delivery.

On the Center MCDU:

- MENU key Select
- ACARS prompt (3L) Select

On the ACARS Main MENU page:

- ATC REQUESTS (1R) Select
- DEPART CLX (1R) Select

On the DEPART CLX RQ page 1/2:

Enter information as appropriate. See examples below:

ATS FLT ID (1L)	Enter “DAL578”
AC TYPE (2L)	Enter “B744”
ORIG STA (3L)	Verify/Enter “RJAA”
GATE (4L)	Enter “21”
FACILITY (1R)	Enter “RJAA”
ATIS Code (2R)	Enter “M”
DEST STA (3R)	Verify/Enter “PHNL”



- NEXT PAGE key Select

On the DEPART CLX RQ page 2/2:

In Narita only, enter P followed by an altitude (i.e., P350). At other stations, leave this page blank.

Note: Proposed (P) altitudes should only be entered if the flight crew desires an altitude different from the filed altitude.

SEND* (5R) Select



ATC will acknowledge your request with a confirming reception message.



When ready, ATC will send approval of your DCL.



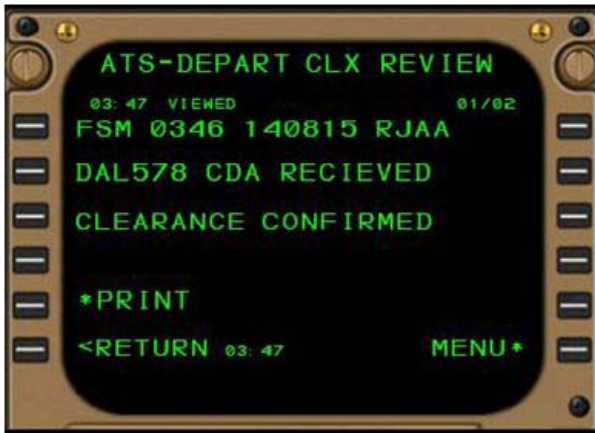
If the departure clearance is acceptable:

*ACCEPT (5L on page 2/2) Select

*PRINT (5L on page 2/2) Select

Note: *PRINT will appear after *ACCEPT is selected.

ATC will acknowledge your request with a confirming reception message.



Considerations:

- At NRT the ACARS DCL clearance replaces both the 10 minute prior call to Clearance Delivery, and the second call “When ready to start engines”.
- Use of voice should only be used by exception (i.e., altitude negotiations).
- If the aircraft is ready to push back and data link clearance has not been received, advise Clearance Delivery via voice.
- If the flight crew does not accept the clearance within 10 minutes, the previously sent clearance is considered null and void. Revert to voice.

ACARS Electronic Fuel Slip

The pre-merger Electronic Fuel Slip will no longer be sent via ACARS when the PDC is requested.

Note: The Electronic Fuel Service Record (EFSR) will be identified (when provided) on the WDR Update. When “EFSR” is displayed on the WDR Update, flight crews are only required to verify the total fuel on board and the lateral distribution. (Fueling tolerance is checked and verified electronically.)

ACARS Load Data Request

The ACARS Load Data Request screen is not currently in use. The WDR Addendum and WDR Update contain load data and are automatically generated for the crew by AWABS. Refer to FOM 5.6 for a detailed explanation of this functionality.

ACARS Takeoff Data Request/WDR Update

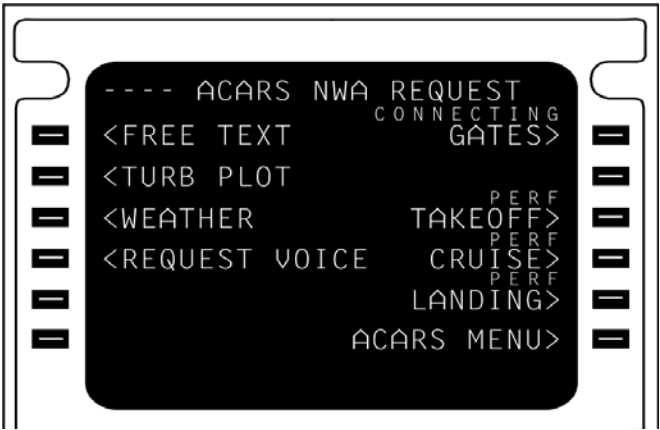
Runway data is generated automatically by AWABS and is uplinked as a free text message. In the event a crew needs to utilize a runway and/or update conditions which are not depicted on the WDR Update, the ACARS T/O PERF page is still available for use by exception only.

The crew may initiate a WDR Update request after production and uplink of the initial WDR Update. Requests prior to production of the initial WDR Update are rejected because there may not be complete passenger and/or fuel data in AWABS yet.

Note: Because the RCP depends upon flight identification data in the header of every downlink message, assure that ACARS is properly initialized.

From the ACARS MENU page select:

<NWA REQUESTS Select
Displays ACARS NWA REQUEST page.



PERF TAKEOFF> Select
Displays ACARS T/O PERF page 1/5.

```

    --- ACARS T/O PERF 1/5
    RUNWAY          SAVE/PREVIEW
    [ ][ ][ ][ ][ ][ ] (S/P) S
    WIND (OPTIONAL) USE HWND
    [ ]/[ ] (Y/N) -
    NEXT PAGE TO OVERRIDE
    OTHER WORLD FLIGHT
    ENVIRONMENTAL
    CONDITIONS (OPTIONAL)
    <SEND          NEXT PAGE>
    <HELP          ACARS MENU>
  
```

RUNWAY (required) - Enter the coded runway/intersection identifier provided on the WDR Addendum. The identifier must be recognizable by AWABS.

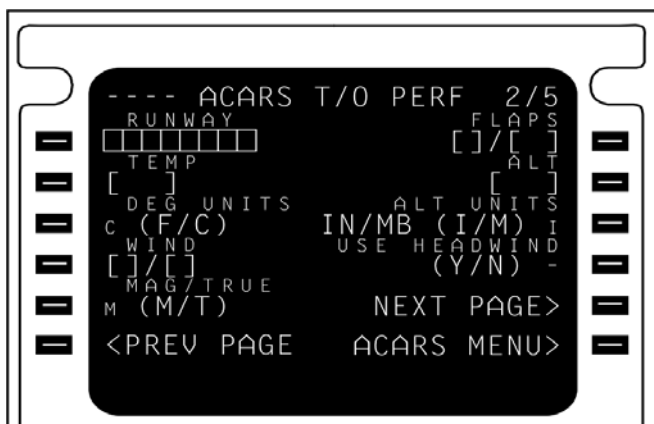
WIND (optional) - Input wind direction/speed (e.g., 05/16 for 050 degrees at 16 knots). Enter a revised wind direction/speed to override the current WDR.

SAVE/PREVIEW - Default is “S”. However, this field is not operational.

USE HWND - This field is not operational.

<SEND Select
Initiates WDR Update request.

NEXT PAGE> Select
Displays ACARS T/O PERF page 2/5.



```

  --- ACARS T/O PERF 2/5
  RUNWAY [ ][ ][ ][ ][ ][ ] [ ]/[ ]
  TEMP [ ]/[ ] ALT [ ]/[ ]
  DEG UNITS C (F/C) IN/MB (I/M) I
  WIND [ ]/[ ] USE HEADWIND (Y/N) -
  MAG/TRUE M (M/T)
  <PREV PAGE NEXT PAGE>
  ACARS MENU>
  
```

ACARS T/O PERF page 2/5 contains the following fields for input of overrides to the current WDR environmental conditions:

RUNWAY (required) - The runway displayed will be the runway entered on TAKEOFF PERF page 1/5. It may be changed by typing over the displayed runway.

TEMP (optional) - Enter the revised temperature. Precede the temperature with a “P” (plus) if the value is positive, or “M” (minus) if the value is negative (e.g., P65 or M12). “P” is the default value.

DEG UNITS (optional) - Default temperature value is F (Fahrenheit). Change to C (Celcius) if appropriate.

WIND (optional) - Enter the revised wind direction/speed (e.g., 05/16 for 050 degrees at 16 knots).

MAG/TRUE - This field is not operational.

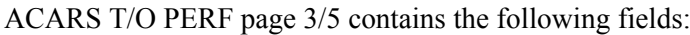
FLAPS - This field is not operational.

ALT (optional) - Altimeter setting. Default is “I” (inches).

ALT UNITS (optional) - Default is “I” (inches). Change to “M” (millibars) if appropriate.

USE HEADWIND - This field is not operational.

NEXT PAGE> Select
Displays ACARS T/O PERF page 3/5



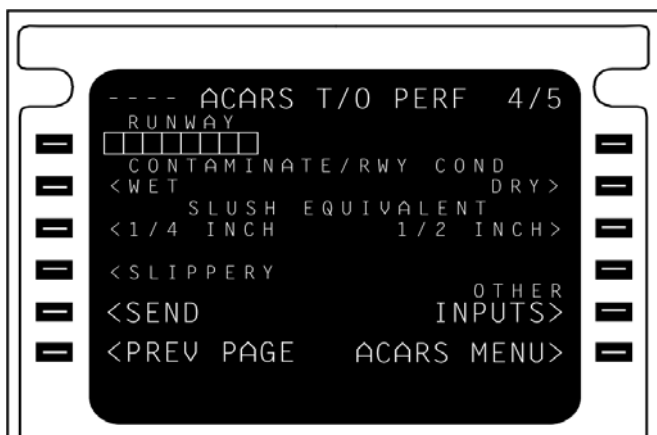
RUNWAY (required) - The runway displayed will be the runway entered on TAKEOFF PERF page 1/5. It may be changed on this page by typing over the displayed runway.

ANTI-ICE ON - Default value displayed is “Y”. However, this field is not operational.

PACKS ON - Default value displayed is “Y”. However, this field is not operational.

<SEND	Select
Initiates WDR Update request.	

CONTAMINATE NEXT PAGE> Select
Displays the ACARS T/O PERF page 4/5.



ACARS T/O PERF page 4/5 contains the following fields for input overrides of the current WDR environmental conditions:

Note: AWABS has the ability to provide adjusted V1 speed for contaminated runway conditions.

RUNWAY (required) - The runway displayed will be the runway entered on TAKEOFF PERF page 1/5. It may be changed on this page by typing over the displayed runway.

CONTAMINATE/RWY COND (optional) - Select <WET or DRY> as appropriate.

SLUSH EQUIVALENT (required if WET is selected) - Select 1/4 inch or 1/2 inch as appropriate.

Dry Snow/Wet Snow/Slush/Standing Water Equivalency			
Dry Snow Depth	1/2"	2"	4"
Equivalent Contaminant Depth	0"	1/4"	1/2"
When contaminant depth is between two values, use equivalent depth to the higher value.			

<SLIPPERY - This function is not available.

OTHER INPUTS> - This function is not available.

<SEND Select
Initiates WDR Update request.

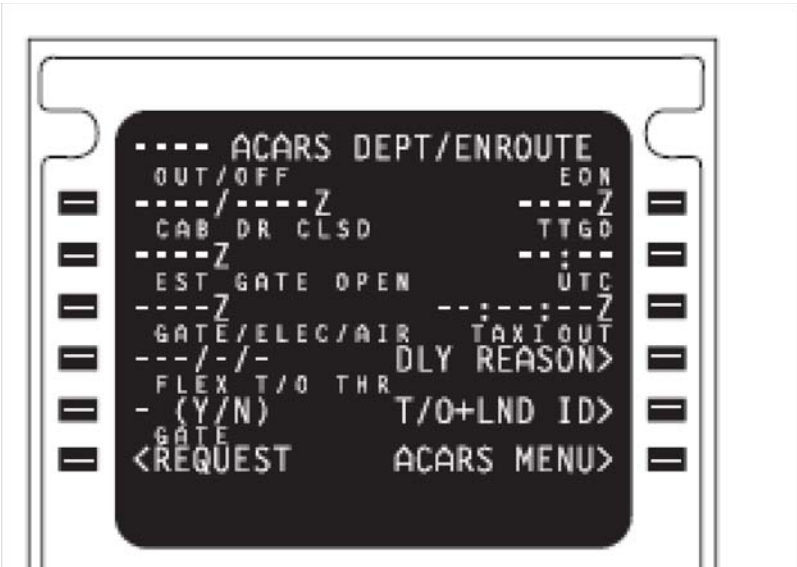
Note: ACARS T/O PERF page 5/5 is not used.

Recording Full Thrust Takeoffs

After a TO Thrust takeoff has been accomplished:

Access the ACARS MENU page.

DEPT/ENROUTE Select
Displays the ACARS DEPT/ENROUTE page.



FLEX T/O THR (5L) Enter “N”
Enter “N” (No) into the scratchpad and line select 5L.

Note: The term “FLEX” is now known as “Assumed Temperature” (AT). Although the “FLEX” term is no longer used, the ACARS screens will retain the “FLEX” label for the immediate future.

Note: There is never a requirement to enter “Y”. This indicates that an Assumed Temperature (AT) takeoff has been accomplished. AT takeoffs are not required to be recorded.

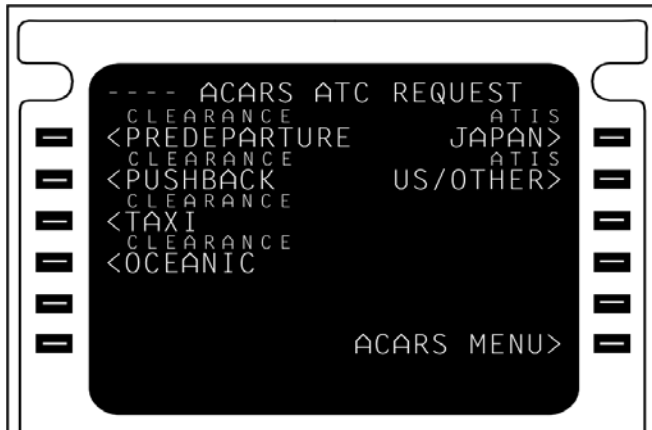
ACARS Oceanic Clearance Request

Request clearance 30-90 minutes prior to the Oceanic Boundary.

From the ACARS MENU page select:

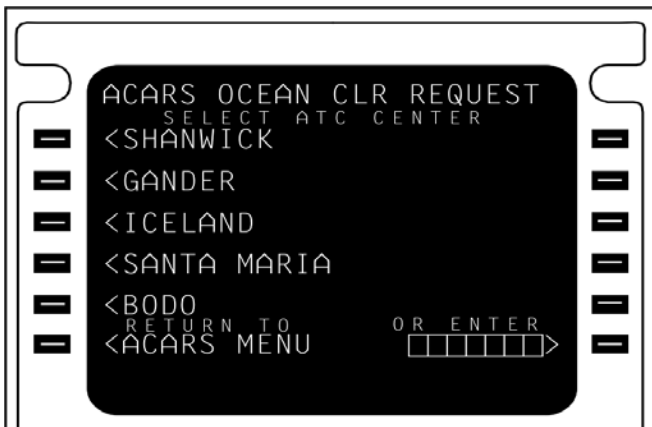
<ATC REQUESTS Select

Displays ACARS ATC REQUEST page.



<CLEARANCE OCEANIC Select

Displays ACARS OCEAN CLR REQUEST ATC CENTER page.



Select the appropriate ATC FIR.

Displays ACARS OCEAN CLR REQUEST page.

—

—

—

—

—

—

ACARS OCEAN CLR REQUEST

ATC CENTER FLT NO

<GANDER

ENTRY POINT ALT REQ

ETA SPD REQ

M

ENTER OPTIONAL FREE TEXT

[]

FORMAT FOR

PRINTER>

RETURN TO

<ACARS MENU SEND>

—

—

—

—

—

—

A230175B

Complete the OCEAN CLR REQUEST as follows:

- FLT NO - Enter “DAL” followed by the flight number, without leading spaces, zeroes, or extra letters (e.g., DAL68, DAL1). (This data can be preloaded prior to departure.)
- ENTRY POINT - Enter the oceanic entry waypoint. (This data can be preloaded prior to departure.)
- ALT REQ - Enter the requested flight level (e.g., type “330” for 33,000 feet). (This data can be preloaded prior to departure.)
- ETA - Enter the estimated time over the oceanic entry waypoint.
- SPD REQ - Enter the filed/requested Mach. ACARS format requires the placement of a zero prior to the Mach number (e.g., type “085” for Mach .85). (This data can be preloaded prior to departure.)

SEND> Select

A RCL RECEIVED (Request for Clearance) message will be uplinked within 5 minutes. The RCL RECEIVED message will specify a time limit. If the oceanic clearance is not received within the time limit, contact ATC via voice.

Note: Reference Jeppesen Chart AT 1/2 for voice procedures.

Note:

Upon receipt of the clearance:

View the message on the ACARS MCDU and check the following:

- Flight number/identification
- Oceanic entry point
- Route (Ensure all route coordinates received match with the published NAT track message.)
- ETA for crossing the oceanic entry point
- Assigned Flight Level and Mach
- Clearance ends with “END OF MESSAGE”

Note: If there any discrepancies with the information above, contact the appropriate clearance delivery via voice.

If the oceanic clearance is acceptable:

<ACCEPT Select
A CLEARANCE CONFIRMED message should be received within
a few minutes.

If the oceanic clearance is NOT acceptable:

<REJECT Select
Contact the appropriate clearance delivery via voice.

ACARS Engine Condition Monitoring (ECM) Report

Note: Complete the ECM report when the aircraft is stabilized in cruise for flights over one hour. After completing the initial report, additional reports should be completed once every three hours while in cruise.

EICAS EVENT RCD switch Push
Pushing the Event Record switch on the EICAS Control Panel takes a snapshot of the required parameters and stores them in the EICAS memory.

Perform the following steps on the Center MCDU to access the Central Maintenance Computer (CMC):

MENU key Select

<CMC Select

<EICAS MAINT PAGES Select

Page 1/3 is displayed.

Select the NEXT key twice, or the PREV key once to access page 3/3.

<71 PERFORMANCE Select

If a printed data readout is desired:

REPORT> Select

<PRINTER Select

If engine data is desired to be displayed on the Secondary EICAS:

<RECORD Select

When <RECORD is selected, the carets (<) next to DISPLAY and RECORD will disappear momentarily. When the carets reappear accomplish the following:

<MANUAL SNAPSHOT Select

Manual snapshots are shown in sequence with the date and time of the snapshots listed. The most recent snapshot is shown first.

Line select 1L to access the most recent snapshot.

To return to the ACARS and enter ECM data:

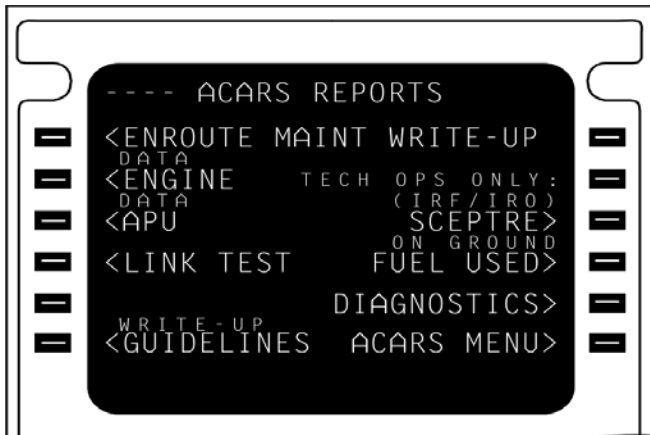
MENU key Select

<ACARS Select

Displays the ACARS MENU page.

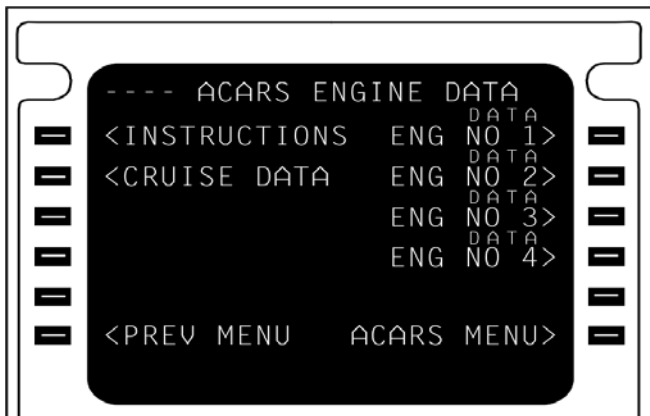
REPORTS MAINTENANCE> Select

Displays the ACARS REPORTS page.

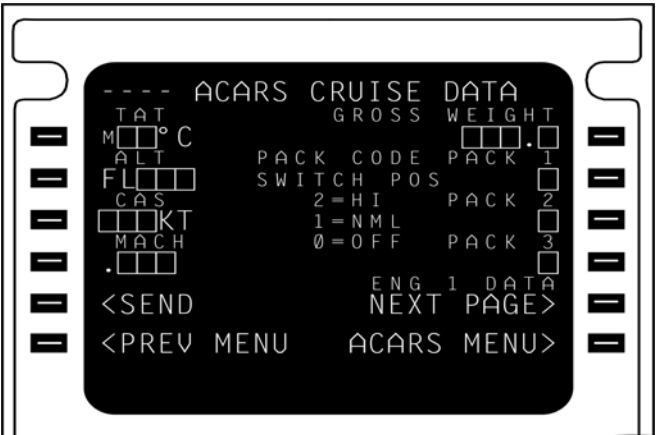


<DATA ENGINE Select

Displays the ACARS ENGINE DATA page.



<CRUISE DATA Select
Displays the ACARS CRUISE DATA page.



The image shows a simulated ACARS CRUISE DATA page on a flight deck display. The page is titled "ACARS CRUISE DATA" and contains several data entry fields and navigation options. The fields are arranged in a grid-like format. On the left side, there are five horizontal bars representing function keys. On the right side, there are five horizontal bars representing function keys. The data fields include: TAT (Temperature At Time) in degrees Celsius, ALT (Altitude), CAS (Calibrated Airspeed) in knots, MACH (Mach number), GROSS WEIGHT, PACK CODE, SWITCH POS (2=HI, 1=NML, 0=OFF), PACK 1, PACK 2, PACK 3, ENG 1 DATA, and NEXT PAGE. Navigation options include <SEND, <PREV MENU, and ACARS MENU.

ACARS CRUISE DATA			
TAT	GROSS	WEIGHT	
M °C	PACK CODE	PACK 1	
ALT	SWITCH POS	PACK 2	
CAS	2=HI	PACK 3	
KT	1=NML		
MACH	0=OFF		
<SEND	ENG 1 DATA		
	NEXT PAGE>		
<PREV MENU	ACARS MENU>		

Complete the CRUISE DATA page with the following information:

- TAT - Enter the TAT in degrees C. The field defaults with “M” for minus. To enter a plus temperature, precede the temperature entry with a “P” (e.g., “P10” represents +10°C).
- ALTITUDE - Enter the flight level.
- CAS - Enter the calibrated airspeed in knots.
- MACH - Enter the mach number from the first officer’s airspeed/mach indicator.
- GROSS WEIGHT - Enter the present gross weight in thousands of pounds.
- PACK CODE - At the applicable prompt (2R, 3R, 4R), enter the code for the position of the PACK switches. Enter “0” for OFF; enter “1” for NORMAL FLOW; enter “2” for HIGH FLOW.

ENG 1 DATA NEXT PAGE> Select
Displays the ACARS ENG NO.1 page.

Complete the ENG NO.1 DATA page with the following information:

- EPR COMMAND - Enter the commanded EPR.
- EPR - Enter the actual EPR.
- N1 - Enter N1 rotor speed (percent).
- EGT - Enter the engine EGT in degrees C.
- N2 - Enter the N2 rotor speed (percent).
- FUEL FLOW - Enter the engine fuel flow in pounds per hour.
- TLA - Enter zero ("0") for the thrust lever angle.
- AVM - Enter the engine airborne vibration monitor in units of amplitude from the broadband (BB) value.
- BLEED - Enter the bleed value position. Enter "1" if the BLEED VALVE is OPEN; enter "0" if the BLEED VALVE is CLOSED.

NEXT PAGE> Select

Displays the ACARS ENG NO.2 page.

Complete the ENG NO.2 DATA page (as described for Engine 1).

Continue to select NEXT PAGE> and complete the engine data entries for engines 3 and 4.

<SEND Select

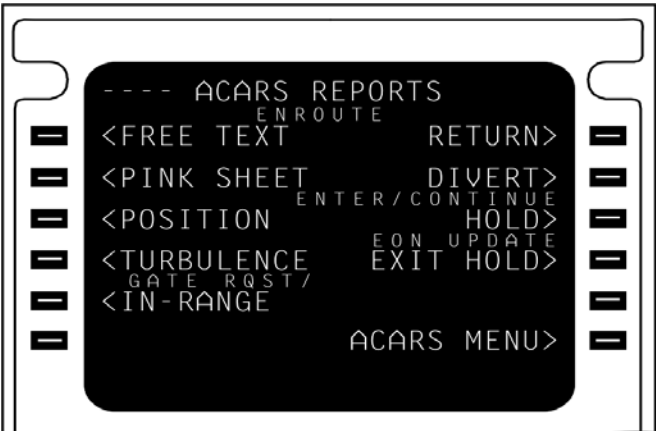
ACARS Domestic and International Position Reports

The POSITION page is used to make position reports to Dispatch and Meterology (not ATC). The POSITION page divides into domestic and international reports. Use the international report when operating outside of radar coverage. This will ensure that Dispatch will receive waypoint data for comparison to the flight plan.

Domestic Position Report

From the ACARS MENU page select:

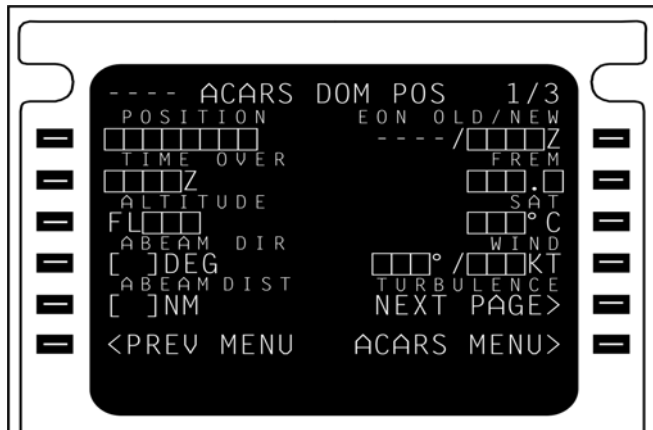
REPORTS FLIGHT PROGRESS> Select
Displays ACARS REPORTS ENROUTE page.



<POSITION Select
Displays ACARS POSITION page.



<DOMESTIC Select
 Displays ACARS DOM POS page 1/3.



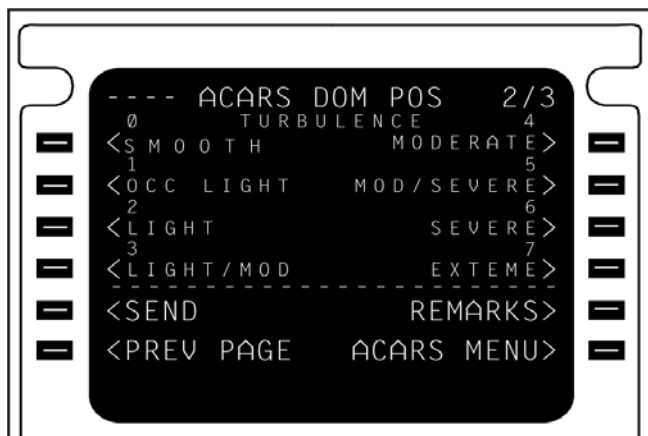
Complete the DOM POS page 1/3 with the following information:

- **POSITION** - Enter the applicable named waypoint (as designated on the flight plan).
- **TIME OVER** - Enter the actual time over the reporting point.
- **ALTITUDE** - Enter the flight level over the reporting point (e.g., type “330” for 33,000 feet).
- **EON OLD/NEW** - The previous estimated on time (EON) displays as the old time. A new entry is required in the entry boxes to send the report (even if this time is the same as the displayed old time).
- **FREM** - The fuel remaining in thousands of pounds should be displayed (automatically fills).
- **SAT** - Enter the static air temperature in degrees C.
- **WIND** - Enter the wind direction and velocity over the reporting point (round direction to the nearest 5 degrees and velocity to the nearest 5 kts).

Note: Note: The ABEAM DIR and ABEAM DIST are not required entries.

TURBULENCE NEXT PAGE> (as required) Select
Displays ACARS DOM POS TURBULENCE page 2/3.

Note: If no turbulence code is selected from the TURBULENCE page, the default code for “smooth” will be sent.



The image shows a cockpit display of the ACARS DOM POS TURBULENCE page 2/3. The display is a rectangular screen with a black background and white text. At the top, it reads "---- ACARS DOM POS 2/3". Below this, there are several lines of text, each preceded by a number from 0 to 7. The text is as follows:

0	TURBULENCE	4
<S	M O O T H	M O D E R A T E>
1		5
<O	C C L I G H T	M O D / S E V E R E>
2		6
<L	I G H T	S E V E R E>
3		7
<L	I G H T / M O D	E X T E M E>

<S	E N D	R E M A R K S>
<P	R E V P A G E	A C A R S M E N U>

On the left and right sides of the display, there are several horizontal bars, likely representing physical buttons or indicators on the cockpit panel.

Complete the DOM POS TURBULENCE page 2/3 with the following information:

- TURBULENCE CODE - Line select the appropriate turbulence condition (SMOOTH - 0 through EXTREME - 7).

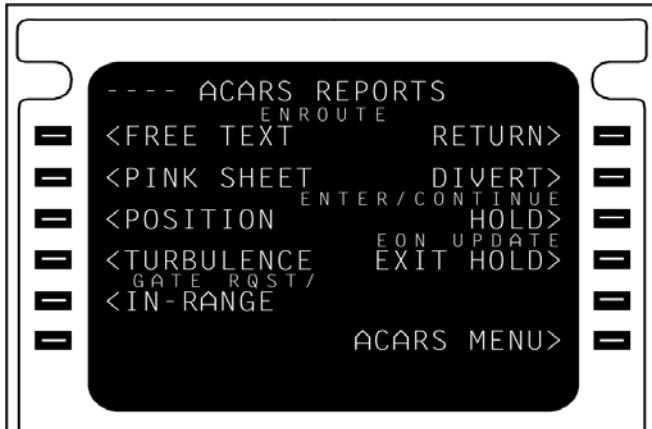
Note: Select REMARKS> to access ACARS DOM POS page 3/3.
The page is a free text page to provide entry of remarks.

SEND> Select

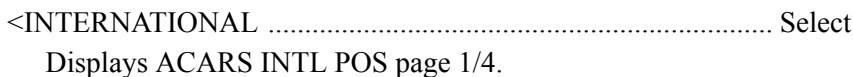
International Position Report

From the ACARS MENU page select:

REPORTS FLIGHT PROGRESS> Select
Displays ACARS REPORTS ENROUTE page.



<POSITION> Select
Displays ACARS POSITION page.



Complete the INTL POS page 1/4 with the following information:

- POSITION - Enter the applicable named waypoint (as designated on the flight plan).
- ALTITUDE - Enter the flight level over the reporting point (e.g., type "330" for 33,000 feet).
- NEXT POS - Enter the next reporting point.
- ENSUING POS - Enter the reporting point that precedes the next reporting point (next reporting point plus one).
- TIME OVER - Enter the actual time over the reporting point.
- EST OVER - Enter the estimated time over the next reporting point.

NEXT PAGE> Select

Displays ACARS INTL POS 2/4

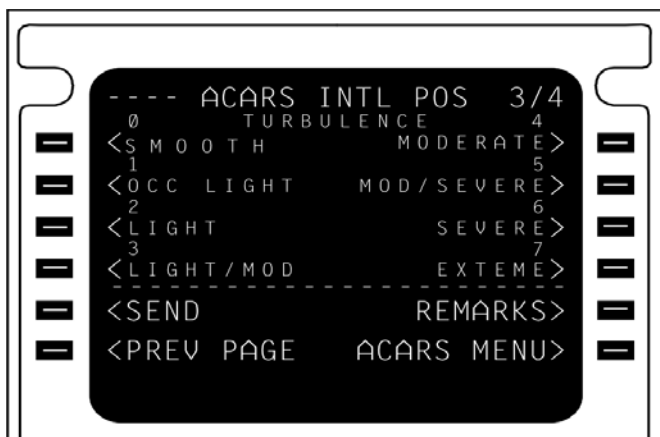
The image shows a cockpit display screen for ACARS INTL POS 2/4. The screen is black with white text and input boxes. The fields are as follows:

---- ACARS INTL POS 2/4			
EON OLD/NEW		SAT	
----/----Z		----°C	
FREM		WIND	
----.---		----° / ----KT	
<SEND		TURBULENCE	
<PREV PAGE		NEXT PAGE>	
		ACARS MENU>	

- EON OLD/NEW - The previous estimated on time (EON) displays as the old time. A new entry is required in the entry boxes to send the report (even if this time is the same as the displayed old time).
- FREM - The fuel remaining in thousands of pounds should be displayed (automatically fills).
- SAT - Enter the static air temperature in degrees C.
- WIND - Enter the wind direction and velocity over the reporting point (round direction to the nearest 5 degrees and velocity to the nearest 5 kts).

TURBULENCE NEXT PAGE> (as required) Select
Displays ACARS INTL POS TURBULENCE page 3/4.

Note: If no turbulence code is selected from the TURBULENCE page, the default code for “smooth” will be sent.



The image shows a cockpit display unit with a central screen and two columns of physical buttons on either side. The screen displays the following text:

```

----- ACARS INTL POS 3/4
0          TURBULENCE          4
<SMOOTH          MODERATE>
1                                5
<OCC LIGHT      MOD/SEVERE>
2                                6
<LIGHT          SEVERE>
3                                7
<LIGHT/MOD      ----- EXTREME>
<SEND          REMARKS>
<PREV PAGE    ACARS MENU>
  
```

The physical buttons on the left and right are rectangular and correspond to the line numbers 0 through 7, as well as the <SEND> and <PREV PAGE> functions.

Complete the INTL POS TURBULENCE page 3/4 selecting the following information:

- TURBULENCE CODE - Line select the appropriate turbulence condition (SMOOTH - 0 through EXTREME - 7).

Note: Select REMARKS> (5R) to access ACARS INTL POS page 4/4. The page is a free text page to provide entry of remarks.

SEND> Select

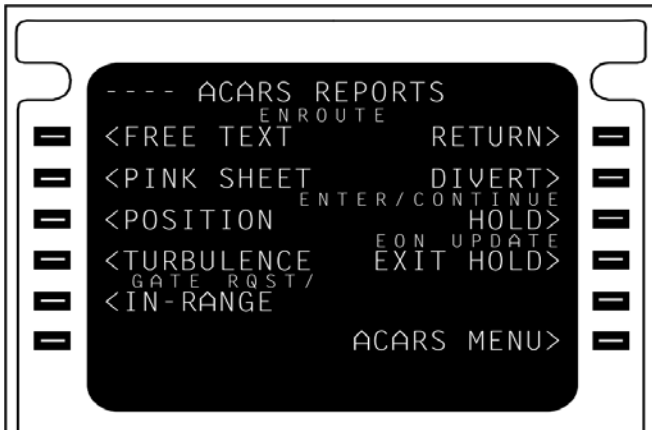
ACARS In-Range Data Report

Complete this report approximately 20 - 30 minutes before arrival, after the type of approach, arrival weather, or ATC delays are known.

Note: The ACARS IN-RANGE screen is for reporting estimated on time (EON) only. Transmitting the ACARS IN-RANGE report does not generate landing performance data. Refer to the ODM for landing performance data. Additionally, the connecting gate requests function is inactive.

From the ACARS MENU page select:

REPORTS FLIGHT PROGRESS> Select
Displays ACARS REPORTS ENROUTE page.



<GATE RQST/IN-RANGE Select
Displays ACARS IN-RANGE page 1/3.

----		ACARS IN-RANGE		1/3	
EON OLD/NEW		LDG RWY			
-----/		[] [] [] []		Z	
CONNECTING		GATE RQSTS:		FLT NO	
[] NO		[] NO		[] NO	
[] NO		[] NO		[] NO	
[] NO		[] NO		[] NO	
<SEND		GND SVC RQSTS		NEXT PAGE>	
<PREV PAGE		ACARS MENU>			

- Complete the following data entry:
- EON OLD/NEW - Enter the estimated on time (EON) in the NEW data entry boxes.
 - Note:** Entry of an EON is required to send the IN-RANGE report. Enter an EON, even if it is the same time that is displayed as the OLD EON.
 - Note:** The CONNECTING GATE RQSTS and LDG RWY functions are inactive.
 - GND SVC REQUEST NEXT PAGE..... Select (as required)
Displays ACARS IN-RANGE page 2/3.

----		ACARS IN-RANGE		2/3	
APU INOP		WHEELCHAIRS			
- (Y/N)		AISLE CHAIRS		[]	
		UNACCOMP MINORS		[]	
		ELEC CARTS		[]	
		REMARKS		[]	
<SEND		NEXT PAGE>			
<PREV PAGE		ACARS MENU>			

ACARS IN-RANGE page 2/3 contains the following fields for optional input:

- APU INOP - This field is used to confirm APU status. Entering “Y” indicates “yes”, the APU is inoperative and that external power is required. The default value is “N”, which indicates “no”, the APU is not inoperative.
- WHEELCHAIRS - Enter the number of wheelchairs requested.
- AISLE CHAIRS - Enter the number of aisle chairs requested.
- UNACCOMP MINORS - Enter the number of unaccompanied minors on board.
- ELEC CARTS - Enter the number of electric carts requested.

Note: Select REMARKS NEXT PAGE> (5R) to access ACARS IN-RANGE page 3/3. The page is a free text page to provide entry of remarks/special requests.

<SEND Select

Note: An uplink message will be sent in response to the IN-RANGE report. The uplink message will include the inbound gate assignment, and will automatically list all working and/or deadheading pilots and flight attendants and their next flight schedule departure, destination, and gate number (or “terminate” at the end of a rotation).

ACARS Landing Performance Request - Override Options

This function is not operational. Refer to the ODM for specific landing performance requirements.

ACARS Taxi-In Delay Reasons

The key to improving operational performance is identifying primary delay drivers. Pilot ACARS arrival reports provide real-time operational feedback. This critical input will enhance our ability to refine the arrival process and ultimately improve operational reliability.

Flight crews should now use the ACARS Taxi-In Delay Reason function to report the reason(s) for delays incurred while taxiing to the gate. This function is selected directly from the ACARS Arrival Data page, which is automatically displayed after landing. A recent enhancement displays the arrival gate number on this page (including any gate change after landing). After reviewing the gate assignment, Delay Reasons can be selected, and delay times should be entered by delay category (in minutes). Additional text is not necessary in this report. This data will be automatically sent with the Arrival Data.

The following illustrations provide a step-by-step summary of this delay reporting feature.

1. Select Arrival Data page



2. Select Delay Reason page



3. Enter delay minutes in applicable category(s)

ACARS DLY REASONS/TIME

TAXI - OUT:	WT / BAL
[:]	[:]
DE - ICING	MAINT PROC
[:]	[:]

TAXI - IN:	
MARSHALLER	GATE AGENT
[:]	[:]
GATE OCCUPIED	
[:]	ARRIVAL DATA>
EQUIP IN SAFETY ZONE	ACARS MENU>
[:]	
ACARS UPLINK	

Example of a completed arrival delay report with three entries:

- 2 min. delay for awaiting Marshaller
- 12 min. delay for Gate Occupied
- 3 min. delay for Equip In Safety Zone

ACARS DLY REASONS/TIME

TAXI - OUT:	WT / BAL
[:]	[:]
DE - ICING	MAINT PROC
[:]	[:]

TAXI - IN:	
MARSHALLER	GATE AGENT
00:02	[:]
GATE OCCUPIED	
00:12	ARRIVAL DATA>
EQUIP IN SAFETY ZONE	ACARS MENU>
00:03	

4. Return to the Arrival Data page

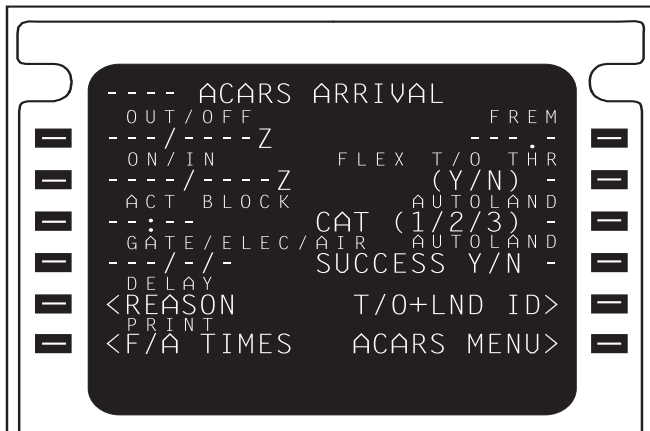
Data is automatically sent with Arrival/Summary Data Report.

ACARS Postflight

Note: The ACARS ARRIVAL page will be automatically displayed on arrival, provided that the six-digit DAL employee ID numbers have been entered for each crew member on the T/O+LAND ID page. If the employee ID numbers have not been entered, the last page accessed in flight will be displayed along with the MCDU advisory, “ENTER ID DATA”.

From the ACARS MENU page select:

<DATA ARRIVAL Select
Displays ACARS ARRIVAL page.



Note: The ACARS DELAY REASONS page may be accessed; however, the functionality of this page is inactive and will not transmit.

Verify/complete the following data entries:

ON/IN - Verify the ON and IN times have been automatically entered.

Note: The IN time reflects the last time the Parking Brake was set before a cabin door was opened. If the Parking Brake was set before arriving at the gate (awaiting a gate in the penalty box or stopped short of the gate), and the Parking Brake is not subsequently set when parked at the gate, ACARS records and sends the earlier brake set time.

FREM (Fuel Remaining) - Verify the arrival fuel has been automatically entered. If the arrival fuel is not displayed, manually enter the fuel on board in 1,000 pound increments (e.g., 25,700 = 26.0).

FLEX T/O THR (Y/N) - Enter “N” if a Full Thrust takeoff (TO Thrust) was accomplished (if not previously entered on the DEPT/ENROUTE page).

Note: There is never a requirement to enter “Y”. This indicates that an Assumed Temperature (AT) takeoff has been accomplished. AT takeoffs are not required to be recorded.

AUTOLAND CAT (1/2/3) - Enter the following if an autoland was accomplished:

Enter “1” if the autoland was accomplished in CAT I weather conditions.

Enter “2” if the autoland was accomplished in CAT II weather conditions.

Enter “3” if the autoland was accomplished in CAT III weather conditions.

SUCCESS Y/N - Enter the following if an autoland was accomplished:

Enter “Y” if the autoland was successful.

Enter “N” if the autoland was unsuccessful.

Note: Parameters for a successful autoland attempt are delineated in the MDM, TOPP Dispatch Documents section, Aircraft Log System, Log Sheet (section VII). Do not record “Y” if there was an associated autoflight malfunction that would have prevented a successful CAT III approach (e.g., LAND 2/NO LAND 3 announces any time during the approach).

Note: An unsuccessful autoland is required to be documented in the aircraft logbook as an irregularity (write-up in the IRF block). The Autoland column (A/L RW column) will remain blank.

T/O+LAND ID> Select
Displays ACARS T/O+LAND ID page.

```
---- ACARS T/O+LAND ID
TAKEOFF                                LAND
< CAPTAIN ----- >
< F/O ----- >
< CAPTAIN ----- >
< F/O ----- >
<DEPT DATA ACARS MENU>
```

Verify/enter the six-digit DAL employee number for each crew member.

Note: Employee ID numbers are normally entered automatically from the FLIGHT DATA page. Employee ID numbers are required to be entered for ACARS functionality.

Note: The T/O+LAND ID page cannot be used to update takeoff and landing currency (TAKEOFF and LANDING prompts are inactive). Takeoff and landing currency is maintained through DBMS.

The Arrival Message will be automatically sent approximately five minutes after the IN event occurs.

ACARS Initialization (Data Link Aircraft Only)

An FPS 2.0 flight plan must be available for FMC Data Link to function. Future uplinks are inhibited with a full buffer. The following steps clear previous uplinks and prevent buffer overload.

Prior to CPDLC operations:

ATC key Select



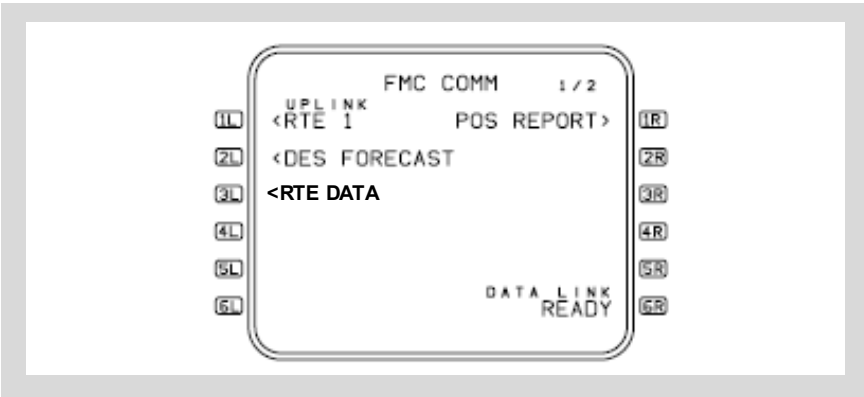
If ATC LOG entries are present:

ERASE LOG (6R) Select

CONFIRM (6R) Select

Prior to Data Link operations:

FMC COMM key Select



If the word “UPLINK” is
displayed above 1L, 2L, or 3L: Select associated key
RTE DATA page:

LOAD prompt (6R) Select

ERASE prompt (6L) Select

RTE page:

PURGE prompt (4R) Select

DESCENT FORECAST page:

PURGE prompt (6R) Select

FMC COMM Select

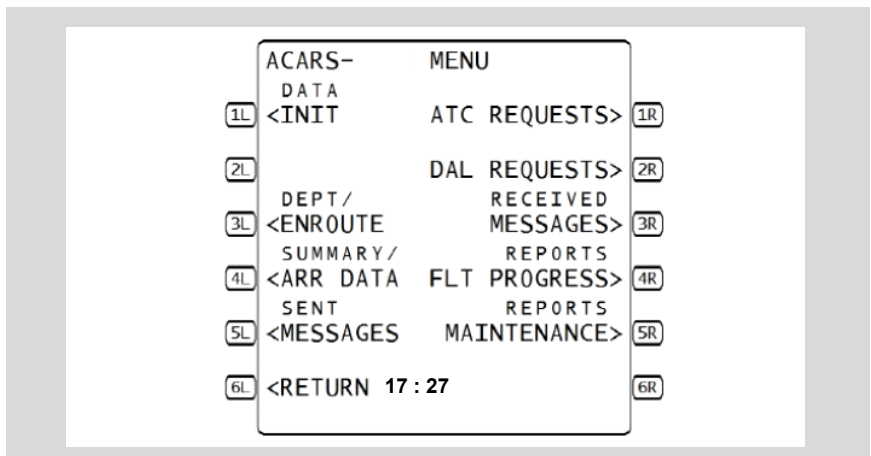
Verify the word “UPLINK” is
removed above 1L, 2L, and 3L Complete

DATA LINK READY prompt (6R) Visible on page 1/2 or 2/2

To load the FMC via Data Link

MENU key Select

ACARS (2L) Select



INIT DATA (1L) Select

ACARS-		INIT DATA 1/2	
1L	FLIGHT NO.	ETE	1R
	0000	00:00	
2L	FLT RLS DATE	UTC	2R
	00	172701Z	
3L	DEPT STN	FMC RESET*	3R
	0000		
4L	DEST STN	FOD	4R
	0000	LBS 032.2	
5L	*INIT RQST	ID/RLS DATA	5R
		NEXT PAGE>	
6L	<RETURN 17:27		6R

INIT RQST (5L) Push

Selection of this prompt will automatically load all ACARS initialization information (boxed values) on this page except ETE. This value must be manually entered.

All uplinked data will be stored in the FMC data buffer awaiting crew action.

Note: Subsequent uplinks will not be sent until the previous uplink is acted upon (LOAD or PURGE).

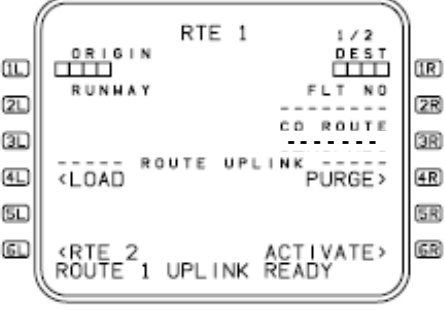
Note: If the automatic uplinks are not received within 2 minutes of ACARS initialization, or an amended flight plan requires new data, refer to the FMC Data Link Reset at the end of this section.

Note: If for any release it becomes necessary to reload the current release data, refer to the FMC Data Link Reset at the end of this section.

RTE 1

RTE 1 page Push

An EICAS message (FMC MESSAGE), a chime, and a scratchpad message (ROUTE 1 UPLINK READY) will alert the crew when the uplinked route is available to load.



LOAD (4L) Select

After selecting the LOAD prompt, the scratchpad message ROUTE 1 UPLINK READY will change to ROUTE 1 UPLINK LOADING. A FLT NUMBER UPLINK message is displayed as the origin, destination, and FLT number fields are loaded. Upon completion of the route uplink, both messages are removed.

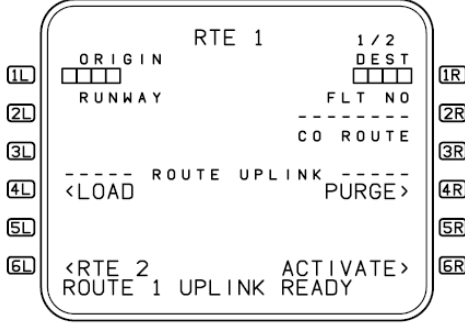
Note: Selection of the PURGE prompt at 4R rejects the uplinked flight plan prior to loading.

When the ROUTE 1 UPLINK LOADING message disappears:

ACTIVATE (6R) Select

EXEC Select

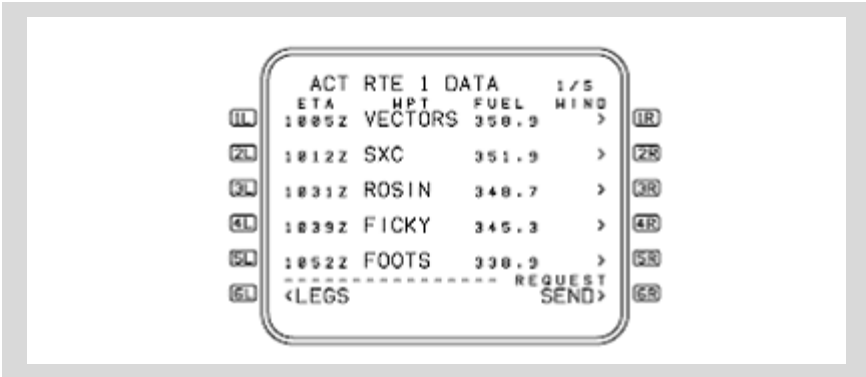
Note: The departure runway, SID, transition, STAR, and arrival runway must be manually loaded.



Wind Data

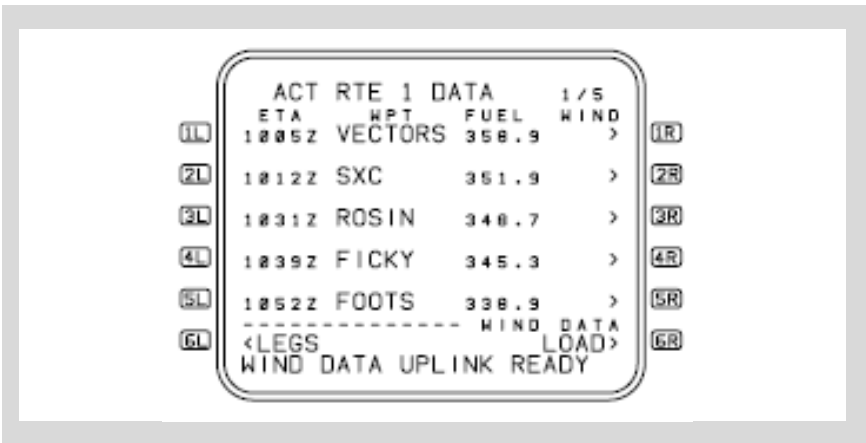
Wind uplinks can only be loaded after the ROUTE is loaded, activated, and executed. Adding SID, STAR and transition data to the ROUTE before loading WIND will prevent the loss of any wind data for fixes on those segments.

ACT RTE 1 DATA page..... Select



REQUEST SEND (6R) Select

An EICAS message (FMC MESSAGE), a chime, and a scratchpad message (WIND DATA UPLINK READY) is displayed when the wind velocity/temperature data is available for loading.



LOAD (6R) Select

After selecting the LOAD prompt, the scratchpad message WIND DATA UPLINK READY will change to WIND DATA UPLINK LOADING.

Note: The uplink contains data for the specified flight plan wind fixes at FL 240, FL 300, FL 340, and FL 390. Temperature data is sent for one pressure level higher than the expected cruise altitudes at the wind fixes based on FPS 2.0 predictions.

Note: A “W” prompt in the wind column of the ACT RTE DATA page indicates that a waypoint has been entered.

Routes with a large number of waypoints may require multiple wind uplinks. Receipt of the following ACARS message will signal the crew to repeat the wind uplink process.

--DATA LINK ADVISORY--PARTIAL WIND UPLINK SENT DUE TO MESSAGE SIZE LIMITS. CHECK FMC COMM PAGE - CONFIRM ALL UPLINKS ARE LOADED THEN SEND A WIND REQUEST FROM THE FMC RTE-DATA PAGE-6R.

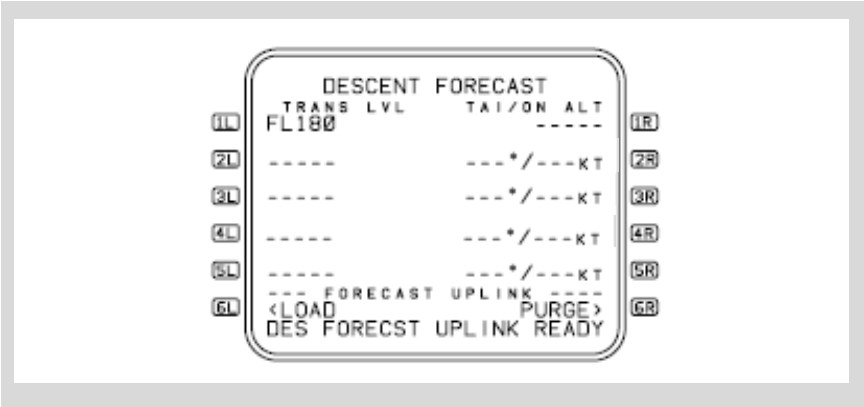
If required, numerous wind loads will be transmitted.

To request additional winds:

- ACT RTE 1 DATA page Select
REQUEST SEND (6R) Select
When wind DATA UPLINK READY message appears in the scratchpad:
LOAD (6R) Select

Descent Forecast

- VNAV DES page Select
FORECAST (5R) Select
A DES FORECAST UPLINK READY message will appear when
the descent winds are available for loading.



- LOAD (6L) Select
The EXEC light will not illuminate.

After Data Link operations are complete:

FMC COMM Key Select

If an UPLINK is still visible at 1L, 2L, or 3L:

Associated line select key Select

LOAD (4L, 6L, or 6R)..... Select

EXEC Select (if illuminated)

FMC Data Link ACARS Messages

Message (Preceded by ** FMC DATA LINK ADVISORY**)	Condition
UNABLE FMC UPLINK - NO FPS 2.0 FLIGHT PLAN AVAILABLE FOR DALXXX - USE MANUAL FMC LOADING PROCEDURES	The FPS 2.0 flight plan cannot be retrieved
UPLINK FAILED DUE TO BUFFER FULL CONDITION. CHECK FMC COMM PAGE FOR UPLINK STATUS AND SELECT PROMPTS WITH UPLINK DISPLAYED ABOVE THEM. ACCEPT, LOAD, CANCEL OR REJECT ANY REMAINING UPLINKS. SELECT LOAD ON ANY REMAINING ROUTE AND WIND UPLINKS AND THEN SELECT ERASE TO CLEAR THEM IF ACTIVE CONTENT EXISTS AND IS NOT INTENDED TO BE REPLACED	Buffer is full
PARTIAL FMC WIND UPLINK SENT DUE TO MESSAGE SIZE LIMITS ** CHECK FMC COMM PAGE-CONFIRM ALL UPLINKS ARE LOADED THEN SEND A WIND REQUEST FROM THE FMC RTE-DATA PAGE-6R	Wind Uplink too big - split into multiple uplinks
CURRENT XXX UPLINK ALREADY SENT. PERFORM - FMC RESET - IF UPLINK OF SAME DATA REQUIRED XXX can be RTE, PERF, WIND or INIT	Release number hasn't changed and request is made
FMC XXX UPLINK FAILED. SEND FMC XXX REQUEST. XXX can be RTE, PERF or WIND	Uplink error (CRC) reject
FMC DATALINK STATUS SUCCESSFULLY RESET	FMC Reset
WPR VERIFIED	WPR Enabled or WPR Reset

Automatic Enroute Wind Update

Automatic wind updating provides automatic uplinks of enroute and descent forecast winds. At wind forecast times (0430z, 1030z, 1630z, and 2230z), a communications alert and chime will accompany the automatic WIND DATA UPLINK READY message in the scratchpad. After loading and executing, the DES FORECAST UPLINK READY message will be displayed. Load the descent forecast winds and updating is complete.

If less than 3 hrs of flight time remain at the new forecast times, only descent forecast winds will be sent. Wind updates that occur after the "out" event will not be sent until 30 min after takeoff.

If automatic uplinks are not received within 15 min of a new forecast time, perform an FMC RESET and then send a manual request. Sending a request for either Wind or Descent Forecast will deliver both uplinks. The dispatcher has no role in FMC Data Link functions.

Abeam Points

When executing Direct to a down track fix and copying ABEAM PTS, any abeam point that had uplinked winds will show an altitude/temperature of ---/--. Abeam points after that without uplinked winds will show 0/0 for altitude/temperature up until the next uplinked winds waypoint. If the total down track distance is greater than 300 nms, the performance prediction calculations will be negatively affected. Use the temperatures displayed on the WIND pages to the right of the wind altitudes or the FP to reload the altitude/temperature for one pressure level higher for any abeam point that shows ---/-- or 0/0. This will provide proper FMC time/fuel calculations. Wind values at ABEAM PTS remain valid and enroute updates will accept new wind and temperature data for the created abeam points as long as the original fix was a database airport, Navaid, NDB, or waypoint. ABEAM PTS off LAT/LON entries will create new LAT/LON fixes. Send Dispatch the new LAT/LON fixes and they will create and send a revised flight plan with the new LAT/LON waypoints which will allow uplinking of new wind data.

FMC Data Link Reset

If automatic uplinks are not received within 2 minutes of ACARS initialization, flight crews should attempt the FMC RESET procedure followed by a second selection of the *INIT RQST prompt (INIT DATA page 1/2).

Crews should confirm receipt of the “FMC DATALINK STATUS SUCCESSFULLY RESET” ACARS message prior to re-selecting the INIT RQST prompt. If this message is not received after 2 minutes, manually load the ACARS and FMC.

Note: If unwanted FMC uplinks are received, select LOAD in order to display the ERASE prompt, then select ERASE to discard the uplink.

FMC RESET

A FMC RESET must be performed after a track change to enable wind data for the new position fixes. To perform an FMC RESET:

From the ACARS Main Menu:

- INIT DATA (1L) Select
- FMC RESET (3R) Select

Satellite Communications (SATCOM) Operations

The SATCOM system interfaces with the existing headsets, microphones, flight deck speakers, Left and Right MCDUs (not Center), and Left SAT button on each Audio Panel. When making SATCOM calls, use the Left SAT buttons and the Left and Right MCDUs only.

SATCOM voice transmission and reception is handled in a similar manner as other radio communications (i.e., using the transmit switches and boom/hand mic, or the oxygen mask microphones). The following tips are provided to aid in transmission and reception:

- Expect a slight delay between transmitting and receiving.
- The hand mic may provide more clear communication for the listener.
- It is recommended to set the SAT volume on the Audio Panel as high as possible, and then adjust the headset/SPKR volume to a comfortable level.

SATCOM should be used as the preferred method of voice communications with the OCC when outside of the U.S. SATCOM does not replace HF as the primary means for ATC contact.

The following pages provide procedures for accessing the SATCOM system, dialing a manual and a pre-stored call, and receiving a call. Additionally, the procedure for placing a call on hold is provided.

Note: Currently, SATCOM is programmed with pre-merger OCC telephone numbers. These numbers are not valid; therefore, dialing a pre-stored number is not available.

SATCOM ACCESS

- MENU key (L or R MCDU) Select
- <SAT (3L) Select
- Displays the SAT-PHONE Menu page 1/2.



The SAT-PHONE Menu page consists of two pages. The first page is used for placing phone calls, determining channel status, reviewing call history, accessing worldwide Air Traffic Service (ATS) phone directories, and calling ATL Radio.

The second page is used by Maintenance.



The ICS-220A SATCOM system features both manual and directory (pre-stored) dialing capabilities. Traditional 10 digit phone numbers, 6 digit ATS SATCOM “short codes”, and a 3 digit ATL Radio “speed dialing” code (001) can all be manually dialed.

The chart displays a section of the Pacific Northwest, including parts of Alaska and the contiguous United States. Key features include:

- Altitude Bands:** Indicated by green dashed lines and labels such as 10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 160, 170, 180, 190, 200, 210, 220, 230, 240, 250, 260, 270, 280, 290, 300, 310, 320, 330, 340, 350, 360, 370, 380, 390, 400, 410, 420, 430, 440, 450, 460, 470, 480, 490, 500, 510, 520, 530, 540, 550, 560, 570, 580, 590, 600, 610, 620, 630, 640, 650, 660, 670, 680, 690, 700, 710, 720, 730, 740, 750, 760, 770, 780, 790, 800, 810, 820, 830, 840, 850, 860, 870, 880, 890, 900, 910, 920, 930, 940, 950, 960, 970, 980, 990, 1000, 1010, 1020, 1030, 1040, 1050, 1060, 1070, 1080, 1090, 1100, 1110, 1120, 1130, 1140, 1150, 1160, 1170, 1180, 1190, 1200, 1210, 1220, 1230, 1240, 1250, 1260, 1270, 1280, 1290, 1300, 1310, 1320, 1330, 1340, 1350, 1360, 1370, 1380, 1390, 1400, 1410, 1420, 1430, 1440, 1450, 1460, 1470, 1480, 1490, 1500, 1510, 1520, 1530, 1540, 1550, 1560, 1570, 1580, 1590, 1600, 1610, 1620, 1630, 1640, 1650, 1660, 1670, 1680, 1690, 1700, 1710, 1720, 1730, 1740, 1750, 1760, 1770, 1780, 1790, 1800, 1810, 1820, 1830, 1840, 1850, 1860, 1870, 1880, 1890, 1900, 1910, 1920, 1930, 1940, 1950, 1960, 1970, 1980, 1990, 2000, 2010, 2020, 2030, 2040, 2050, 2060, 2070, 2080, 2090, 2100, 2110, 2120, 2130, 2140, 2150, 2160, 2170, 2180, 2190, 2200, 2210, 2220, 2230, 2240, 2250, 2260, 2270, 2280, 2290, 2300, 2310, 2320, 2330, 2340, 2350, 2360, 2370, 2380, 2390, 2400, 2410, 2420, 2430, 2440, 2450, 2460, 2470, 2480, 2490, 2500, 2510, 2520, 2530, 2540, 2550, 2560, 2570, 2580, 2590, 2600, 2610, 2620, 2630, 2640, 2650, 2660, 2670, 2680, 2690, 2700, 2710, 2720, 2730, 2740, 2750, 2760, 2770, 2780, 2790, 2800, 2810, 2820, 2830, 2840, 2850, 2860, 2870, 2880, 2890, 2900, 2910, 2920, 2930, 2940, 2950, 2960, 2970, 2980, 2990, 3000, 3010, 3020, 3030, 3040, 3050, 3060, 3070, 3080, 3090, 3100, 3110, 3120, 3130, 3140, 3150, 3160, 3170, 3180, 3190, 3200, 3210, 3220, 3230, 3240, 3250, 3260, 3270, 3280, 3290, 3300, 3310, 3320, 3330, 3340, 3350, 3360, 3370, 3380, 3390, 3400, 3410, 3420, 3430, 3440, 3450, 3460, 3470, 3480, 3490, 3500, 3510, 3520, 3530, 3540, 3550, 3560, 3570, 3580, 3590, 3600, 3610, 3620, 3630, 3640, 3650, 3660, 3670, 3680, 3690, 3700, 3710, 3720, 3730, 3740, 3750, 3760, 3770, 3780, 3790, 3800, 3810, 3820, 3830, 3840, 3850, 3860, 3870, 3880, 3890, 3900, 3910, 3920, 3930, 3940, 3950, 3960, 3970, 3980, 3990, 4000, 4010, 4020, 4030, 4040, 4050, 4060, 4070, 4080, 4090, 4100, 4110, 4120, 4130, 4140, 4150, 4160, 4170, 4180, 4190, 4200, 4210, 4220, 4230, 4240, 4250, 4260, 4270, 4280, 4290, 4300, 4310, 4320, 4330, 4340, 4350, 4360, 4370, 4380, 4390, 4400, 4410, 4420, 4430, 4440, 4450, 4460, 4470, 4480, 4490, 4500, 4510, 4520, 4530, 4540, 4550, 4560, 4570, 4580, 4590, 4600, 4610, 4620, 4630, 4640, 4650, 4660, 4670, 4680, 4690, 4700, 4710, 4720, 4730, 4740, 4750, 4760, 4770, 4780, 4790, 4800, 4810, 4820, 4830, 4840, 4850, 4860, 4870, 4880, 4890, 4900, 4910, 4920, 4930, 4940, 4950, 4960, 4970, 4980, 4990, 5000, 5010, 5020, 5030, 5040, 5050, 5060, 5070, 5080, 5090, 5100, 5110, 5120, 5130, 5140, 5150, 5160, 5170, 5180, 5190, 5200, 5210, 5220, 5230, 5240, 5250, 5260, 5270, 5280, 5290, 5300, 5310, 5320, 5330, 5340, 5350, 5360, 5370, 5380, 5390, 5400, 5410, 5420, 5430, 5440, 5450, 5460, 5470, 5480, 5490, 5500, 5510, 5520, 5530, 5540, 5550, 5560, 5570, 5580, 5590, 5600, 5610, 5620, 5630, 5640, 5650, 5660, 5670, 5680, 5690, 5700, 5710, 5720, 5730, 5740, 5750, 5760, 5770, 5780, 5790, 5800, 5810, 5820, 5830, 5840, 5850, 5860, 5870, 5880, 5890, 5900, 5910, 5920, 5930, 5940, 5950, 5960, 5970, 5980, 5990, 6000, 6010, 6020, 6030, 6040, 6050, 6060, 6070, 6080, 6090, 6100, 6110, 6120, 6130, 6140, 6150, 6160, 6170, 6180, 6190, 6200, 6210, 6220, 6230, 6240, 6250, 6260, 6270, 6280, 6290, 6300, 6310, 6320, 6330, 6340, 6350, 6360, 6370, 6380, 6390, 6400, 6410, 6420, 6430, 6440, 6450, 6460, 6470, 6480, 6490, 6500, 6510, 6520, 6530, 6540, 6550, 6560, 6570, 6580, 6590, 6600, 6610, 6620, 6630, 6640, 6650, 6660, 6670, 6680, 6690, 6700, 6710, 6720, 6730, 6740,

Desired phone number Enter

- US phone numbers: Enter 1 + Area Code + Phone Number (e.g., 14047151317).
- International phone numbers: Enter 00 + Country Code + City Code + Phone Number.
- Short Codes: Enter the six digit ATS short code (e.g., 436697)
- Speed Dialing: Enter “001” to connect with ATL Radio.
- Directory (pre-stored) numbers: Select facility phone number (see DIRECTORY DIALING),

Note: Do not use 001 to dial the U.S from an international location

<MAKE CALL (2L) Select

This will transfer the phone number in the scratchpad to the line below <MAKE CALL. The phone number will change to the facility name (e.g., ATL RADIO) if listed in the directory.



<MAKE CALL (2L) Select (again)

To initiate the calling sequence.

The channel status will indicate RINGING.



When the call connects to the ground telephone network, the channel status changes to ACTIVE. Once the call is in progress, the <MAKE CALL prompt will change to <END CALL.



Push-to-Talk switch Press

If desired, the switch may be held continuously to conduct a telephone style conversation. When the PTT button is released, the call mute feature is activated.

Note: Deselecting the L SAT button on the Audio control Panel will not terminate the phone call.

To terminate the call:

<END CALL (2L) Press

Note: Deselecting the L SAT button on the Audio Control Panel will not terminate the phone call.

DIRECTORY DIALING

The ICS-220A SATCOM system supports directory dialing to ATC facilities worldwide. ATL Radio may also be directly dialed.

When the channel status is READY:

<DIRECTORY (6R) Enter



Pilots may select pre-stored ATC or AOC Directory phone numbers. Due to limited geographic coverage, the Emergency prompt should not be used; crewmembers should contact ATL Radio.

ATC Directory

The ATC Directory phone numbers are stored in a hierarchy. Theaters are displayed as the top level followed by countries and facilities.

<ATC DIR (2R) Press



Theater Directory (e.g., PACIFIC - 5L) Press



Country Sub-Directory (e.g., JAPAN - 5L) Press

Note: ATL RADIO is displayed at 1L on all SUB-DIR pages.



Facility (e.g., FUKUOKA - 2L) Press



<MAKE CALL (2L)(2L) Select
To initiate the calling sequence.

AOC Directory

The AOC Directory is provisioned for future company phone numbers. At present, only ATL RADIO is displayed. Due to limited geographic coverage, the Emergency prompt should not be used; crewmembers should contact ATL Radio.

AOC DIR> (2R) Press





<ATL RADIO (2L) Press



<ATL RADIO (1L) Select

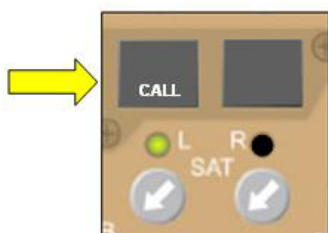
<MAKE CALL (2L) Select

To initiate the calling sequence.

RECEIVING A CALL

When a call is received, the following will occur:

- Audio SELCAL chime (cannot be silenced).
- Audio Control Panel L SAT Transmitter Select CALL light (white) illuminates.
- SATCOM CALL Memo message is displayed on the Primary EICAS. Blanks after 30 seconds.
- The SAT Channel Status will change to INCOMING
- The <ANSWER (2L) and <REJECT (3L) prompts will appear.
- GND CALL will appear in the middle of the scratchpad.



REVIEWING CALL HISTORY

When the channel status is ready:

<HISTORY (6L) Select



The most recent phone call is displayed on line 1.



Controller Pilot Data Link Communications and Automatic Dependent Surveillance (CPDLC/ADS-C)

Equipment Requirements

The following equipment must be operational for CPDLC/ADS-C:

- 2 HF or 1 HF + SATCOM
- 2 MCDUs (L + R)
- SATCOM, for operations beyond VHF coverage
- ACARS
- ACARS printer
- FMC with DATALINK and active ATC functions (ATC INDEX page and sub-menu pages available when ATC button is selected on the MCDU).

During the ACARS INIT RQST process crews will receive the following message:

AIRCRAFT IS CPDLC/ADS CAPABLE-USE CPDLC/ADS PROCEDURES

Note: Refer to the Operations Manual, Volume 2, Flight Management, Navigation Section, Air Traffic Control Data Link section 11.50, for a detailed explanation of all CPDLC/ADS functions.

CPDLC/ADS-C Enroute Procedures

Crews should LOGON 15 minutes before entry into CPDLC/ADS airspace (Oceanic Entry Point for OCAs, or the FIR boundary). Both CPDLC and ADS-C logon are initiated simultaneously from the same ATC LOGON/ STATUS page and SEND prompt; subsequent connections may occur at different times.

A LOGON request initiates the data link process and is required prior to ATC establishing CPDLC and/or ADS-C connections.

Note: If the logon is REJECTED, the crew should confirm that the proper flight number and aircraft tail (registration) number are correctly entered on the ATC LOGON/STATUS page:

- Make the necessary corrections, or
- Contact ATC or Company to correct the flight plan, and then
- Reinitiate the logon

A CPDLC connection will be initiated by ATC prior to OCA airspace / FIR boundary. Confirm that ADS connects after LOGON by noting an ADS (ACT) at 5L on the ATC LOGON/STATUS page.

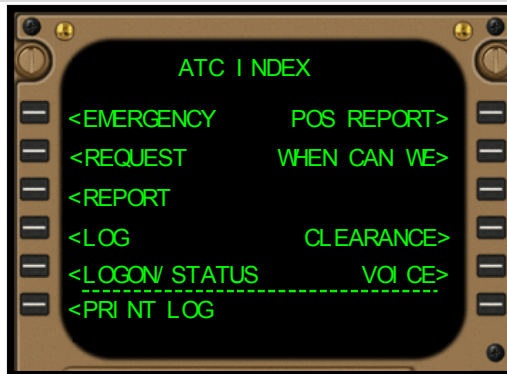
ADS-C reports are defined by ATC and include the following: periodic (time function), event (waypoint passage, along with lateral or vertical deviations), or demand (present position).

ADS-C position reports include weather, but do not include fuel and cannot be used by company. Unusual weather conditions should be reported to ATC via voice and to company via ACARS. ADS-C operation is transparent and crew monitoring is not possible.

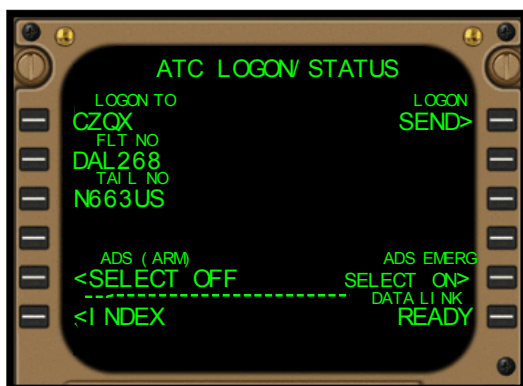
Note: Delta is charged for ADS-C reports. ADS-C should disconnect automatically when the aircraft is in radar contact; if not, toggle ADS (OFF), and then select 5L to display ADS (ARM).

Logon Procedure

MCDU ATC key Select
The ATC INDEX page is displayed if the aircraft is CPDLC/ADS capable.



LOGON/STATUS (5L) Select
Displays the ATC LOGON/STATUS page, used to initiate an ATC data link connection.



LOGON TO (1L) Insert the CPDLC identifier

Example: CZQX is the logon code for Gander. Identifiers are listed in the Airway Manual, ATC & Flt Control Communication, ATC Communication.

Note: CPDLC Logon codes may be different from their FIR identifiers. Some examples are: New York Oceanic (KZWY), Anchorage Oceanic (PAZN) and Magaden (GDXB).

FLT NO (2L) Confirm or enter the flight number, e.g. DAL268

Note: Do not insert spaces or leading zeros.

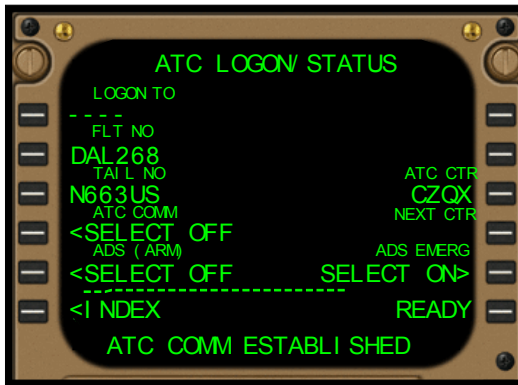
TAIL NO (3L) Verify

Verify full aircraft tail number (registration) as placarded on instrument panel or in logbook.

LOGON (1R) SEND

- 15 minutes prior to the Oceanic Entry Point (OEP) or FIR boundary
- Prompt will change to SENDING, followed by SENT
- After an ATC acknowledgement, ACCEPTED is displayed at 1R
- If data on ATC LOGON/STATUS page does not match precisely with ICAO flight plan data, REJECTED displays at 1R
- If there is no connection within 10 minutes, a RESEND prompt will appear at 1R

When a CPDLC connection is established, the logon code will be displayed under ACT CTR (3R) and ATC COMM ESTABLISHED will be displayed in the FMC scratchpad.



Check the ATC LOGON/STATUS for ADS connection.

ADS (5L) Ensure SELECT OFF displays in large font

ADS (ARM) indicates that ADS-C is selected on, but an ADS connection does not exist. ADS (ACT) appears at 5L when an ADS connection exists. This may or may not be coincidental with CPDLC logon depending on how the controlling ATC manages ADS.

Note: For aircraft departing from an airport in proximity to the FIR (e.g. PDX, SEA, SNN, DUB), the crew should initiate logon after passing 10,000 feet and 15 minutes prior to the FIR boundary estimate.

Procedures

ATC Uplink Messages

When a CPDLC message is received by an aircraft, the crew is alerted by a chime and an EICAS message (ATC MESSAGE).

CPDLC communications should be handled by the pilot monitoring while the pilot flying should handle FMS changes.

Flight crews should follow these steps carefully when responding to an ATC uplink message.

1. Select the ATC key Accomplish

2. Print the uplink message Accomplish

Pilots are required to print a message that contains a conditional clearance and/or profile change (i.e., speed, route, or altitude changes).

3. Review the uplink message Read independently and silently
If applicable:

LOAD (4R) the clearance Select (do not execute)

Compare the FMC contents with the clearance Evaluate

4. Decide (ACCEPT, STANDBY, or REJECT) SEND

5. Execute all remaining tasks (as applicable):

MCP / FMC Set / EXEC

REPORT (6R) / ARM Set / EXEC

The ATC key should always be selected after receiving a CPDLC response from the controller. Pressing the ATC key displays the ATC uplink and prevents printing the original request by mistake.

Each pilot should review the message silently and independently. If a LOAD prompt is displayed on the ATC UPLINK page, pilots should load the uplink and then evaluate the message; do not execute the pending FMC modification! When both pilots come to a consensus on the clearance, reply to ATC using the ACCEPT, STANDBY or REJECT prompts. Afterwards, crewmembers should initiate actions necessary to comply with the new clearance (i.e., set the MCP, execute the FMC, and ARM the responses as applicable).

ATC uplink messages present the following responses: ACCEPT, STANDBY, or REJECT.

- If the correct response to the uplink message is affirmative (WILCO, ROGER, or AFFIRM), select the ACCEPT prompt.
- If the correct response to the uplink message is negative (UNABLE or NEGATIVE), select the REJECT prompt.
- If the crew needs additional time (< 5 minutes) to process a clearance, select the STANDBY prompt.

Inoperative Printer

If the printer is inoperative, crews must read the entire uplink, referring to page numbers in order to assure that the entire content is understood. Pilots should consider voice procedures after receipt of a CPDLC PREDEPARTURE CLEARANCE or ROUTE CLEARANCE message. In these situations, the instructions may not be fully displayed on the ATC UPLINK page.

Load Prompts

If an uplink is received that contains data that can be loaded into the FMC, a LOAD prompt is provided on the uplink page.



- If the FMC cannot accept the uplinked data, a message is provided to the crew (i.e., PARTIAL CLEARANCE LOADED or UNABLE TO LOAD). If either loading failure message is displayed, REJECT the clearance.
- If the uplink data is loaded without display of any failure messages, the crew should check to ensure the route modification created during the loading process does not contain any discontinuities. If a discontinuity exists in the route modification, REJECT/UNABLE the uplink and clarify using voice communications.
- If uplink data loads without any failure messages or discontinuities, execute the FMC route modification and ACCEPT the clearance.

Report Prompts

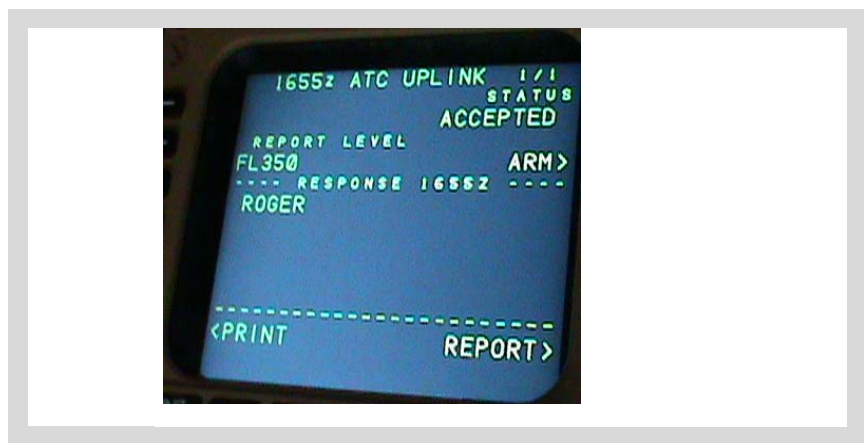
The REPORT prompt creates manual pilot reports in response to certain ATC requests. These prompts are displayed if the uplink message contains a REPORT confirmation (6R), or a WHEN CAN YOU ACCEPT request and the corresponding report is in the REPORT list.



ARM Prompts

Three (3) reports can be armed for automatic transmission. If the report is armed, the report will automatically be transmitted when the associated trigger condition is satisfied.

Uplink Message	Trigger Condition	Downlink Message
REPORT LEVEL [altitude]	Aircraft levels after a climb	LEVEL [altitude]
REPORT REACHING [altitude]	Aircraft has reached an altitude	REACHING [altitude]
REPORT PASSING [position]	Aircraft has passed the position	PASSING [position]



The ARM prompt (2R) may be selected after ACCEPT has been selected on the REPORT uplink.

Conditional Clearances

A “conditional” clearance is a CPDLC uplink message that contains the words “AT” or “BY”.

CAUTION: Use extreme caution when dealing with Conditional Clearances. Numerous ATC violations have resulted from crews missing the “conditional” nature of the clearance and climbing either early or late.

ATC will precede a conditional clearance with MAINTAIN FLXXX, indicating that the flight crew should maintain their present altitude until the conditions of the clearance are met. The condition will be a time or position, e.g. “AT (time or position) CLIMB TO AND MAINTAIN FLXXX”.

Example:

MAINTAIN FL360
/AT LISKY CLIMB TO AND MAINTAIN FL380
/REPORT LEVEL FL380

Expect Messages

CAUTION: Crews should use caution when dealing with EXPECT messages.

An EXPECT message is not a clearance. If any doubt exists, revert to voice procedures. In the event of a communications failure; revert to appropriate lost communications procedure referenced in the Airway Manual, ATC & Flt Control Communication, ATC Communication.

Aircraft Downlink Messages

Ensure each pilot has read the downlink message before it is sent. To avoid potential ambiguity, do not send multiple clearance requests within a single downlink message. Utilize separate templates for each request.

To maximum extent possible, pilots should use the preformatted downlink pages to compose and send clearance requests, CPDLC position reports, and other requested reports. Additional qualifiers such as DUE TO WEATHER are provided on the downlink pages and should be used as needed (e.g. OFFSET REQUEST for weather deviation).

When the crew does not receive a response to a message after a reasonable period of time, and no error message has been received, send an inquiry message (i.e., WHEN CAN WE) rather than resending the original message. Alternately, revert to voice procedures.

Only use free text messages when an appropriate pre-formatted element does not exist. Pre-formatted elements minimize likelihood of crew or ATC error or misunderstanding.

Note: ETA changes of 3 minutes or more at the next compulsory reporting point and turbulence reports can be reported via CPDLC free text.

The FREE TEXT page may be accessed as follows:

ATC key	Select
ATC INDEX page	Displayed
REPORT (3L)	Select
FREE TEXT (1R)	Select
Free Text (1L - 4L)	Enter
SEND (5R)	Select

CPDLC/ADS Automatic Functions

Transfer to Next FIR

Once logged on to an Air Traffic Service Unit (ATSU) that provides CPDLC and/or ADS services, transfer to a subsequent ATSU that provides CPDLC and/or ADS should be automatic.

- When approaching a FIR boundary, display the ATC LOGON/ STATUS page to monitor the transition from the current ATC facility to the next.
- Approximately 60 minutes prior to the FIR boundary, in addition to the ACT CTR, the NEXT CTR identifier will populate. Approaching the boundary, the ACT CTR will populate with the identifier of the new ATSU.

Note: If an automatic transfer does not occur at the FIR boundary, crews should send a new LOGON request

CPDLC/ADS Radio Communications

Refer to the Airway Manual, ATC & Flt Control Communication and Airway Manual, Intercontinental Ops & Theaters for Theater specific guidelines for additional information.

Atlantic

All coast in frequencies are sent via CPDLC.

- [AT 0430Z Contact Shannon on 135.6].

Pacific

The active OCA will uplink a CONTACT message:

- [Contact San Francisco Center on 8843 for HF SELCAL].

Note: This is actually ARINC, not Center, and should be addressed as follows:

San Francisco, Delta 786 CPDLC DCBA.

- All coast-in frequencies are sent via CPDLC.
- A CPDLC position report after crossing the FIR boundary is required in all Pacific OCAs (Oakland, Anchorage, and Fukuoka) for data authority confirmation; ADS is then used for all subsequent position reporting.

To send a CPDLC Position Report to ATC:

ATC key Select
ATC INDEX page Displayed
POS REPORT (1R) Select
ATC (6R) Select

CPDLC/ADS Termination

Exiting CPDLC and ADS airspace, the crew will receive an ATC COMM TERMINATED message in the MCDU scratchpad. Upon radar contact crews should check to see that there is no active ADS connection ADS (ACT) on the LOGON/STATUS page. If the automatic disconnect does not occur, crews should manually disconnect CPDLC/ADS modes as required to avoid unnecessary fees.

To terminate ADS-C surveillance:

ATC key Select
ATC INDEX page Displayed
LOGON/STATUS (5L) Select
ADS (ARM) or ADS (ACT) (5L) Select
ADS (OFF) (5L) Displayed

CPDLC and ADS Non-Normal Procedures

Re-log on:

- If the automatic transfer between FIRs fails

Revert to Voice:

- If an abnormal data link condition exists, or there is a question about the validity or sequence of data link transmissions.
- If a valid downlink response is not received within a reasonable amount of time. Pilots should consider all open messages as not delivered and resolve via voice.
- If unable to re-establish a CPDLC connection after EICAS advisory message DATALINK LOST.
- If a discontinuity exists in the route modification. The crew should REJECT/UNABLE the uplink and clarify using voice.

CPDLC and ADS Emergency Modes

Note: Revert to voice any time voice is the best method to communicate their situation/intentions.

Note: Normally use the CPDLC EMERGENCY template rather than the ADS emergency prompt to declare an emergency. This will trigger both CPDLC and ADS emergency modes. ATC facilities receiving ADS only emergency communications will send a confirmatory CPDLC message (see below) to ensure intentional activation and determine if the crew is under duress.

CPDLC Emergency Procedure

MCDU ATC key Select
 EMERGENCY (1L) Select



The EMERGENCY REPORT page is used to generate an emergency message to ATC. The following prompts can be selected:

- MAYDAY (1L) inserts MAYDAY MAYDAY MAYDAY and displays the VERIFY EMERGENCY page. If a message is sent with MAYDAY selected, the system automatically transmits a position report and activates ADS in the emergency mode.
- PAN (1R) inserts PAN PAN PAN and displays the VERIFY EMERGENCY page.
- DIVERT TO (2L) defaults to the destination airport. If selected, the remaining route to destination will be included in the downlink message. If an airport other than destination (i.e. alternate airport) is entered, a direct route to the new airport will be included in the message.
- DESCEND TO (4L) defaults to current MCP altitude. A new value, in feet XXXXX, or flight level, such as FLXXX, indicates intent to descend to the selected value.
- SOB (2R) allows entry of people on board. Fuel and time remaining is displayed when a number is entered.
- ERASE EMERGENCY appears when any message elements are entered. If pushed, it erases all the entered data. If the EMERGENCY REPORT has been transmitted, this display changes to CANCEL EMERGENCY which can be used to cancel the message.

On the VERIFY EMERGENCY page:

REPORT SEND Select

The VERIFY EMERGENCY page is used to verify content, and transmit an emergency message to ATC after it has been generated on the EMERGENCY REPORT page. It also allows inserting a free text message into the generated message to further convey the emergency situation to ATC.

Note: After sending CPDLC/ADS logon (15-25 min prior to OEP), pre-populate the EMERGENCY page with the appropriate ETP airport, SOBs, left or right offset and a Descend To altitude. Crews can update the page as ETP airports change. In an actual emergency, the only other choice to fill in would be MAYDAY or PAN before sending. This could reduce response time if an emergency must be declared.

Note: If the crew inadvertently sends a CPDLC emergency downlink message or resolves the emergency situation, they should send CANCEL EMERGENCY, as soon as possible, to advise the controller and automatically set the ADS-C emergency mode to off. After sending CANCEL EMERGENCY, the crew should confirm the status of the flight and their intentions via either voice or CPDLC.

To check for inadvertent activation of the ADS-C emergency mode using CPDLC, the controller may send the following CPDLC free text uplink or use similar phraseology using voice communication.

Controller CONFIRM ADS C EMERGENCY

The crew should then check the status of the aircraft's ADS-C emergency mode and if the emergency mode has been activated inadvertently, the crew should select ADS-C emergency mode to off and advise the controller either by voice or by CPDLC free text message.

ATC Response to an EMERGENCY Message

When a CPDLC or ADS emergency message is received, ATC may immediately send an ON DEMAND contract to determine the current position. They also may increase the PERIODIC contract reporting rate to 5 minutes.

Confirmation of Emergency Activation

When the ADS emergency mode is activated without a CPDLC emergency message or voice confirmation, and the demand contract report appears to indicate that the aircraft is maintaining normal operations (e.g. the aircraft is not in descent or involved in abrupt maneuvers), the aircraft may be subject to unlawful interference. To check for covert or inadvertent activation of the ADS emergency contract the following data link or voice phraseology shall be used:

Controller	Confirm ADS
Crew	"ROGER"

If the aircraft continues with the ADS emergency mode activated, ATC shall assume the aircraft is in emergency conditions and follow normal alerting procedures.

Acknowledgement of an EMERGENCY message

When an ADS emergency accompanied by a CPDLC emergency message is received by ATC, crews should expect immediate acknowledgement of the emergency by the most appropriate means (CPDLC or voice).

CPDLC acknowledgment

- A CPDLC acknowledgment shall be in the form of a free text message using the words ROGER MAYDAY or ROGER PAN. This uplink free text message requires a response from the pilot to close the CPDLC exchange. Depending on the nature of the emergency, the free text message may or may not be acknowledged by the pilot.

Voice Contact

- When an emergency is acknowledged by CPDLC, controllers may also attempt to make voice contact with the aircraft.

ADS Emergency Procedure

Note: The crew should use the CPDLC emergency downlink messages to automatically select the ADS-C function to emergency mode. ADS emergency controls should only be used when situations prohibit sending a CPDLC emergency message.

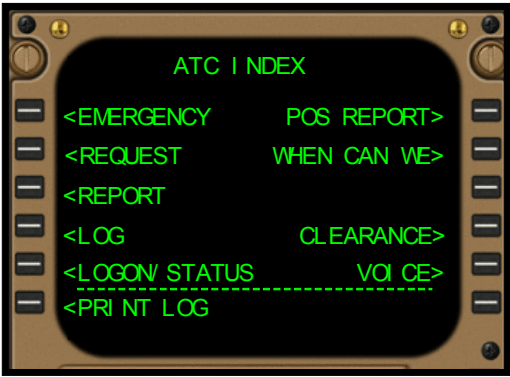
ATC key Select
LOGON/STATUS (5L) Select

ADS EMERG (5R) Select
ATC will acknowledge an ADS Emergency message by contacting
the aircrew by voice procedures or by a text message via CPDLC.

CPDLC REQUEST Examples

Requesting a Higher Altitude

ATC key Select



REQUEST (2L) Select



ALTITUDE (1L) Select

350 Insert under ALTITUDE (1L)



Options (4L, 2R-4R) Select

Example: DUE TO PERFORMANCE

VERIFY (6R) Select



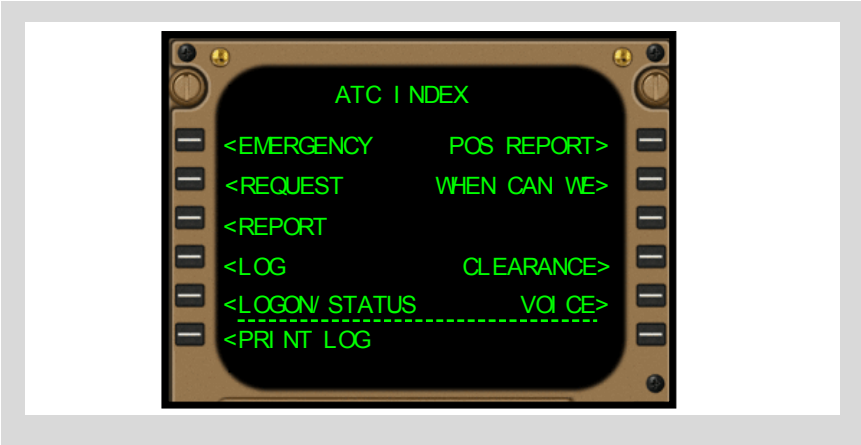
Selection of VERIFY displays the VERI FY REQUEST page. Both pilots should review the page contents prior to selecting REQUEST a SEND prompt.

REQUEST SEND (5R) Select

Once the request is sent the ATC LOG will populate showing a downlink has been made.

Requesting a Deviation Due to Weather

MCDU ATC button Select



REQUEST (2L) Select



OFFSET (3L) Select



OFFSET (1L) Enter R20

DUE TO WEATHER (4R) Select

Note: DUE TO WEATHER must be selected when requesting a weather related deviation.



VERIFY (6R) Select



REQUEST SEND (5R) Select

Note: SLOP is standard procedure. Do not use CPDLC request for SLOP.

Deviation offsets other than SLOP should be requested via the ATC REQUEST page. When the deviation is no longer needed, confirm BACK ON ROUTE with ATC via CPDLC.

The off route distance in a weather deviation request/clearance is measured from the original route of the aircraft (the magenta line). If the crew receives a clearance off route and then requests and receives a subsequent deviation clearance, they should execute the new clearance, which supersedes the previous clearance. Only the most recent clearance is valid

Example:

Crew	REQUEST WEATHER DEVIATION UP TO 20NM RIGHT OF ROUTE.
Controller	CLEARED TO DEVIATE UP TO 20NM RIGHT OF ROUTE. REPORT BACK ON ROUTE.

To deviate an additional 30nm right:

Crew	REQUEST WEATHER DEVIATION UP TO 50NM RIGHT OF ROUTE
Controller	CLEARED TO DEVIATE UP TO 50NM RIGHT OF ROUTE. REPORT BACK ON ROUTE.

Note: If diverting off track due to weather and a waypoint is passed abeam by more than 21nm in heading select mode, the FMC will not sequence the active waypoint on the LEGS and POSITION REPORT pages. The PF should re-program the FMC (execute an FMC offset that is within 21nm of the flight track or fly direct to the next waypoint if cleared so) to enable subsequent waypoints to be sequenced correctly.

HF System

HF Radio Preflight Test

A HF radio check is not required if:

- HF was used on the previous leg and was not written-up in the maintenance logbook.
- Maintenance or the inbound crew checked the HF units and noted an acceptable test in the maintenance logbook.

Frequencies used for HF preflight are listed on the applicable Jeppesen -7 pages. If unable to establish contact with the facility listed on the -7 pages, contact Dispatch for assistance.

To test both HF radios:

CAUTION: Do not operate the HF transmitter while fueling operations are in progress.

HF Frequency Select
See the Airway Manual, ATC & Flt Control Communication for HF frequency chart.

Set both HF radios to the same frequency.

HF Sensitivity Increase
Rotate the HF Sensitivity (HF SENS) control knobs clockwise to increase sensitivity for both HF radios.

HF MIC Selector switch Push
Select the appropriate HF selector (L or R) to test each HF radio.

HF Receiver Selector/Volume Control Push and adjust
Push the L and R Receiver selectors on both HF radios.
Rotate the L and R Receiver selectors to adjust the volume control for both HF radios as required.

SPKR Receiver Selector/Volume Control Push and adjust
Push the SPKR selector and rotate as required.

MIC switch (Push-to-talk switch) Key
Key the MIC switch for each radio and listen for a good side tone.

Note: A coupler tone can be heard up to 20 seconds during HF antenna tuning. When the HF antenna is tuned to that frequency, the tone ceases and the HF system is ready to transmit.

Request the HF radio check with the appropriate controlling agency.

During the check, rotate the HF SENS control knob counter clockwise to decrease sensitivity as necessary to reduce noise and static.

Note: Decreasing sensitivity too far prevents reception, including SELCAL monitoring of HF radio.

To test SELCAL:

Call ARINC on HF-L and request a SELCAL check.

Acknowledge the SELCAL check on HF-R.

This will check both transmitters and receivers.

FMC Worldwide Waypoint Position Reporting (FMC WPR)

Crews can expect FMC WPR to be automatically enabled after the 'OUT' event. With FMC WPR enabled, the FMC will report at every ****DAL POSN RPT**** fix on the flight plan. There is no need for regular ACARS position reports.

ABEAM Points

Automatic FMC WPR will not report at abeam points of ****DAL POSN RPT**** fixes. When over ABEAM PTS, use the Company SEND prompt on the FMS POS REPORT page in lieu of a full ACARS Position Report. If the SEND prompt is used, the position report must be sent as soon after crossing the fix as possible. This report sends the aircraft's current LAT/LON and, if delayed, the system will not link your current position to the proper ****DAL POSN RPT**** fix for flight following updates.

Note: A manual ACARS company report may also be sent using the original fix name, as is current practice.

Track Change

Worldwide FMC WPR is enabled at the 'OUT' event and will report fixes on the current flight plan designated as position reports (****DAL POSN RPT****). In the event of a track change, manually load the new route to comply with ATC clearance, and then contact the dispatcher to request a flight plan revision for the new track/route. Expect a compacted (22 column) revised flight plan uplink when the revision is complete. An In-flight revision may take ten to fifteen minutes.

When a flight plan revision is initiated due to a track change, FPS 2.0 will update the domestic (European or Canada/US) route to align it with the preferred routing based upon the coast in fix and your destination. Similar to current practice, when a track change is received leave a discontinuity after the track endpoint and confirm domestic clearance with ATC.

CAUTION: This may not be your previously filed route.

After receiving ACARS notification that a flight plan revision is complete, perform a WPR RESET (see below) to enable FMC WPR for the new ****DAL POSN RPT**** fixes added to the flight plan. If the revised flight plan is uplinked to the FMC, best practice is to LOAD and then ERASE (do not activate) the data. This will leave the current route in place and clear the MCDU memory buffer. Wind data for the added fixes will be extrapolated from the existing wind package. To request a new wind package for the revised flight plan, first perform a FMC RESET and then request new wind data.

If a new route is uplinked to the FMC and LOADED and ACTIVATED, verify the current route is accurate. This includes verifying fixes leading to the track entry point and domestic segment upon coast in. Enhancements are under development to make this the preferred procedure.

WPR RESET

Certain events require 'resetting' the configuration uplink to allow proper FMC WPR operation. A WPR Reset will re-send the configuration uplink based on the current FPS release number.

WPR Reset should be used for any of the following reasons:

- The dispatcher/ATC advises WPR is not working
- A reroute or track change occurs

Prior to sending a WPR Reset, ensure the route in the FMC matches the current ATC clearance. Ensure notification is received that the Flight Planning System has been updated if applicable (e.g., track change).

From the ACARS Main Menu

DAL REQUESTS (2R) Select
MISC RPT (5L) Select
CODE (1L) Enter 00
ENTER "WPR RESET" Select 2L
SEND (5L) Select

Note: Revert to manual ACARS or HF reporting if WPR VERIFIED message is not received after two attempts or the dispatcher/ATC advises that FMC WPR is not working.

FMC RESET

A FMC RESET must be performed after a track change to enable wind data for the new position fixes. To perform a FMC RESET:

From the ACARS Main Menu:

INIT Select

FMC RESET Select

After a successful reset, new wind data may be requested.

Manual ACARS Position Reporting

The ACARS 601 position report page can be used for full latitude Standard Navigation Fix reports. However, the position report page only accepts waypoint names of up to eight characters in length. ACARS position reports for half degree fixes (N5530.0W04000.0) can be made via the WAYPT POS RPT page:

From the ACARS Main Menu:

RETURN Select

ATS Select

WAYPT POS RPT Select

Turbulence Reporting

FMC WPR downlinks do not report turbulence. Accordingly, flight crews should report any significant turbulence to Flight Control, via the ACARS-601 Turbulence Report Page. These reports will supplement the TP system and provide better turbulence avoidance information.

Flights with Nontraditional Call Signs

Delta flights occasionally operate with an ATC-filed call sign that differs from the Delta flight number. This occurs on certain military charter flights (e.g. "Camber") and on stub flights. (Refer to FOM chapter 5.2, Stub Flights.)

Verify or enter the ATC-filed call sign in the FMS. This will assure ADS and transponder information are properly transmitted to ATC. The ACARS flight number will be populated with the ATC-filed number and must remain unchanged. ACARS messages will be received by Delta OCC dispatchers as a result of an automated process; however, an ACARS error message will be transmitted to the flight. This message can be ignored.

The flight plan will include the following dispatcher remarks for any flight operated with a call sign differing from the Delta flight number:

FLIGHT PLAN FILED AS CMBxxx
CMB CALL SIGN MUST BE ENTERED IN THE FMS AND USED
FOR ALL ATC COMMUNICATIONS
DO NOT ATTEMPT TO ENTER DELTA FLIGHT NUMBER IN FMS
OR ACARS

Intentionally
Blank

Supplementary Procedures

Electrical

Chapter SP

Section 6

Electrical Power Up

BATTERY switch ON
Verify OFF light extinguished.

STANDBY POWER selector AUTO

Hydraulic DEMAND pump selectors OFF

Windshield WIPER selectors OFF

ALTN FLAPS selector OFF

Landing gear lever DOWN

Flap position indication and flap lever Agree

Electrical power Establish

BUS TIE switches – AUTO

If external power desired:

EXT PWR 1 and/or EXT PWR 2 AVAIL lights - Illuminated

EXT PWR 1 and/or EXT PWR 2 switch(es) - Push

Verify ON light(s) illuminated.

If APU power desired:

APU selector – START, then ON

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

APU GEN 1 and APU GEN 2 AVAIL lights - Illuminated

APU GEN 1 switch - Push

Verify ON light illuminated.

APU GEN 2 switch - Push

Verify ON light illuminated.

Electrical Power Down

The following flight deck procedures are accomplished to permit removal of electrical power from the airplane.

This procedure assumes the Secure procedure is complete.

APU switch and/or EXT PWR switch(es) OFF

STANDBY POWER selector OFF

When APU has completed shutdown cycle:

BATTERY switch – OFF

Note: The battery switch should remain ON until APU shutdown is complete. [AFM]

Transferring Electrical Power To or From the APU Power

Unnecessary APU gearbox loading can be reduced by sequential selection of APU GEN 1 and then APU GEN 2 when transferring power to or from the APU.

During preflight or parking, if APU electrical power is desired after the APU is running and the AVAIL lights are illuminated, accomplish the following:

APU GEN 1 and APU GEN 2 AVAIL lights - Illuminated

APU GEN 1 switch - Push

Verify ON light illuminated.

APU GEN 2 switch - Push

Verify ON light illuminated.

Supplementary Procedures

Engines, APU

Chapter SP

Section 7

Engine Continuous Ignition

Continuous ignition must be on when operating in:

- moderate to heavy rain
- hail or sleet
- moderate to severe turbulence
- volcanic ash
- upon entering icing conditions

Use standby ignition if continuous ignition is not available.

To manually select continuous ignition:

CON IGNITION switch ON

Confirm CON IGNITION ON Memo message is displayed.

Engine Ground Pneumatic Start

This procedure will be used when the APU is inoperative.

Before Engine Start

Note: With only one engine generator online, automatic load shedding may take place. Accordingly, several EICAS and Status messages (including fuel boost pumps, equipment cooling, recirculation fans, and cabin lights) may appear. These messages should disappear after electrical power from the second engine is online.

Note: Consider selecting the L UTILITY switch to OFF until the second generator is on line to reduce the electrical demand. (The L Utility System is recommended since the Business Class seats and Inflight Entertainment System are powered by the R Utility System.)

External power must be used until the main cargo doors are closed and the first engine is started.

Coordinate the engine start and determination of which engine (engine 1 or 4) to start with ground personnel as soon as possible.

Accomplish the following after completing the Pushback/Start Checklist, and after obtaining engine start clearance from ATC (if required):

Pack Control selectors (all) OFF

Isolation Valve switch (opposite side of engine to be started) Closed

Hydraulic Demand Pump selectors (system 1, 2, and 3) OFF

Duct pressure Observe

Observe duct pressure is a minimum of 30 psi (less 1 psi per 1,000 feet of pressure altitude).

Start engine 1 or 4 using normal Engine Start procedures.

After Engine Start

After the engine is started and prior to pushback:

Hydraulic Demand Pump selectors (system 1, 2, and 3) AUTO

Isolation Valve switch Open

Pack Control selector (one pack) NORM

After Pushback

Start remaining engines using the Engine Crossbleed Start procedure.

After two engines are started:

If ECC CLNG SUP FAN Status message is displayed:

Equipment Cooling selector OVRD, then NORM

If any RECIRC FAN UPR or LWR Status message is displayed:

Pack Reset switch Push

Momentarily press switch until all Status messages (RECIRC FAN UPR L, R and RECIRC FAN LWR L,R) disappear.

Engine Crossbleed Start

Crossbleed start guidelines while attached to the tug:

- Crossbleed starts are not permitted during pushback or when an aircraft is under tow.
- Crossbleed starts are permitted when attached to a pushback tug provided the parking brake is set.

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

Thrust lever (operating engine) Advance

Advance Thrust lever to approximately 70% N2.

Accomplish normal engine start.

Manual Override Start

This procedure will be used when an engine Start Valve is inoperative.

Coordinate the engine start with Maintenance personnel.

Accomplish the following after completing the Before Start and Pushback/Start Checklists, and after obtaining engine start clearance from ATC (if required):

Duct pressure Observe

Observe duct pressure is a minimum of 30 PSI (less 1 PSI per 1,000 feet of pressure altitude).

START switch Pull

Advise Maintenance to manually OPEN the Start Valve.

FUEL CONTROL switch RUN

Select RUN at maximum motoring (N2 greater than or equal to the fuel-on indicator and no increase for five to ten seconds).

START switch Push

Push the Start switch IN at 45% - 50% N2.

Advise Maintenance to manually CLOSE the Start Valve.

Pratt & Whitney 4056 Engine Oil Indications

Oil quantity is displayed automatically on the lower EICAS if the system detects a low quantity in an oil system.

The system may detect a differential oil quantity between the left and right side engines during normal engine operation. This differential is caused by a combination of the engine oil tank location and the sensitivity of the oil quantity indication system to the wing dihedral. Detection of the differential results in nuisance automatic displays of oil indications.

The amount of engine oil quantity drop on the engine start up will vary from engine to engine. This quantity drop also depends on engine power settings and engine location on the aircraft. On a properly serviced engine, the typical oil quantity readings prior to engine start can vary from 23-27 quarts on engines 1 & 2 to 20-24 quarts for engines 3 & 4. With engines operating from ground idle through initial cruise, the typical oil quantities vary from 15-22 quarts for engines 1 & 2 and from 8-15 quarts for engines 3 & 4.

Automated Engine Reporting System

An automated B747-400 engine reporting system has been activated to improve data accuracy and reduce pilot manual keystrokes. Flight crews will send automatic engine reports on all aircraft via the CMC prompt on the MENU page

To downlink an engine report, complete the following procedure:

Center CDU - MENU key Select
EICAS MAINT pages (3L) Select
<71 PERFORMANCE (2L) Select
Page forward to page 3/3.
RECORD (2L) Select
REPORT (5R) Select
ACARS (2L) Select

Engine report has been sent.

After completing the initial report, additional reports should be completed every three hours while in cruise.

Assumed Temperature Thrust Rollback

There are circumstances, particularly at high assumed temperatures, when the Thrust Management Computer (TMC) may rollback the pilot entered assumed temperature to a cooler temperature. This computer adjusted temperature should be accepted and V-speeds corresponding to the original, pilot-entered temperature, selected and verified.

Intentionally
Blank

Supplementary Procedures
Fire Protection

Chapter SP
Section 8

Engine/APU/Cargo Fire/Overheat Test (Fire Warning Test)

FIRE/OVHT TEST switch Push and hold

Note: EICAS warning message FIRE WHEEL WELL may display.

Observe:

EICAS warning message >TEST IN PROG displays.

Fire bell sounds.

Master WARNING lights illuminate.

Engine Fire Warning lights illuminate.

APU Fire Warning light illuminates.

Fuel Control switch Fire Warning lights illuminate.

CARGO FIRE FWD and AFT Warning lights illuminate.

EICAS warning message >FIRE TEST PASS displays.

FIRE/OVHT TEST switch Release

Squib Test

SQUIB TEST 1 switch Push and hold

Observe:

- Engine squib lights illuminate.
- APU squib light illuminates.
- Cargo squib lights illuminate.

SQUIB TEST 2 switch Push and hold

Observe:

- Engine squib lights illuminate.
- APU squib light illuminates.
- Cargo squib lights illuminate.

Heading Reference Switch Operation

Use TRUE when operating in regions where true referencing is needed (polar regions). Use NORM in all other regions.

HDG reference switch NORM or TRUE

Note: If using HDG SEL and the HDG reference switch position is changed, the AFDS roll mode will change to HDG HOLD. HDG SEL can be reselected.

Note: If the HDG reference switch position must be changed for an approach, it must be changed before the APP mode is armed.

If the HDG reference switch position is changed after the APP mode is armed:

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

Operating Procedures in the QFE Environment

Arrival Procedures

- For all altitudes above the Transition Level, use the MTRS switch on the EICAS control panel to activate the meters display on the PFD. Set assigned metric flight levels in the MCP Altitude Select Window by referencing the meters readout on the PFD. Use the “747-400 Conversions & Reference Charts” hardcard as a reference to convert metric flight levels to feet.
- Request the QNH altimeter setting from Approach Control prior to descending below the Transition Level.
- When cleared below the Transition Level, set QNH in the altimeters and turn off the MTRS switch. Use the “ALT/HEIGHT CONVERSION” table found on the arrival and/or approach chart to convert assigned QFE heights in meters to QNH altitudes in feet. Set the QNH altitude in the MCP Altitude Select Window, rounding the altitude setting to the next higher 100 feet.
- Verify FMS altitudes match the QNH altitudes published on the arrival and/or approach chart. Fly the arrival and/or approach procedure using normal Delta procedures.

Departure Procedures

- Request the QNH altimeter setting from Ground Control.
- When assigned a departure procedure, verify that the FMS altitudes match the QNH altitudes published on the departure chart.
- While below the Transition Altitude, use the “ALT/HEIGHT CONVERSION” table found on the departure chart to convert assigned QFE heights in meters to QNH altitudes in feet. Set the QNH altitude in the MCP Altitude Select Window, rounding the altitude setting to the next higher 100 feet.
- When cleared to an altitude above the Transition Altitude, set QNE in hectopascals (1013 hPa) in the altimeters. Use the MTRS switch on the EICAS control panel to activate the meters display on the PFD. Set assigned metric flight levels in the MCP Altitude Select Window by referencing the meters readout on the PFD. Use the “747-400 Conversions & Reference Charts” hardcard as a reference to convert metric flight levels to feet.

Intentionally
Blank

Weather Radar Test

WARNING: Do not operate the weather radar in other than the TEST position during refueling operations, in the vicinity of trucks or containers holding flammable or explosive liquids, while the aircraft is in the hangar, or parked at the jetway or gate.

WX RADAR selector TEST

GAIN Control selector AUTO

Note: Ensure the Gain Control selector is in Auto for displaying accurate weather returns. If AUTO is not selected, weather returns could be inadvertently filtered (decreased) at low manual gain settings.

EFIS ND mode selector MAP

EFIS WXR switch Push
Selects the ND Radar display on.

Auxiliary Weather Radar selector RADAR
Selects the AUX Radar display on.

Range Control selector Cycle
Check the ND display and the AUX display at high and low ranges.
Verify the presence of the following:

- Green, Amber, Red, and Magenta test bands
- Alphanumeric legends (cues) appear on the edges of the ND and AUX displays

Note: Advise Maintenance of a system fault annunciation or an absence of a test pattern.

SYS switch Cycle
Check the Left (L) and Right (R) Radar system.

EFIS WXR switch Push

Auxiliary Weather Radar selector OFF
Selects the AUX Radar display off.

Radar Operation

The recommended tilt and range settings are guidelines for good radar operation. The flight crew is not limited to these settings. Operational needs often dictate flexibility in tilt and range selections.

Before Takeoff

Confirm RADAR operation with a confidence check.

Set tilt 15° UP, WX mode, and short range.

Slowly lower tilt until weather or ground returns are displayed.

If no returns can be detected, suspect an inoperative radar.

WARNING: Do not operate weather radar in a hangar or within 50 feet of any personnel, large reflective objects, or combustible liquids.

To evaluate terminal area weather before takeoff:

Set tilt at 15° UP, RANGE at 40 nm or less.

The radar height of weather targets displayed is at least (Tilt x Distance x 100). Weather targets displayed at:

10 nm	are at least 15,000 feet AGL
15 nm	are at least 22,500 feet AGL
20 nm	are at least 30,000 feet AGL

Slowly lower tilt from 15° UP to 4° UP while evaluating weather returns in the area.

Takeoff

During takeoff, tilt is initially set at 4° UP, with range at shortest appropriate for terminal area conditions.

During initial climb (below 10,000 feet AGL) set the tilt between 1° to 2° UP. (Maintain the radar display clear of ground returns while allowing weather returns to be displayed).

Climb

As climb continues above 10,000 feet AGL, lower tilt as necessary to maintain ground returns at the outer edge of the display.

A range selection of 80 nm or less is optimal during climb, unless a longer range setting is needed for deviation planning.

Cruise

To establish enroute park:

Set RANGE at 80 nm or less.

Adjust tilt to produce ground returns at the outer edge of radar display.

This tilt setting guards against over scanning nearby weather areas and provides continuous confirmation that the radar is working.

Weather targets will separate from ground returns and move toward the bottom of the display.

Range settings above 100 nm should be selected occasionally for long-range planning.

Set tilt to produce a scattering of ground returns beyond 100 nm.

Storms detected at long range will increase in displayed intensity as they are approached. Plan early deviations accordingly.

Note: Nearby weather areas may not be detected due to over scanning. When returning to a shorter range, lower tilt to enroute park position.

At cruise altitudes above 30,000 feet:

Use sufficient down tilt to direct the beam into unfrozen areas of nearby storms.

Confidence Check:

Enroute radar performance can be checked by adjusting tilt to display the farthest possible ground returns.

In WX mode and with GAIN control in AUTO, properly functioning radar should detect ground returns to the following distances:

10,000 feet AGL	100 nm
20,000 feet AGL	140 nm
30,000 feet AGL	175 nm
40,000 feet AGL	200 nm

Descent

On descent from cruise altitude, raise tilt as necessary to maintain ground returns at the outer edge of the display.

Low Altitude Park

Generally used at altitudes below 10,000 feet AGL:

Set tilt 1 1/2° to 2° UP, range at shortest appropriate distance.

Note: If ground returns flood display, raise tilt until ground returns are removed, and weather can be displayed.

Approach

Approach Park

On final approach:

Set tilt at 10° UP, range at 20 nm.

At 10° UP tilt the radar height of weather returns displayed will be above aircraft altitude by at least (Tilt x Distance x 100). Weather areas will be developed above aircraft altitude by at least:

10 nm	10,000 ft.
15 nm	15,000 ft.
20 nm	20,000 ft

Strong returns at mid to upper levels indicates hazardous convective activity.

In a thunderstorm environment, occasionally lower tilt to produce ground returns and detect radar shadows, then return tilt to approach park.

Radar Guidelines

Tilt Formula

Using ground returns as a reference provides quick and effective tilt management. When more precise tilt management is desired, the tilt formula can be used.

Tilt x Distance x 100 = feet (above or below) aircraft altitude.

Example: With 5° DOWN tilt, the radar beam would be centered approximately 20,00 feet below aircraft altitude 40 nm ahead.

$5 \times 40 \times 100 = 20,000$ feet (below aircraft altitude)

Tilt Accuracy Check

To check the accuracy of tilt control, the following exercise can be conducted. Optimal conditions for this check are straight and level flight, altitude 10,000 feet AGL or higher, level terrain, and no intervening weather.

Adjust tilt until the yellow ground return arc starts at a distance equal to $[2 \times \text{AGL altitude}/1000]$.

Example: If aircraft at 34,000 feet AGL, yellow ground returns start at 68 nm on the display (2×34).

Check tilt setting:

Tilt should be at 3 1/2° DOWN + 1 1/2° (acceptable limits 2° - 5° DOWN).

If tilt is not within 2° - 5° DOWN, note difference between tilt setting and 3 1/2° DOWN. This is the amount of tilt error present and should be applied to all tilt settings.

Gain Control

For proper calibration of the receiver, GAIN control must be in AUTO. Manual GAIN can be used to evaluate the relative strength of surrounding weather areas.

Observe weather targets while slowly reducing the GAIN.

Weaker targets will shrink and disappear while stronger targets persist. At minimum GAIN any weather targets still display contain extremely heavy rain

If display becomes filled with red returns:

- Check tilt, raise if necessary to remove ground returns from the display.
- Weather area being scanned may be Level 3 in strength.
- Reduce GAIN level until only heavier areas display as red, to differentiate rain intensity within the weather area.

WARNING: At reduced levels of GAIN, some weather targets will disappear from the indicator. Targets which are displayed will understate the true strength of the weather. Return GAIN to AUTO , immediately after using manual GAIN.

Attenuation

Expect attenuation any time weather targets reach Level 3, when the radome is wet or ice covered, or when operating within precipitation.

To locate intense rain areas that may be totally attenuated:

- Watch for crescent-shaped returns, concave on the back side.
- Note an absence of returns or shadow beyond the target.
- Use ground returns to confirm radar penetration, and locate radar shadows.

When flying through areas of moderate to heavy rain, radar range may become limited by attenuation:

- Set tilt to attempt to produce ground returns beyond the weather returns. If attenuation is confirmed:
 - Monitor the outer edge of the weather returns.
 - Turn away from shadows that dip towards the bottom of the display.
 - Fly toward the area of farthest returns (this is the area of lightest precipitation).
 - Advise ATC that your radar range is limited and request vectors away from known thunderstorm areas.

WARNING: Radar shadows are areas of unknown weather intensity. Never penetrate a storm that produces a radar shadow.

Turbulence Avoidance

When using radar to avoid turbulence enroute:

- Deviate upwind of storms when possible.
- Expect turbulence to be present in any convective activity, regardless of intensity level displayed on radar.
- When convective storms reach Level 3 (red), expect moderate to severe turbulence in all areas of the storm, including the Level 1 and 2 areas.
- TURB mode can be used to detect areas of horizontal rain movement within 40 nm. Set tilt to insure beam is sweeping at flight altitude.

WARNING: An absence of indicated turbulence in TURB mode does not mean it is safe to penetrate a weather area that by other indications is hazardous.

IRS Fast Realignment

A fast realignment may be accomplished when significant ground delays are encountered. A fast realignment may be accomplished when the combined operating time from the last full IRS alignment to the expected next destination arrival time does not exceed 18 hours. To accomplish the fast realignment:

IRS Mode selectors ALIGN

CDU Set
Enter present position on SET IRS POSITION line of the POS INIT page as required.

IRS Mode selectors NAV

IRS High Latitude Alignment

A high latitude alignment must be accomplished when the latitude of the origin airport is greater than 70°12.0' and less than 78°15.0'.

IRS Mode selectors OFF, then ALIGN
The IRS Mode selectors must remain in ALIGN for a minimum of 17 minutes

CDU Set
Enter present position on SET IRS POSITION line of position initialization page.

IRS Mode selectors NAV

FMC Preflight Procedures

Modifying FMC Drag and Fuel Flow Factors

Performance Engineering has established a fuel flow factor to refine the 747-400 base line performance data. This fuel factor adjusts the predicted fuel burn based on the actual performance of the aircraft, is provided on the flight plan, and will vary by ship number. To enable the FMC fuel prediction to agree with flight plan fuel predictions, the flight crew should verify the drag and fuel flow factors in the FMC agree with the flight plan. The drag factor will always be set to 1.0 and is not shown on the flight papers.

During preflight of the IDENT page, check line 5L to ensure that the DRAG FACTOR (DRAG) is +1.0 and the FUEL FLOW FACTOR (FF) agrees with the flight papers. If the numbers agree, no further action is required. If they do not agree, proceed with the following procedure:

INIT REF key Select
<INDEX Select
MAINT> Select
<PERF FACTORS Select

Note: This page is only available on the ground.

On the PERF FACTORS page, type “ARM” into the scratchpad and line select 6R.

Drag and Fuel Flow Factor Enter

Type the revised drag and fuel flow factor into the scratchpad. If both the drag and fuel will be modified, separate the values with a slash (e.g., 1.0/3.0). If only the fuel flow factor must be revised, include a leading slash followed by the new fuel flow factor (e.g., /3.0).

Line select the DRAG/FF line (2L) to enter the revised data.

Select any key to leave the PERF FACTORS page. (Leaving the page will delete the “ARM” function, with the revised drag and/or fuel flow factor saved.)

Route Entry Procedures - Pilot Flying

Prior to loading the route on the RTE pages, it is recommended that PLN (Plan mode) be selected on the ND mode selector (EFIS Control Panel). Enabling the Plan mode will display a static map background with route data oriented to true north on the ND display. This will allow the route to be viewed as it is being built.

After loading the route, verify the route is correct by accomplishing the following:

ND mode selector PLN
Enables the Plan mode on the ND display.

LEGS key Select
Displays LEGS page 1.

Route Check
Review the entire route for accuracy on the ND display by line selecting the MAP CTR STEP> prompt (6R) to step through the route waypoint-by-waypoint, or by selecting the NEXT PAGE key to step through each LEGS page.

After verifying the route:

ND mode selector MAP
Replaces the MAP CTR STEP> prompt with the RTE DATA> prompt on the LEGS page. This prompt is used to access pages used for waypoint wind and temperature data entries.

RTE Key Select
Displays RTE 1 page 1.

ACTIVATE> Select

EXEC key Select

Route Verification Procedures - Pilot Monitoring

The pilot monitoring (PM) must verify all FMS preflight entries. In addition to the FMS entries outlined in the Preflight Procedures - Pilot Flying, the PM will accomplish the following route loading and verification procedures.

Note: FMS Navigation - Loading and Verification (Class I or Class II Airspace) procedures are found in the Airway Manual, Airspace & Enroute Navigation, Route Management.

Class I or Class II On-Airways

After the FMS has been initialized by the PF, the PM will independently verify the IRS alignment lat/long coordinates by accomplishing the following:

Initial Data Set

IDENT page:

Verify that the MODEL is correct - 747-400

Verify that the ENGINES are correct - PW4056

Verify that the NAV DATA is correct - DL4

Verify that the navigation database ACTIVE date range is current.

Verify that the FF (Fuel Flow factor) agrees with the Flight Plan.

If the FF does not agree, refer to SP.11, Modifying FMC Preflight Procedures - Modifying FMC Drag and Fuel Flow Factors.

POS INIT page 1/3 Select

Verify the lat/long coordinates entered into the SET IRS POS boxes (6R) if IRS is in align mode, or the lat/long coordinates displayed on the LAST POS line if IRS alignment is complete.

After the route has been entered, the PM will independently verify the route of flight has been loaded accurately by accomplishing the following:

ND mode selector PLN

Enables the Plan mode on the ND display.

LEGS key Select

Displays LEGS page 1.

Route Check

Using the Flight Plan, review the entire FMC route for accuracy. Utilize the ND display by line selecting the MAP CTR STEP> prompt (5R) to step through the route waypoint-by-waypoint, or select the NEXT PAGE key to step through each LEGS page.

After verifying the route:

ND mode selector MAP

Replaces the MAP CTR STEP> prompt with the RTE DATA> prompt on the LEGS page.

After the route has been verified for accuracy, the PM will verify the total mileage for the route loaded by accomplishing the following:

PROG key Select

Displays PROGRESS page 1/2.

Distance Check

Compare the distance to go (DTG) for the destination (DEST) against the distance found on the FMS Preflight Data block of the Flight Plan.

Class II Off-Airways

In addition to the Class I/Class II On-Airways procedures, the PM will use the flight plan and check the full lat/long coordinates of:

- Any FMC waypoint whose outbound course leads to a Class II Off-Airways waypoint.
- All Class II Off-Airways FMC waypoints.

The PM will signify verification by circling these waypoints on the flight plan.

Wind and Temperature Entries

Referencing the Wind Data Blocks on the flight plan, wind and temperature data should be entered into the WIND page for each cruise waypoint during the CDU Preflight Procedure.

If time limitations do not permit the completion of wind and temperature FMC entries during preflight, enter as many wind and temperature values as feasible. The remaining entries can be completed when workload permits.

To enter waypoint winds and temperatures:

LEGS key Select

RTE DATA> Select

Displays the ACT RTE DATA page.

WIND prompt (>) Select

Line select the WIND prompt for the first cruise segment waypoint.

Displays the WIND page for the selected waypoint.

Altitudes Enter

Enter altitude data from the Wind Data Blocks on the flight plan into the ALT line (1L). Enter the initial flight level and final flight level. If the altitude range between the initial flight level and final flight level is 4,000 feet or greater, an intermediate flight level that approximates the flight level midway between the initial and final flight levels should be entered. On shorter flights, where the initial flight level and final flight level are less than 4,000 feet apart, an intermediate flight level does not need to be designated.

Wind data Enter

Enter wind direction and speed data from the Wind Data Blocks on the flight plan into the DIR/SPD lines (1R, 2R, 3R, and 4R). Enter as much wind data as possible for each waypoint. New wind entries are required for subsequent waypoints when a difference exceeding 10 degrees or 10 knots exists from the previous waypoint.

Maximum allowable input is limited to 250 knots.

Temperature data Enter

Enter temperature data from the Wind Data Blocks on the flight plan into the ALT/OAT line (5R). Enter the SAT value listed for flight level at which waypoint is planned to be crossed. New temperature values are required for subsequent waypoints when a difference of +/-2 degrees exists from the previous waypoint.

NEXT PAGE key Select

Displays the next sequential waypoint.

Continue as instructed above until the desired wind data is programmed for the remainder of the cruise portion waypoints. When completed accomplish the following:

RTE DATA> Select

Selecting RTE DATA> will return to the ACT RTE DATA page associated with the last waypoint.

Note: A “W” prompt in the WIND column of the ACT RTE DATA page indicates that a waypoint wind has been entered.

The Descent Forecast Programming procedure may be found later in this chapter.

Restricted Critical Terrain Route Entry

If the body of the flight plan is annotated with ****CRITICAL TERRAIN SEGMENT - SEE CRITICAL TERRAIN REMARKS****, the flight is planned to enter a Restricted Critical Terrain area(s). When this occurs accomplish the following:

Identify the FMS route (e.g., J510) associated with the Critical Terrain Entry Point on the HOWGOZIT block of the flight plan.

Locate the following items in the Airway Manual:

Note: Refer to the Airway Manual, Mountainous Terrain, Mountainous Area Procedures.

- Airway Segment associated with the FMS route on the HOWGOZIT block of the flight plan.
- Diversion Airport associated with the Airway Segment.
- FMS Route associated with the Airway Segment.

Load the FMC in the following order:

RTE key Select

<RTE 2 Select

Enter the diversion airport ICAO identifier on the DEST line.

DEP/ARR key Select

ARR line select key (for Diversion Airport) Select

Select the appropriate FMS route (e.g., J510) from the list of STARS.

LEGS key Select

Verify waypoints, airspeeds, and altitudes correspond to Route Description from the Airway Manual.

Prior to entering Restricted Critical Terrain areas:

One pilot should have RTE 2 displayed on the ND (for situational awareness).

Check weather at diversion airport.

Note: Do not ACTIVATE/EXECUTE RTE 2.

Note: If weather radar is not in use, consider selecting TERR on EFIS control panel.

FMC Lateral Navigation Entries and Conventions

Direct to a Waypoint

LEGS key Select

Waypoint Select

Line select the desired waypoint.

Waypoint Enter

Enter the selected waypoint over the active waypoint (1L) on LEGS
page 1.

ND display Check

Check the ND display for proper modified route.

EXEC key Select

Enter the selected waypoint over the active waypoint (1L) on LEGS
page 1.

Note: If desired, the unmodified route may be copied to the inactive
route by selecting the RTE COPY prompt (any previous
inactive route will be erased).

Note: Abeam points for the new route based upon the waypoints
bypassed may be generated by selecting the ABEAM PTS
prompt.

Modifying the Route

LEGS or RTE key (as appropriate) Select

Waypoints Select and enter

Line select and enter the waypoints in the desired sequence.

ND display Check

Check the ND display for proper modified route.

EXEC key Select

Creating a Course Offset

RTE key Select

Offset Enter

Enter desired left or right offset and offset NM distance (e.g. “R1” or “R2” for SLOP, or “L15” or “R15” for track diversion).

Note: The OFFSET prompt is only displayed when offset entry is possible. (The prompt will not display while currently on a SID, STAR, approach, approach transition, discontinuity, end of route, holding pattern, or course change of 135 degrees or more.)

Deleting a Course Offset

A course offset may be removed by accomplishing one of the following:

- Push the DEL key and select 6R
- Accomplish Direct To a waypoint
- Enter 0 (zero) at 6R and push the EXEC key.

Note: An offset will end automatically at an approach, approach transition, discontinuity, end of route, holding pattern, or when course changes by 135 degrees or more.

Creating a Route Discontinuity

Note: This procedure can be used to separate waypoints that would likely be linked by radar vectors.

LEGS key Select

Waypoint Select

Line select the waypoint that precedes the desired discontinuity location.

Waypoint Enter

Enter the selected waypoint over the next waypoint in the list.

EXEC key Select

Note: If the selected waypoint is already in the active route, the current TO course is displayed with a caret prompt for selection (6R).

Deleting a Waypoint

- LEGS key Select
- Waypoint Select
 - Line select the waypoint that follows the waypoint that will be deleted.
- Waypoint Enter
 - Enter the selected waypoint over the waypoint to be deleted.
- EXEC key Select

Entering a Waypoint Not In The Data Base

- Waypoint Define
 - Define the waypoint as described in the steps below.
- Defined Waypoint Enter
- EXEC key Select

Define the waypoint by:

- Place bearing/distance:
 - For the GEP 163 radial, 40 DME, enter GEP163/40.
- Place bearing/place bearing:
 - For the intersection of the FGT 120 radial and the RST 360 radial, enter FGT120/RST360.
- Latitude and Longitude coordinates:
 - Enter the desired coordinates into the scratchpad with no slashes (/) or spaces between characters (e.g., N4452.9W09312.8).

Note: Longitude entries require leading zeroes when the value is less than 100 (e.g., N57W088). Trailing zeroes are optional when latitude and longitude are whole degrees.

- Distance along track before or after a LEGS page waypoint:
 - Line select the waypoint to the scratchpad.
 - Add/(distance) or /-(distance).

Note: A positive distance is a distance beyond the waypoint. A minus distance is a distance before the waypoint. For example, MSP/-5 defines a waypoint along the track 5 NM before MSP.

- Line select this waypoint over the waypoint that it affects (MSP).
- The intersection of two airways:
 - On the RTE page, enter the two airways on succeeding lines under the VIA prompt.
 - The FMC will calculate the fix and display it on the right side of the page.
- The intersection of an assigned heading and an inbound course to a fix.
 - On the LEGS page, enter the fix as the active waypoint.
 - Take the fix just entered to the scratchpad and place it back at 1L (creates a line to the fix).
 - Enter the desired inbound course at 6R.

Intercepting a Course To a VOR/Waypoint

LEGS page Select

Navaid/Waypoint Enter

Line select or type the desired navaid/waypoint into the scratchpad and line select it over the active waypoint (1L) on LEGS page 1.

Note: A Route Discontinuity is created if the navaid identifier is not in the existing flight plan.

If the inbound course is correct:

INTC CRS Select

Line select the computed intercept course (INTC CRS) (6R).

If the inbound course is not correct:

Intercept Course Enter

Type the desired course into the scratchpad and line select it over the existing intercept course (INTC CRS) (6R).

ND display Check

Check the ND display for proper modified route.

EXEC key Select

Note: Selection of the intercept course line will remove ABEAM PTS and RTE COPY prompts.

LNAV switch Select

If necessary, use the HDG SEL mode and map display to establish an appropriate intercept heading to the course. Arm LNAV.

Note: If the aircraft heading will not intercept the selected course, a NOT ON INTERCEPT HEADING message will appear on the scratchpad line.

Intercepting a Radial Outbound From a VOR/Waypoint

LEGS page Select

Navaid/Waypoint Enter

Line select or type the desired navaid/waypoint into the scratchpad and line select it over the active waypoint (1L) on LEGS page 1. (This creates an anchor point for the radial outbound.)

Note: A Route Discontinuity is created if the navaid identifier is not in the existing flight plan.

Place Bearing/Distance Waypoint Enter

Line select or type the navaid/waypoint entered at 1L into the scratchpad. Once in the scratchpad, type the outbound radial followed by a “/” and then enter a suitable DME distance (e.g., CUE180/100). Line select the Place Bearing/Distance Waypoint into 2L.

ND display Check

Check the ND display for proper modified route.

EXEC key Select

Waypoint Sequence Modify

Line select the Place Bearing/Distance Waypoint at 2L into the scratchpad. Once in the scratchpad, line select 1L to sequence the Place Bearing/Distance Waypoint to become the active waypoint. Sequencing the Place Bearing/Distance Waypoint to the active waypoint (1L) will allow the aircraft to intercept and track the radial outbound.

INTC CRS Select

Line select the computed intercept course (INTC CRS) (6R).

Note: The displayed intercept course is set to the same outbound radial defining the Place Bearing/Distance Waypoint.

ND display Check

Check the ND display for proper modified route.

EXEC key Select

LNAV switch Select

Note: As a technique, the PM may elect to enter the VOR and radial into the FIX or NAV RAD page for orientation.

Intercepting an Airway

RTE key Select
ACT RTE page 2 is displayed.

Airway Enter
Type the airway (e.g., J43) into the scratchpad and enter it into the “VIA” column at 1L.

End Waypoint Enter
Type the end waypoint on the airway into the scratchpad and enter it into the “TO” column at 1R.

Waypoint Sequence Check
Close any discontinuities present and verify the entered route is correct. Modify the route as appropriate.

ND display Check
Check the ND display for proper modified route.

EXEC key Select

LNAV switch Select

Creating Latitude/Longitude Reporting Points

- LEGS key Select
- Latitude/Longitude - Interval Enter
Enter the initial latitude or longitude and the desired interval in the scratchpad (e.g., W165-10).
- Line Select key Select
Press the line select key next to any waypoint that exists prior to the initial latitude or longitude.
- ND display Check
Check the ND display for proper modified route.
- EXEC key Select

Changing a Destination

- RTE key Select
Displays ACT RTE page 2.
- PREV PAGE key Select
Displays RTE page 1.
- Destination Enter
Enter the new destination (four letter ICAO identifier) at the DEST prompt.
- RTE or LEGS page Modify
Modify the route as necessary using the RTE or LEGS pages.
- ND display Check
Check the ND display for proper modified route.
- EXEC key Select

Establishing Holding Pattern

HOLD key Select

Displays the HOLD page.

<NEXT HOLD Select

Displays ACT RTE LEGS page.

Holding fix Enter

To hold at present position:

PPOS> Select

A standard holding pattern will be constructed at the aircraft's present position.

Displays the RTE HOLD page.

To hold at a waypoint:

Waypoint Select

Line select the holding waypoint from the LEGS page to the scratchpad.

Hold at Data Line (Boxes) Select

Line selecting the Hold At boxes (6L) designates the waypoint as a holding fix.

Displays the RTE HOLD page.

RTE HOLD page Check/Modify

Check the data on the RTE HOLD page and modify as required to comply with the ATC clearance.

EXEC key Select

Note: Modifications made to a holding pattern while active in the hold only become effective on the next crossing of the holding fix.

Note: Holding patterns can be erased before they become active by line selecting the next waypoint (waypoint that is listed after the Hold At waypoint) and entering it over the Hold At waypoint.

Exiting Holding Pattern

HOLD key (if not currently displayed) Select
Observe EXIT HOLD prompt displayed.

EXIT HOLD> Select
The EXIT HOLD prompt changes to EXIT ARMED.

EXEC key Select
Observe EXIT ARMED is displayed. Aircraft turns to the holding
fix and resumes the active route.

Programming a SID and/or Departure Runway

DEP/ARR key Select

Displays the DEPARTURES page.

Note: On the DEPARTURES page, a <SEL> prompt appears next to each procedure and runway when selected. The non-selected procedures and runways disappear. When a procedure is selected, the EXEC key illuminates.

SID (if required) Select

SID Transition (if required)..... Select

Runway Select

Note: Select the NEXT PAGE key as necessary to access all runways and procedures.

LEGS page Select

Clean up any route discontinuities to the clearance limit.

Waypoint sequence, altitudes and airspeeds Check

Modify as necessary to agree with clearance.

EXEC key Select

The <SEL> prompt(s) change to <ACT> prompt(s).

Note: This entire procedure must be re-accomplished when the runway and/or SID is changed. This will prevent the possibility of incorrect routing or inadequate obstacle clearance.

Programming a STAR and/or Approach

Note: The associated airport must be entered as route origin or destination.

DEP/ARR key Select
Displays the ARRIVALS page.

Note: On the ARRIVALS page, a <SEL> prompt appears next to each procedure and runway when selected. The non-selected procedures and runways disappear. When a procedure is selected, the EXEC key illuminates.

STAR (if required) Select

STAR Transition (if required) Select

Approach Select

Note: Select the NEXT PAGE key as necessary to access all runways and procedures.

Approach Transition (if required) Select

LEGS page Select
Clean up any route discontinuities to the clearance limit.

Waypoint sequence, altitudes and airspeeds Check
Modify as necessary to agree with clearance.

EXEC key Select
The <SEL> prompt(s) change to <ACT> prompt(s).

Note: This entire procedure must be re-accomplished when the runway and/or STAR is changed. This will prevent the possibility of incorrect routing or inadequate obstacle clearance.

Programming a Runway Dependant (R/D) STAR

A Runway Dependant (R/D) STAR is an arrival that provides separate and specific procedures for multiple runways. These STARs require pilots to select a specific runway in order for the FMC to properly load the entire STAR.

The 747-400 FMC Nav Database is only capable of storing a single version of each STAR. Therefore, R/D STARs are individually programmed into the FMC (one STAR for each runway served). Each STAR is identified in the FMC by unique code, which consists of a shortened portion of the STAR name followed by the runway served. The unique FMC STAR code will not match the Jeppesen STAR chart title. For example, the DUMET 22A STAR in Shanghai (PVG) appears on the Jeppesen chart as “DUMET 22A [DUM22A]”. In the FMC, the DUMET 22A appears as the “DUM16” and the “DUM 17B” in the FMC. The “DUM” portion of the identifier indicates that the procedure is the DUMET 22A STAR, and the “16” identifies that the procedure is for arrivals to Runway 16. Likewise, the “DUM17B” code identifies that the procedure is the DUMET 22A STAR to Runways 17L and 17R.

When programming a R/D STAR, it is important to verify that the waypoints and any associated altitude and airspeed restrictions match the charted procedure prior to selecting the EXECUTE key. Ensure FMC programming will comply with the ATC clearance.

Programming a R/D STAR is accomplished in the same manner as programming a normal STAR. The procedure below provides expanded guidance on specifically programming R/D STARs.

DEP/ARR key Select
Displays the ARRIVALS page.

Note: On the ARRIVALS page, a <SEL> prompt appears next to each procedure and runway when selected. The non-selected procedures and runways disappear. When a procedure is selected, the EXEC key illuminates.

STAR Select
The STAR will be identified by a shortened portion of the STAR name followed by the runway served. As an example, the GOPHER FIVE STAR to Runway 30L at Minneapolis (MSP) appears as GEP30B.

STAR Transition (if required) Select

Approach Select

When the STAR is selected, only the approaches for the runway associated with the selected STAR will be displayed (all other approaches will disappear). As an example, selecting the GEP30B STAR at Minneapolis (MSP) will limit approach selections to only those approaches available for Runways 30L and 30R.

Note: Select the NEXT PAGE key as necessary to access all runways and procedures.

Approach Transition (if required) Select

LEGS page Select

Clean up any route discontinuities to the clearance limit.

Waypoint sequence, altitudes and airspeeds Check

Modify as necessary to agree with clearance.

EXEC key Push

The <SEL> prompt(s) change to <ACT> prompt(s).

Note: This entire procedure must be re-accomplished when the runway and/or STAR is changed. This will prevent the possibility of incorrect routing or inadequate obstacle clearance.

FMC Vertical Navigation Entries and Conventions

Manually Changing a Climb, Cruise or Descent Speed

VNAV key Select
The applicable page is displayed for the active mode (CLB, CRZ, or DES).

Desired Speed.....Enter
Type the desired speed, mach, or both into the scratchpad and line select the ECON SPD/SPD line (2L).

EXEC key Select
The page title changes to display the selected speed for the applicable mode (e.g., ACT 325KT CLB).

To return to ECON Climb, Cruise, Or Descent:

VNAV key Select
The applicable page is displayed for the active mode (CLB, CRZ, or DES).

<ECON..... Select

EXEC key Select
The page title changes to display economy for the applicable mode (e.g., ACT ECON CLB).

Climbing or Descending Direct To MCP Altitude (Unrestricted Climb or Descent)

This procedure deletes all waypoint altitude constraints between the current altitude and the altitude set in the MCP.

MCP Altitude Window Set

VNAV key Select
The applicable page is displayed for the active mode (CLB or DES).

CLB DIR> or DES DIR> Select

EXEC key Select

Changing a Cruise Altitude - Recruising UP During Climb

This procedure is used during climb to change a programmed cruise altitude to a higher assigned altitude (e.g., cleared from an initial cruise altitude of FL 310 to FL 330).

Note: This procedure only works when no waypoint altitude constraints exist between the current altitude and the new cruise altitude.

MCP Altitude Window Set

MCP Altitude selector Push

This automatically changes the cruise altitude on the VNAV CLB page.

Changing a Cruise Altitude - Recruising Down During Climb

This procedure is used during climb to change a programmed cruise altitude to a lower assigned altitude (e.g., cleared from an initial cruise altitude of FL 310 to FL 290).

MCP Altitude Window Set

VNAV key Select

In the Climb Phase, the VNAV CLB page is displayed.

New Cruise Altitude Enter

Type the new cruise altitude into the scratchpad and line select the CRZ ALT line (1L).

EXEC key Select

Note: Using the MCP Altitude selector function (as describing in “Recruising Up”) will not allow a change to a lower altitude until the initial cruise altitude is reached.

Changing a Cruise Altitude - Recruising Down During Level Off

This procedure is used when level at an intermediate altitude that has been assigned as a final cruise altitude (e.g., level at FL 290 and cleared to maintain FL 290 as the final cruise altitude).

VNAV key Select

In the Climb Mode, the VNAV CLB page is displayed.

New Cruise Altitude Enter

Type the new cruise altitude into the scratchpad and line select the CRZ ALT line (1L).

EXEC key Select

MCP Altitude selector Push

This step is required to establish the aircraft on the VNAV PATH.

Accomplishing a Cruise Climb or Descent

This procedure is used when a climb or descent is required (for ATC, fuel efficiency, or turbulence/weather) after a programmed cruise altitude has been reached.

MCP Altitude Window Set

MCP Altitude selector Push

This automatically changes the cruise altitude on the VNAV CRZ page.

Programming a Speed/Altitude Constraint at a Waypoint

This procedure is used to enter a speed/altitude constraint (restriction) for a LEGS page waypoint.

RTE LEGS page Select

To enter or modify a constraint:

Speed/Altitude Enter

Type the speed and/or altitude constraint into the scratchpad and line select the applicable waypoint SPD/ALT line).

To modify speed and altitude, enter the desired speed followed by a “/” and then the desired altitude(e.g., 250/190).

Note: A speed entry can only be made if an altitude constraint exists at the same waypoint.

To modify altitude only, enter the desired altitude without “/” (e.g., 190).

EXEC key Select

To delete a constraint:

DEL key Select

Speed/Altitude Select

Line select the applicable waypoint SPD/ALT line and observe that the estimated values appear.

EXEC key Select

Programming a Speed/Altitude Transition

This procedure is used to modify the existing speed/altitude transition that has been automatically programmed by the FMC.

VNAV key Select

The applicable page is displayed for the active mode (CLB or DES).

To modify the speed/altitude transition:

Speed/Altitude Enter

Type the speed followed by a “/” and then the desired altitude (e.g., 250/110) into the scratchpad. Once entered, line select the SPD TRANS line (3L)

EXEC key Select

To delete a speed/altitude transition:

DEL key Select

Speed/Altitude Select

Line select the SPD TRANS line (3L).

EXEC key Select

Programming a Speed/Altitude Restriction

This procedure is used to enter a speed/altitude restriction not associated with a waypoint.

VNAV key Select

The applicable page is displayed for the active mode (CLB or DES).

To enter the speed/altitude transition:

Speed/Altitude Enter

Type the speed followed by a “/” and then the desired altitude (e.g., 250/190) into the scratchpad. Once entered, line select the SPD RESTR line (4L)

EXEC key Select

To delete a speed/altitude restriction:

DEL key Select

Speed/Altitude Select

Line select the SPD RESTR line (4L).

EXEC key Select

Programming an Offpath Descent

VNAV DES page Select

<OFFPATH DES Select

Descent Waypoint Enter

Type the descent waypoint into the scratchpad and line select the DES TO line (1L).

Desired Speed and Altitude Enter

Type the desired speed and altitude at which the descent waypoint is required to be crossed into the scratchpad and line select the SPD/ALT line (1R).

Note: A Clean Circle (blue) displays distance from the aircraft to the computed top of descent point at current altitude for a clean idle descent path direct to the fix. If the aircraft is flown so that it is beyond this top of descent point, a negative distance is displayed. This clean circle will also display on the ND.

Note: A Drag Circle (white) is computed and displayed whenever the aircraft is flown inside the clean circle.

FMC Performance Data Entries

Entering a Step Climb While in Flight

VNAV key Select

Displays VNAV CRZ page when level at the FMC cruise altitude.

If not at the FMC cruise altitude (VNAV CLB page is displayed):

NEXT PAGE key Select

Displays VNAV CRZ page.

STEP SIZE Enter

Enter the desired step size (2000 or 1000) as appropriate.

Note: For additional information on step climb entries, reference
“Evaluating a Step Climb While in Cruise” below.

Evaluating a Step Climb While in Cruise

The VNAV CRZ page provides a means of evaluating trip fuel burn and time to destination for one of the following cases for a given flight plan:

- Optimum step climbs performed throughout the cruise phase of flight.
- Step climbs performed at pre-planned points throughout the cruise phase of flight.
- No steps performed throughout the cruise phase of flight.
- Provides a means for the pilot to enter a STEP TO altitude.

STEP SIZE (4L):

This value will propagate from the PERF INIT page, or if changed on the VNAV CRZ page, will propagate to the PERF INIT page.

Default value (ICAO) corresponds to use of ICAO flight levels - two thousand foot climb step below FL290 and four thousand foot climb step at FL290 and above.

Positive values of altitude and zero (0) may be entered. Entering a zero (0) causes the flight plan predictions to be computed with no step climbs.

Planned step altitudes may be entered at waypoints by selecting the LEGS page. The step climb altitude is entered by inputting the altitude at the waypoint where step climb is planned followed by a S, which indicates a planned step point (e.g., 370S).

STEP TO (1R):

The calculated step climb altitude displayed is based on the STEP SIZE value (4L). This altitude will be automatically displayed (in small font) by the FMC.

A pilot entered value that is greater than CRZ ALT (1L) may be entered. The manually entered value will appear in large font.

This field will blank if MOD is displayed or if “TO T/D” IS DISPLAYED at 2R.

Once the aircraft flies by the optimum step climb AT point displayed at 2R, the altitude will remain the same until the aircraft passes the optimum step climb point for the next climb altitude.

If the step size is zero (0), this field will be blank and no pilot entries can be made.

If there are planned steps on the LEGS page, this field will display the STEP TO altitude corresponding to the next flight plan leg on the LEGS page which has a step-to altitude. No pilot entries can be made in this case.

AT (2R):

If the step size is greater than zero (0) and there are no planned steps on the LEGS page, this field will display the ETA/Distance to the optimum step climb point if present position is greater than 200 miles from the T/D (within 200 miles of the T/D the ETA and distance are relative to the T/D point).

If there are planned steps on the LEGS page, this field will display the ETA/Distance to the next planned step AT point, provided that the distance to the T/D is greater than 200 miles. After a planned step AT point is passed without the aircraft climbing, the field will display NOW.

If the STEP SIZE is zero (0), this field will be blank.

AVAIL AT (2R):

The “AT” line title changes to “AVAIL AT” when the STEP TO altitude entered at a waypoint on the LEGS page and MAX altitude at the waypoint is less than the STEP TO altitude. “AVAIL AT” indicates where MAX ALT will be equal to the STEP TO altitude.

TO T/D (2R):

The “AT” line title changes to “TO T/D” when the computed ETA and distance to the top of descent are within 200 NM.

NOW (2R):

The “AT” line title changes to “NOW” if a recommended step point is passed.

DEST FUEL/ETA (3R):

If the step size is greater than zero (0) and there are no planned steps:

Flight plan predictions, fuel, and ETA are made assuming that step climbs will be made at the optimum step climb AT points and to the STEP TO altitudes throughout the flight.

If the aircraft does not climb at the step climb AT point, ETA and FUEL will be based on making an immediate step climb from the current position and altitude to the STEP TO altitude and then continuing the flight making all steps at the remaining optimum altitudes.

If the step size is zero (0):

Flight plan predictions are made assuming that the aircraft will continue at the current cruise altitude for the entire flight.

If there are planned steps on the LEGS page:

Displays the estimated fuel and time to fly to destination assuming step climbs executed at the planned step points.

If the last planned step point is a step to a higher altitude and the step size is greater than zero, flight plan predictions are made assuming that subsequent steps will be executed at the optimum step climb points.

If the last planned step point is a step to a higher altitude and the step size is zero, flight plan predictions are made assuming that the aircraft will remain at the final step altitude.

If the last planned step point is a step to a lower altitude, the remainder of the flight plan prediction assumes continued cruise to destination at the lower step down altitude.

After the aircraft passes a planned step AT point and does not make a climb, FUEL and ETA computations are made assuming an immediate climb to the planned altitude displayed at 1R.

Descent Forecast Programming

The Descent Forecast page may be used to enter forecast descent winds/altitudes and anticipated engine anti-ice use to more accurately define the descent path.

VNAV DES page Select

FORECAST> Select

Displays the DESCENT FORECASTS page.

Transition Level Check

Verify the transition level is appropriate for the destination airport.
Modify if required.

Thermal Anti-Ice On Altitude (if required) Enter

Enter the altitude where engine anti-ice is anticipated to activated into the scratchpad and line select the TAI/ON ALT line (1R).

Desired Wind Altitude(s) Enter

Type the desired altitude(s) into the scratchpad and line select an ALT line (2L - 5L).

Note: The FMC will not automatically sort the altitudes in a sequential order.

Desired Wind Direction(s)/Speed(s) Enter

Enter the direction/speed for the entered altitudes into the scratchpad and line select the appropriate WIND DIR/SPD line (2R - 5R).

Programming Waypoint Winds and Temperatures

For waypoint wind and temperature entry procedures see “Wind and Temperature Entries”, FMC Preflight Procedures in this section.

Additional FMC Entries

Fix Page Functions

Valid entries are airport, navaid, waypoint or localizer identifiers contained in the data base.

Radial Entry:

Navaid or waypoint Enter

Enter the identifier of the navaid or the name of the waypoint into the scratchpad.

FIX (1L) Select

Displays the bearing and distance (BRG/DIS) from the selected fix to the aircraft.

Displays the entered fix inside a green circle on the ND

Desired radial Enter

Enter the radial into the scratchpad without entering a “/” (e.g., 358).

BRG/DIS Select

Line select the data into one of the three BRG/DIS lines (2L - 4L).

Displays the radial in large font and the distance to the intersection in small font (e.g., 358/25).

When the radial intersects the active route, the estimated time of arrival (ETA), distance to go (DTG), and the predicted altitude (ALT) to the intersection is displayed.

Displays the radial as a green dashed line on the ND display.

Distance Entry:

Navaid or waypoint Enter

Type the identifier of the navaid or the name of the waypoint into the scratchpad.

FIX (1L) Select

Displays the bearing and distance (BRG/DIS) from the selected fix to the aircraft.

Displays the entered fix inside a green circle on the ND.

Desired distance Enter

Enter “/” followed by the distance into the scratchpad (e.g., /25).

BRG/DIS Select

Line select the data into one of the three BRG/DIS lines (2L - 4L).

Displays the radial in small font and the distance to the intersection in large font (e.g., 358/25).

When the distance intersects the active route, the estimated time of arrival (ETA), distance to go (DTG), and the predicted altitude (ALT) to the closest of two intersections is displayed.

Displays a green distance circle on the ND display.

Abeam Entry:

Navaid or waypoint Enter

Enter the identifier of the navaid or the name of the waypoint into the scratchpad.

FIX Select

Displays the bearing and distance (BRG/DIS) from the selected fix to the aircraft.

Displays the entered fix inside a green circle on the ND.

ABEAM Select

Displays the estimated time of arrival (ETA), distance to go (DTG), and the predicted altitude (ALT) for the abeam point.

Displays a green dash line from the fix to the abeam point on the ND.

ETA-ALT Entry:

Navaid or waypoint Enter

Enter the identifier of the navaid or the name of the waypoint into the scratchpad.

FIX Select

Displays the bearing and distance (BRG/DIS) from the selected fix to the aircraft.

Displays the entered fix inside a green circle on the ND.

PRED ETA-ALT Select

Entering an altitude/flight level:

Displays the predicted along track distance and altitude (e.g., 82NM FL310).

Displays the predicted airplane position as a green “donut” (with the entered altitude/flight level) on the ND.

Valid altitude entry is flight level or altitude.

Entering a time:

Displays the predicted along track distance and time (e.g., 82NM 1500Z).

Displays the predicted airplane position as a green “donut” (with the entered ETA) on the ND.

Valid time entry is 0000-2359 followed by “Z”.

Inhibiting Navaid(s) From FMC Radio Updating

Three methods are available to inhibit navaid updating to the FMC:

- Navaid Inhibit - selected navaids are inhibited for use by the FMC for updating.
- VOR-only Inhibit - only the VOR portion of the navaid will be inhibited for use by the FMC for updating.
- VOR/DME Nav Inhibit - inhibits the FMC from using VOR/DMEs for radio updating. Does not affect DME/DME updating.

INIT REF key Select

<INDEX Select

Displays the INIT/REF INDEX page.

NAV DATA> Select

Displays the REF NAV DATA page.

To inhibit the VOR portion of a navaid only (DME is available):

Navaid identifier Enter

VOR ONLY INHIBIT Select

Note: Up to two identifiers may be entered.

To inhibit the VOR and DME portion of a navaid:

Navaid identifier Enter

NAVAID INHIBIT Select

Note: Up to two identifiers may be entered

To inhibit use of all VORs:

VOR/DME NAV INHIBIT> Select

ALL is displayed on the VOR ONLY INHIBIT lines

ENABLE will replace the INHIBIT prompt.

Note: VOR ONLY and NAVAID Inhibits may be deleted by use of the DEL key. VOR/DME NAV Inhibit may be deleted by selecting the ENABLE prompt.

Manual ILS Tuning

NAV RAD key Select

Displays the NAV RADIO page.

ILS frequency and course Enter

Valid entries:

ILS frequency followed by a “/” and then the front course (e.g., 108.10/010).

Note: Frequency entries are 108.10 to 111.95 inclusive.

Front course only, with a frequency and course already entered.

A “/” must be entered before the course (e.g., /010).

ILS - MLS Select

Displays “M” next to the entered ILS frequency and front course (e.g., 108.10/010M), indicating manually tuned.

To delete Manual ILS Tuning:

DEL key Select

ILS-MLS Select

Returns the ILS to FMC autotuning.

Navigation Accuracy Checks

Long Range Navigation Systems shall be checked for accuracy before entering Class II or Minimum Navigation Performance Specification (MNPS) airspace.

The accuracy check is normally performed by the Pilot Monitoring (PM) as follows:

If crossing directly over a VOR:

Approaching the VOR:

EFIS POS switch Select

Selecting the POS function of the EFIS Control Panel will display three IRU positions (white snowflakes) and green raw data radials extending from the aircraft position to green VOR stations tuned on the NAV RAD page.

PROG key Select

Displays PROGRESS page 1/2.

POS REF> Select

Displays POS REF (Position Reference) page 2/3.

Over the VOR:

FMC POS Select

Line select the FMC POS (1L).

Compare the FMC position with the VOR charted coordinates.

Place a check mark in the Flight Plan block indicating, “NAV ACCURACY CHECKS COMPLETED”.

If not crossing directly over a VOR:

EFIS POS switch Select

Selecting the POS function of the EFIS Control Panel will display 3 IRU positions (white snowflakes) and green raw data radials extending from the aircraft position to green VOR stations tuned on the NAV RAD page.

EFIS VOR switch Select

Selecting the VOR function of the EFIS Control Panel will display VOR stations on the ND.

FIX Select

Displays the FIX page.

VOR Enter

From the ND, enter a VOR identifier that is within 40 - 130 NM.

Compare the VOR's radial/DME on the ND (raw data) against the bearing/distance on the FIX page (FMC position).

Place a check mark in the Flight Plan block indicating, "NAV
ACCURACY CHECKS COMPLETED".

Departure or Landing 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
- Touchdown zone indicator (amber crosshatched area) on the PFD altitude tape

For operations into an airport not in the database, only the following approach procedures are authorized:

- ILS approaches
- Visual approaches

Note: Non-ILS approaches, other than ASR approaches, are not authorized.

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

Departure Airport Not In FMC Navigation Database

Preflight Procedure

Accomplish a normal preflight with the following exceptions:

INIT REF key Select
Displays the POS INIT page.

SET IRS POS Enter

Note: Entry of an ICAO airport into the REF AIRPORT line that is not contained in the database will cause the message NOT IN DATABASE to be displayed.

Enter the ARP latitude/longitude from the Jeppesen -9 page into the scratchpad.

Use the ARP latitude/longitude to initialize the IRS.

Note: During the FMC verification, pay particular attention to the LAST POS line on the POS INIT page to ensure that the correct latitude/longitude has been entered. The entered position will be displayed on the LAST POS line once the IRS enters the NAV Mode.

RTE key Push

If ORIGIN contains an ICAO identifier from a previous flight and the departure airport is not represented in the database:

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 that the ACTIVE date range is current.

Clear the NAV DATA OUT OF DATE scratchpad message.

RTE key Push

DEST Enter

Note: The ORIGIN will be left blank.

Route Enter

LEGS key Push

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

The DEPARTURES page is not available for the departure airport. Manually enter the departure route waypoints utilizing the following hierarchy:

- Waypoint from the database
- Latitude/longitude from the Jeppesen chart

Note: The flight crew must pay particular attention to confirm that these waypoints are entered correctly by verifying leg courses and distances on the LEGS page.

Note: In flight on non-database route segments, it is imperative that the flight crew monitor raw data to comply with the assigned route.

ACTIVATE and execute the route.

VNAV key Push

Displays the CLB page.

Transition Altitude Enter

In the absence of an ORIGIN airport, the transition altitude must be manually typed into the scratchpad and line selected at the TRANS ALT line (3R).

NAV RAD key Push

Manually enter any NAVAID frequencies and courses required for departure navigation and/or reference.

6301 - 6310

LDG ALT switch Pull ON (Manual)

When pulled ON, manual control is selected. When manual control is selected, the landing altitude and MAN (in amber) are displayed in the ECS data block of the EICAS.

6311 - 6316

LDG ALT switch Push ON (Manual)

When pushed, landing altitude control alternately changes between automatic and manual. When manual control is selected, the landing altitude and MAN (in amber) are displayed in the ECS data block of the EICAS.

LDG ALT selector Rotate

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

Do not accomplish the following checklist:

LANDING ALT

Note: After engine start, cancel the LANDING ALT message.

Note: The touchdown zone indicator (amber crosshatched area) is not shown on the PFD altitude tape.

Departure Briefing

In addition to the standard Departure Briefing items listed in the FOM, brief the following:

- Non-standard FMC preflight/verification procedures listed in this section.
- Tuning, identifying, and monitoring of the required raw data on non-database segments.
- Verification of all created waypoints that represent the non-database segment.

With the absence of runway data in the database, utilize the ARPT function of the EFIS Control Panel to display the airport (blue circle) on the ND for situational awareness.

Note: In the absence of runway data, a small map shift may be prevalent at takeoff. This will subside when the FMC begins auto-tuning after takeoff.

Descent Procedure

In addition to the standard Descent procedure, accomplish the following before descent:

6301 - 6310

LDG ALT switch Push (Automatic)

When pushed in, automatic control is selected. When automatic control is selected, AUTO (in white) is displayed on the ECS data block of the EICAS.

6311 - 6316

LDG ALT switch Push (Automatic)

When pushed, landing altitude control alternately changes between automatic and manual. When automatic control is selected, AUTO (in white) is displayed on the ECS data block of the EICAS.

VNAV key Push

Displays CRZ page.

NEXT PAGE key Push

Displays DES page.

FORECAST> Select

Displays the DESCENT FORECAST page.

Transition Level Verify

Verify that the transition level displayed on the TRANS LVL line (1L) is appropriate for the destination. If the departure airport's transition altitude is still displayed, type the transition level into the scratchpad and line select TRANS LVL line (1L).

Landing Airport Not in the FMC Navigation Database

Preflight Procedure

Accomplish a normal preflight with the following exceptions:

RTE key Select

ORIGIN Enter

Note: The DEST will be left blank.

Route Enter

LEGS key Push

The ARRIVALS page is not available for the landing airport. In the absence of arrival procedure data (STAR), manually enter the arrival route waypoints utilizing the following hierarchy:

- Waypoint from the database
- Latitude/longitude from the Jeppesen chart

Note: The crew must pay particular attention to confirm that these waypoints are entered correctly by verifying leg courses and distances on the LEGS page.

Note: In flight on non-database route segments, it is imperative that the flight crew monitor raw data to comply with the assigned route.

Enter the latitude and longitude of the landing 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 50 feet above the landing airport elevation.

Activate and execute the route.

Descent and Approach Procedures

In addition to the standard Descent and Approach procedures, accomplish the following before descent:

VNAV key Push

Displays the CRZ page.

NEXT PAGE key Push

Displays the DES page.

FORECAST> Select

Displays the DESCENT FORECAST page.

Transition Level Enter

In the absence of a DEST airport, the transition level must be manually typed into the scratchpad and line select the TRANS LVL line (1L).

6301 - 6310

LDG ALT switch Pull ON (manual)

When pulled ON, manual control is selected. When manual control is selected, the landing altitude and MAN (in amber) are displayed in the ECS data block of the EICAS.

6311 - 6316

LDG ALT switch Push ON (manual)

When pushed, landing altitude control alternately changes between automatic and manual. When manual control is selected, the landing altitude and MAN (in amber) are displayed in the ECS data block of the EICAS.

LDG ALT selector Rotate to set the landing airport altitude

Do not accomplish the following checklist:

LANDING ALT

Cancel the LANDING ALT message.

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

NAV RAD key Select

If conducting a PAR or ASR, manually enter any NAVAID frequencies and courses required for navigation and/or reference.

If conducting an ILS, manually enter the ILS frequency and course (e.g., 110.90/130) and utilize the approach mode of the autopilot as normal. The autoflight system does not require the approach to be in the FMC database in order to perform an ILS approach.

If conducting a visual approach, an intercept course (INTC CRS) may be entered on the LEGS page. The course line is for situational awareness only. It may not be used as the primary source of navigation.

Arrival Briefing

In addition to the standard Approach Briefing items listed in the FOM, brief the following:

- Tuning, identifying, and monitoring of the required raw data on non-database segments.
- Verification of all created waypoints that represent the non-database segment.
- Autoflight modes to be used on the non-database segments.
- Special considerations for go-around/missed approach procedures.

Note: In the absence of a database missed approach procedure, LNAV cannot be used for lateral guidance.

Alternate Navigation

If during flight both FMCs fail, each CDU and its respective IRU are used to navigate.

Place Navigation Source Selectors to LEFT CDU, CENTER CDU or RIGHT CDU as required.

Left displays the left IRU waypoint and track information on the ND. Center displays the center IRU waypoint and track information on the ND. Right displays the right IRU waypoint and track information on the ND.

LNAV, VNAV, and autothrottles are not available. Heading Select or Heading Hold can be used to maintain aircraft on track. Altitude Hold, FLCH, or Vertical Speed can be used to maintain/change altitude.

While LAND2 or LAND3 may be displayed below 1500 feet in alternate navigation conditions, only CAT I ILS and non-ILS approaches are authorized.

Thrust EPR settings and V speeds will not be available through the FMC. For EPR settings, refer to the ODM, Operation Without Airspeed Indication in the Abnormal section. For V speeds, refer to the ODM, Normal Landing Speeds table in the Approach/Landing section.

The following pages are available on the respective CDUs:

Left (captain's) CDU:

- LEGS - ACT IRS LEGS from left IRU.
- PROGRESS - IRS PROGRESS from left CDU.
- NAV RAD - ALTN NAV RADIO tuning for left navigation radios.

Allows manual tuning of the left VOR, ADF and ILS.

Center CDU:

- LEGS - ACT IRS LEGS from center IRU.
- PROGRESS - IRS PROGRESS from center CDU.
- NAV RAD - ALTN NAV RADIO tuning for center navigation radio.

Allows manual tuning of the center ILS.

Right (first officer's) CDU:

- LEGS - ACT IRS LEGS from right IRU.
- PROGRESS - IRS PROGRESS from right CDU.
- NAV RAD - ALTN NAV RADIO tuning for right navigation radios.

Allows manual tuning of the right VOR, ADF and ILS.

Since no FMC database is available, valid entries on the ACT IRS LEGS page are waypoint names which are currently on the active flight plan or latitude and longitude. Complete departure and arrival procedures cannot be entered unless the waypoints can be identified as latitudes and longitudes.

Refer to Volume 2, Chapter 11.50, FMS Alternate Navigations System Description further guidance.

Intentionally
Blank

Supplementary Procedures

Chapter SP

Fuel

Section 12

Fuel Balancing

Consider the possibility of an engine fuel leak. If fuel imbalance has occurred without indications of a fuel leak, fuel may be balanced.

Excessive fuel imbalance adversely affects CG, aerodynamic drag, and therefore, fuel economy. To maintain CG and reduce drag, operate the airplane within limits of FUEL IMBALANCE EICAS advisories.

If a FUEL IMBALANCE EICAS advisory is displayed, accomplish the applicable FUEL IMBALANCE non-normal checklist. If fuel balancing is desired prior to display of the FUEL IMBALANCE EICAS advisories, fuel may be balanced:

- Between main tanks 1 and 4 by opening crossfeed valves 1 and 4, closing crossfeed valves 2 and 3, turning off the fuel pumps in the low tank, and turning off the override pumps in main tanks 2 and 3
- Between main tanks 2 and 3 by turning off the fuel pumps in the low tank
- Longitudinally by opening all crossfeed valves and turning off the fuel pumps in the low tanks.

Avoid conditions which require fuel suction feed, unless directed by published non-normal procedure.

The fuel system should be returned to normal operating condition when the imbalance condition has been corrected.

Fuel Quantity Indication System (FQIS) - Main Tank Indicator Inoperative Procedures and Considerations

Prior to Engine Start

Calculate total fuel quantity and manually initialize it on the PERF INIT page.

In-flight

If it is necessary to jettison fuel en route:

- Record the FUEL TO REMAIN quantity selected for the jettison operation.
- Wait two minutes after fuel jettison is complete and then manually re-initialize the FMC with the total FUEL TO REMAIN quantity recorded above.

If an en route failure of the FMC calculated total fuel quantity:

- Compute the fuel burn for each leg manually and log it on the flight plan for each remaining waypoint.

Note: FMC Progress Page 1 LAST waypoint FUEL may display 0.0. In some failure modes, PROGRESS PAGE 2 FUEL USED data may be available.

Note: An inoperative main tank FQIS will cause the advisory message FUEL IMBALANCE to be inhibited. Additionally, as appropriate for the affected main tank pair, FUEL IMBAL 1-4 or FUEL IMBAL 2-3 will be inhibited.

If an engine fuel leak is suspected, the following will attempt to identify the affected engine:

If the CWT contains fuel:

- Verify the total fuel quantity available in the CWT and Stabilizer Tank.
- Verify the total fuel quantity available in the CWT and Stabilizer Tank.
- Verify the point (in time and place) en route where the CWT pump low pressure indication (advisory message FUEL LOW CTR L or FUEL LOW CTR R) occurs and compare it with the flight plan point of predicted CWT fuel depletion.
- If CWT fuel depletion precedes the predicted point, an engine fuel leak should be suspected.

If CWT is empty, be alert for the following conditions as indications that a significant fuel leak has occurred:

- Rapid reduction in a fuel quantity indication if the leak resides with an engine associated with an operating fuel quantity indication.
- Excessive lateral trim requirement.

Note: 1/4 unit of aileron trim movement equates to a 6,000 lbs. difference in actual tank quantity between tanks 2 and 3, or a 3,000 lbs. difference in actual tank quantity between tanks 1 and 4.

- An engine flame-out.

If a fuel leak is suspected, but the affected engine has not been determined, accomplish the following procedure:

- Place Stabilizer Tank Pump switches OFF.
- Place Center Wing Tank Pump switches OFF.
- Place Crossfeed Valve 1, 2, 3, 4 switches OFF.

Note: X FEED CONFIG message is displayed.

Determine the affected engine by accomplishing the following:

If Main Tank 1 FQIS is inoperative:

- Place Crossfeed Valve 1, 4 switches ON.
- Place both Main Tank 1 Pump switches off.

Note: Main Tank 4 now supplies fuel to both engines 1 and 4.

- Confirm affected engine fuel leak by observing if Main Tank 4 fuel quantity decreases faster than the combined decrease in both Main Tanks 2 and 3 fuel quantity. A faster decrease of approximately 1,000 lbs. in 30 minutes should be considered confirmation that engine 1 has an engine fuel leak.

If Main Tank 2 FQIS is inoperative:

- Place Crossfeed Valve 2, 3 switches ON.
- Place Override Pump 2 and 3 switches OFF.
- Place both Main Tank 2 Pump switches off.

Note: Main Tank 3 now supplies fuel to both engines 2 and 3.

- Confirm affected engine fuel leak by observing if Main Tank 3 fuel quantity decreases faster than the combined decrease in both Main Tanks 1 and 4 fuel quantity. A faster decrease of approximately 1,000 lbs. in 30 minutes should be considered confirmation that engine 2 has an engine fuel leak.

If Main Tank 3 FQIS is inoperative:

- Place Crossfeed Valve 2, 3 switches ON.
- Place Override Pump 2 and 3 switches OFF.
- Place both Main Tank 3 Pump switches off.

Note: Main Tank 2 now supplies fuel to both engines 2 and 3.

- Confirm affected engine fuel leak by observing if Main Tank 2 fuel quantity decreases faster than the combined decrease in both Main Tanks 1 and 4 fuel quantity. A faster decrease of approximately 1,000 lbs. in 30 minutes should be considered confirmation that engine 3 has an engine fuel leak.

If Main Tank 4 FQIS is inoperative:

- Place Crossfeed Valve 1, 4 switches ON.
- Place both Main Tank 4 Pump switches off.

Note: Main Tank 1 now supplies fuel to both engines 1 and 4.

- Confirm affected engine fuel leak by observing if Main Tank 1 fuel quantity decreases faster than the combined decrease in both Main Tanks 2 and 3 fuel quantity. A faster decrease of approximately 1,000 lbs. in 30 minutes should be considered confirmation that engine 4 has an engine fuel leak.

If an engine fuel leak is confirmed and the engine verified, complete the Fuel Leak Engine procedure, QRH, section 12.

Fuel Freeze Program

During the winter months, certain B747-400 operations will encounter extremely cold weather, which can affect enroute fuel temperatures. Similar to previous years, Delta is implementing a Fuel Freeze Program to mitigate fuel freeze issues. This program is planned for all polar and non-polar Asian flights to and from ATL, DTW, MSP, and JFK. The Fuel Freeze Program will commence annually on November 1 and will remain in effect until April 30.

Westbound Flights

All westbound aircraft departing the US for Asia will be boarded with Jet A fuel, which has a specific fuel temperature of -40°C. However, rather than relying on this specification, the actual fuel freeze temperature (which is typically 5°-10° better) will be analyzed. Plane side fuel sample(s) will be collected and the actual fuel freeze temperature will be determined.

Eastbound Flights

All eastbound flight departing Asia for the U.S. will be uploaded with Jet A-1 fuel, which has a specific freeze temperature of -47 °C. Instead of fuel sampling, Dispatch can calculate the actual fuel freeze temperature when necessary using the SAE specific fuel freeze temperature. As a result, the actual fuel freeze temperature will be included in the Dispatcher's remarks section.

Operating Procedures

Preflight

- This procedure is applicable to all polar and non-polar flights between Asia and the United States.
- The Minimum Predicted Fuel Temperature and its associated ETE can be found in the Dispatcher's remarks section. These values are published for informational only purposes. In addition, the actual fuel freeze temperature will be communicated to the flight crew for all polar flights and any other flight route affected by enroute fuel temperatures colder than -37°C.

After Departure

Westbound Polar Flights

- Within two hours after departure, westbound crews should expect an ACARS message from the dispatcher with the actual fuel freeze value. If notification is not received within two hours, query the dispatcher. If there is sufficient ground time, the Dispatcher may include the actual fuel freeze value on the flight plan.

All Flights

- Review the actual fuel freeze point temperature you have received. Drop the digit after the decimal and maintain a fuel temperature of 3°C or more above (warmer than) this adjusted freeze point value [AFM]. For example, an actual freeze temperature of -46.8°C yields a revised Operational Limit of -43°C.

Fuel Temp Non-Normal

- A FUEL TEMP LOW advisory message indicates the fuel temperature is -37°C or cooler. If this message is displayed, monitor the fuel temperature. Maintain the temperature above the Operational Limit. For specific guidance, refer to the FUEL TEMP LOW non-normal checklist in the QRH.
- If at any time the fuel temperature is in question, contact the dispatcher for assistance in coordinating a plan of action with ATC.

Supplementary Procedures

Warning Systems

Chapter SP

Section 15

EICAS STATUS Messages

STATUS messages are displayed on secondary EICAS and indicate equipment faults which may affect aircraft dispatch capability. Certain STATUS messages will be accompanied by an associated Alert level message (WARNING, CAUTION, or ADVISORY) on primary EICAS.

In dealing with STATUS messages, the flight crew is required to review, record, and report the message for maintenance action. The following procedures will be followed by the flight crew when dealing with EICAS STATUS messages:

Preflight and Prior to Engine Start

Normal crew procedures require checking STATUS messages during preflight and prior to engine start to determine aircraft dispatchability. CAUTION and ADVISORY messages do not require crew action prior to engine start because they reflect systems not yet configured for flight and should disappear as a result of crew action during the preflight. Any WARNING message must be dealt with immediately.

If a STATUS message appears prior to engine start and is not placarded by MEL procedures, advise Maintenance. If maintenance is not available, contact Maintenance Control.

The 747-400 MEL (Section 1 - EICAS Messages) contains a list of EICAS messages with a reference to the applicable MEL item.

After Engine Start

After engine start and prior to takeoff, it is not necessary to check STATUS messages. The STATUS cue will not be displayed on primary EICAS from engine start until approximately 30 minutes after takeoff. Any message adversely affecting the safe continuation of the flight or requiring crew attention will appear as an EICAS Alert message. After engine start and prior to takeoff, any Alert message requires performing the applicable abnormal procedure. Consult the MEL to determine if relief is authorized.

After Takeoff

STATUS messages that occur in flight and are not accompanied by a primary EICAS Alert message do not require flight crew action. They are intended for maintenance follow-up on arrival.

Logging STATUS Messages

Any STATUS messages that appear after engine start through engine shutdown should be recorded in the Aircraft's Maintenance Logbook. Chapter 31 of the Boeing 747-400 Fault Reporting Manual lists the EICAS STATUS messages along with a fault reporting code.

Event Record

The EVENT RCD switch may be pushed to record up to five maintenance events into the EIU memory. Use as directed by operating procedure or at the request of Maintenance Control. Additionally, the EVENT RCD switch may be used at the discretion of the captain to record parameters for a suspect condition.

Supplementary Procedures

Adverse Weather

Chapter SP

Section 16

Introduction

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

Fuel Freeze Program

Refer to SP.12, Fuel Freeze Program, for procedures that are applicable to all polar and non-polar flights between Asia and the United States, annually from November 1 until April 30.

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 (1600m) or less, rain, snow, sleet, ice crystals, etc.) is present; or
- ice, snow, slush or standing water is present on the ramps, taxiways, or runways.

CAUTION: Do not use engine 747 nacelle anti-ice when OAT (on the ground) is above 10°C. Do not use engine or wing anti-ice when TAT (in-flight) is above 10°C.

Preflight Procedure

Although removal of surface snow, ice or frost is normally an ACS function, the flight crew should carefully inspect areas where surface snow, ice or frost could change or affect normal system operations.

Exterior Inspection

Do the normal Exterior Inspection with the following additional steps:

CAUTION: Inspections conducted well before scheduled pushback time can result in a change to the surface condition.

Surfaces Check

Ensure all leading edge devices, all control surfaces, and the upper wing and winglets, are free of snow, ice, and frost. The upper wing surfaces should be confirmed free of frozen contamination by inspection from the best vantage points.

Note: After inspection, monitor environmental conditions and ensure control surfaces remain free of contamination.

Note: Takeoff with light coatings of frost, up to 1/8 inch (3mm) in thickness on lower wing surfaces due to cold fuel is allowable.

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.

Probes, sensors, ports, vents, and drains (as applicable) Check

Check all probes, sensors, ports, vents, and drains are free of ice and snow. Water rundown after snow removal may refreeze 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 themselves are clear.

Pack inlets and outlets Check

Verify the air inlets and outlets, including the outflow valve, are free of snow and ice.

Engine inlets Check

Verify the inlet cowling is free of snow and ice.

Landing gear Check

Gear strut, actuators, doors, tires, brakes, and wheels should be free of snow or ice.

APU air inlet Check
The APU inlet door and cooling air inlet must be free of snow or ice prior to APU start.

Engine Start Procedure

Note: When anticipating taxiing on a slippery or contaminated surface, consider starting all engines.

Do the normal Engine Start procedure with the following modifications:

- 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

Engine Nacelle Anti-ice Operation - On the Ground

Engine Nacelle anti-ice must be selected ON immediately after engine start and remain on during all ground operations when icing conditions exist or are anticipated.

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 engine damage or failure.

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

When engine nacelle anti-ice is needed:

ENGINE NACELLE ANTI-ICE switches ON

When engine nacelle anti-ice is no longer needed:

NACELLE ANTI-ICE switches OFF

Taxi Procedure

Do the normal Taxi procedure with the following modifications:

CAUTION: Avoid taxiing in deep snow or slush since steering will be more difficult. Brakes, landing gear and flaps may also freeze after takeoff if contaminated with snow or slush.

CAUTION: Taxi at a reduced speed. Use smaller nose wheel steering and rudder inputs and apply minimum thrust evenly and smoothly. Taxiing on slippery taxiways or runways at excessive speed or with high crosswinds may start a skid.

CAUTION: When operating the engines over significant amounts of standing deicing or anti-icing fluid, limit thrust to the minimum required. Excessive ingestion of deicing or anti-icing fluid can cause the fluid to build up on the engine compressor blades resulting in compressor stalls and engine surges.

CAUTION: Be alert for high snowbanks along taxiways. No. 1 and No. 4 engines are extremely susceptible to snow and ice ingestion due to taxiway overhang.

Flight controls Check

Note: Increase in control forces can be expected at low temperatures because of increased resistance in cables and thickened oil in snubbers and bearings.

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

- Check that the area behind the airplane is clear.
- Run the engines up to a minimum of 50% N1 for approximately 1 second duration at intervals no greater than 15 minutes.

Before Takeoff Procedure

Refer to the Takeoff Runway Contaminant Decision Tree in this section. For performance corrections, refer to the WDR.

Takeoff Procedure

Refer to the Takeoff Runway Contaminant Decision Tree in this section, if applicable.

Do the normal Takeoff Procedure with the following modifications:

When nacelle anti-ice is required and the OAT is 3°C or below, the takeoff must be preceded by a standing takeoff.

A standing takeoff is accomplished by holding the brakes while in position on the assigned runway until the engines are stabilized at or above 50% N1 before the start of the takeoff roll.

Climb, Cruise, and Descent Procedures

Engine Nacelle Anti-Ice Operation – In Flight

Engine Nacelle anti-ice must be 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. Engine Nacelle anti-ice must be ON before, and during descent in all icing conditions, including temperatures below -40°C SAT.

When operating in areas of possible icing, activate engine nacelle anti-ice before entering icing conditions.

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

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

When engine nacelle anti-ice is needed:

NACELLE ANTI-ICE switches ON

When engine nacelle anti-ice is no longer needed:

NACELLE ANTI-ICE switches OFF

Wing Anti-Ice Operation – In Flight

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

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

Note: Wing anti-icing is not effective with leading edge flaps extended. If icing conditions exist, turn anti-icing on after retraction of leading edge flaps; or complete anti-icing before extension of leading edge flaps.

Note: Prolonged operation in icing conditions with the leading edge and trailing edge flaps extended is not recommended.

When wing anti-ice is needed:

WING ANTI-ICE switch ON

When wing anti-ice is no longer needed:

WING ANTI-ICE switch OFF

Cruise Procedure

Cold Temperature Altitude Corrections

Extremely low temperatures create significant altimeter errors and greater potential for reduced terrain clearance. When the temperature is colder than ISA, true altitude will be lower than indicated altitude.

To ensure adequate obstacle clearance in conditions of extreme cold weather (-10°C or lower, or as specified in the Company Pages), refer to the Airway Manual, Weather, Altimeter Corrections.

Approach and Landing Procedures

Refer to the Guidelines for Takeoff on Contaminated Runways or Landing with Braking Action Less than Good procedure in this section, if applicable.

After Landing Procedure

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 landing on a runway contaminated with ice, snow, or slush:

Do not retract the flaps to less than flaps 25 until the flap areas have been checked to be free of contaminants.

Refer to Taxi procedure in this section for nacelle anti-ice, engine run up, and taxi guidance.

Secure Procedure

Do the normal Secure procedure with the following modifications whenever the temperature falls below 0°C (32°F) or the aircraft may be de/anti-iced during overnight parking:

Parking brake As required

 If the ramp is contaminated with ice or snow, parking brake should remain set.

Outflow valve manual switches ON

Outflow valve manual control CLOSE

The above procedure positions the outflow valve fully closed to inhibit intake of snow, ice, or deicing fluid.

Note: Additional cold weather securing procedures are required to be accomplished by maintenance and/or ACS personnel. Stations have the responsibility for draining the water system.

Guidelines for Takeoff on Contaminated Runways or Landing with Braking Action Less than Good

When there is contamination on the runway or the braking action is less than good, captains must evaluate crew, aircraft, and environmental conditions in determining the safety of operating their flight.

Procedure Guidance

General

- Consider crew capability.
- Consider current Maintenance Carry Overs (MCOs) - reversers, antiskid, etc.
- Consider type and amount of contaminant.
- Consider source and age of reported braking action.
- Consider usable runways and taxiways (NOTAMS, ATIS, etc.).

Taxi

- Be aware that ramps and taxiways may be very slippery.
- Be cautious of jet blast effect on ground personnel and equipment.
- Taxi onto and off runways at an extremely slow speed. Nose wheel slippage may occur causing the aircraft to continue straight ahead and possibly off the paved surface.

Crosswind Guidance

- On slippery runways, crosswind guidelines are a function of runway surface condition, airplane loading, and proper pilot technique.
- The following crosswind guidelines are applicable for takeoff and landing:

Braking Action	Runway Condition	ICAO	MU	RCR	Takeoff/ Landing Max Recommended Crosswind Component	Tailwind Limit
---	Dry	6	≥ 40	≥ 19	30	10*
Good	Damp Frost (<1/8")	5				
Good / Medium	Wet	4				
Medium (Fair)	Dry Snow	3	35-30	13-18	20	5
Medium / Poor	Wet Snow/ Standing Water/ Slush	2	29-26	—	20	0
Poor	Ice - No Melting	1	25-21	6-12	10	
Nil	Do Not Operate					

* Unless the aircraft and airport are authorized for 15 knots.

Note: Crosswind guidelines are not considered limitations. Refer to the Limitations chapter for crosswind limits.

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

Note: When multiple reports are present, e.g. “Braking Action Fair to Good”, use the lower crosswind value.

Takeoff

- Refer to the Takeoff Runway Contaminant Decision Tree, this section.
- Do not take off with braking action report of NIL by any air carrier aircraft or airport operator.
- A rolling takeoff is strongly advised when the crosswind exceeds 20 knots.
- Do not take off with standing water, slush, or wet snow in excess of 1/2 inch (1.2 cm) depth.
- Do not take off in dry snow in excess of four inches (10 cm) depth.

AWABS Determinations

Airport Customer Service (ACS) maintains a template in AWABS which describes conditions on each runway. ACS will enter the runway contaminant type and depth when more than 25% of the runway is affected. AWABS interprets this information according to rules established by Flight Operations to automatically select the contaminant type.

Note: For the A319, A320, A321, B717, B737NG, B757-300, B767-400, A330 and B777-200LR, W (WET) is automatically selected by AWABS when the runway is reported wet. For other aircraft types, the Captain must notify the gate agent or Operations if he wants Load Control Center (LCC) to load plan for W (WET) numbers.

AWABS limits the takeoff weight, as appropriate, based upon the selected contaminant type.

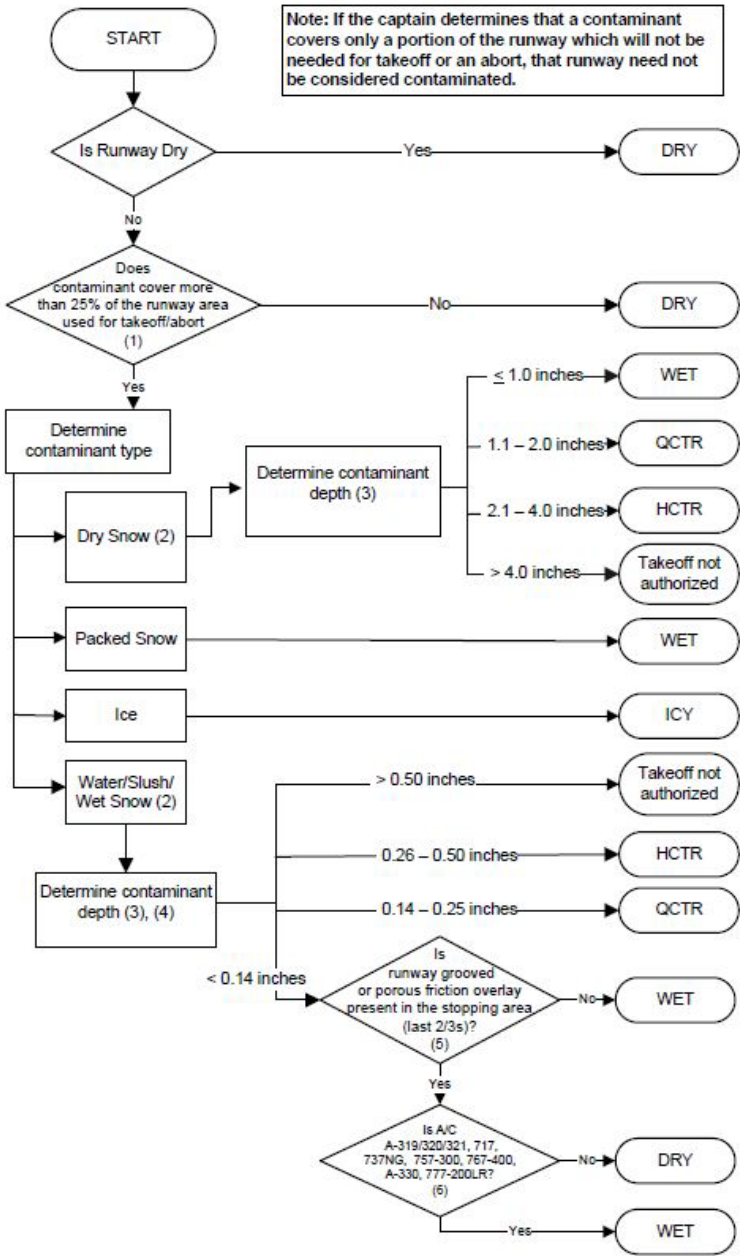
If the Captain determines that a contaminant covers only a portion of the runway which will not be needed for takeoff or an abort, that runway need not be considered contaminated. The Captain's determination affects his flight only and should be communicated to the dispatcher so AWABS can be updated appropriately, via LCC.

Category Definitions

- **DRY** - A runway is dry, or can be considered dry, based upon the considerations discussed in the Takeoff Runway Contaminant Decision Tree.
- **Slippery** - Under slippery conditions it is assumed that only the aircraft's braking capability is degraded; the aircraft's ability to accelerate is assumed to be unaffected.
 - **W (WET)** - A runway which is wet and on which the Captain considers the aircraft's braking capability to be degraded, or a runway covered with packed snow.
 - **I (ICY)** - A runway whose surface is covered by ice.
- **Cluttered** - Under cluttered conditions it is assumed that there is sufficient depth of contaminant that both the aircraft's acceleration and braking capability are degraded.
 - **QCTR (1/4 inch clutter)** - A runway whose surface is covered by an equivalent standing water depth of between .14 and .25 inches.
 - **HCTR (1/2 inch clutter)** - A runway whose surface is covered by an equivalent standing water depth of between .26 and .50 inches. Refer to the Takeoff Runway Contaminant Decision Tree, this section, for dry snow equivalent depths.

Takeoff Runway Contaminant Decision Tree

Use the following decision tree to determine runway condition for takeoff.



Takeoff Runway Contaminant Decision Tree Notes		
1	If the Captain determines that a contaminant covers only a portion of the runway which will not be needed for takeoff or an abort, that runway need not be considered contaminated. Note: There are circumstances that permit the Airport Authority to clear only the center 100 feet of the runway. In those circumstances, only the contaminant coverage within the cleared area is used to establish the percentage coverage.	
2	Snow	AWABS determines if snow is dry or wet on the basis of temperature. Snow is considered: • Wet when the temperature is 30° F (-1.1°C) or above • Dry when the temperature is below 30° F (-1.1°C) Note: A good operational test is: If a well compacted snowball can be made, the snow is wet; if the snowball falls apart, then the snow is dry.
3	A runway can be covered at varying depths over its length/width. When contaminant depths vary along the runway, a weighted average may be required. The contaminant depth along the runway where the aircraft will be at higher speeds should be weighed more heavily than at other points.	
4	A weighted average depth: • Less than or equal to 1/4 inch equates to QCTR, • Over 1/4 inch and up to 1/2 inch equates to HCTR Note: When the average depth exceeds 1/2 inch, takeoff will not be attempted.	
5	Grooved runways and runways with special porous overlays are designed to drain water from the runway surface in order to reduce the possibility of hydroplaning and increase the effective friction coefficient. Properly maintained runways with grooves or porous pavement have been shown to provide braking action approximately equivalent to a dry runway.	
6	A319, A320, A321, B717, B737NG, B757-300, B767-400, A330 and B777-200LR aircraft cannot consider a wet runway dry even if it is grooved or has a porous friction course overlay.	

Contaminant Millimeters to Inches Conversion

Use the following table for foreign stations that report runway clutter depth in millimeters (mm).

mm	0	6.35	12.7	25.4	50.8	101.6	152.4
Inches	0	1/4	1/2	1	2	4	6

Landing

- If FCTM, Quick Reference Landing Length chart does not apply, determine braking action. If braking action is less than good, accomplish an ACARS Landing Performance Request or refer to the ODM, Quick Reference Tab, Operational Landing Distance table.
- Do not land with a braking action report of NIL by any air carrier aircraft or airport operator in the landing or rollout portion of the runway.
- Do not land with standing water, slush, or wet snow in excess of one inch (2.5 cm) depth.
- Do not land in dry snow in excess of four inches (10 cm) depth.
- Consider using MAX AUTO autobrakes for maximum stopping effectiveness.
- Land as early in the touchdown zone as possible.
- Do not assume the last 2,000 feet of the runway will have braking action as good as the touchdown zone.
- Avoid abrupt steering inputs.
- Use maximum allowable symmetrical reverse thrust.
- If side slipping off the runway, select reverse idle and release brakes to return to centerline.
- Aircraft will tend to drift off the runway nose first with forward thrust and tail first with reverse thrust.
- Be aware of the possibility of white out effect from reverse thrust use in dry snow.

Ground De/Anti-Icing Procedure

Pre-Gate Departure Communication

The captain can expect to talk to several different people during the deicing process, however, only two call signs are used.

- “Iceman” is a person who communicates with the captain via the VHF radio from a position within operations, the control center or the deice pad tower. This person will refer to the aircraft’s “Ship Number” in all communications.
- “Deicer/Coordinator” is the person who will be in direct control of the actual deicing operation on the aircraft. He/she will be plugged into the aircraft interphone system or on VHF radio and must be in direct communication with the captain at all times. This person will not know the flight number and will refer to the aircraft’s “Ship Number” in all communications.

The following communication procedures will be used:

PRE-GATE DEPARTURE COMMUNICATION	
CAPTAIN:	“This is ship #_____, we will require deicing.”
ICEMAN:	“Ship #_____, your aircraft will be deiced with the engines running.
	OR
ICEMAN:	“Ship #_____, your aircraft will be deiced_____ (at the gate, off the gate, or at the remote) with the engines shut down.”
CAPTAIN:	“Roger, ship #_____”

Use the appropriate procedure for deicing at the gate or at the remote site with engines running or shut down.

Note: Advise deicer/coordinator if the APU will be running during de/anti-icing.

Note: Ensure engine inlets have been inspected and are clear prior to engine start.

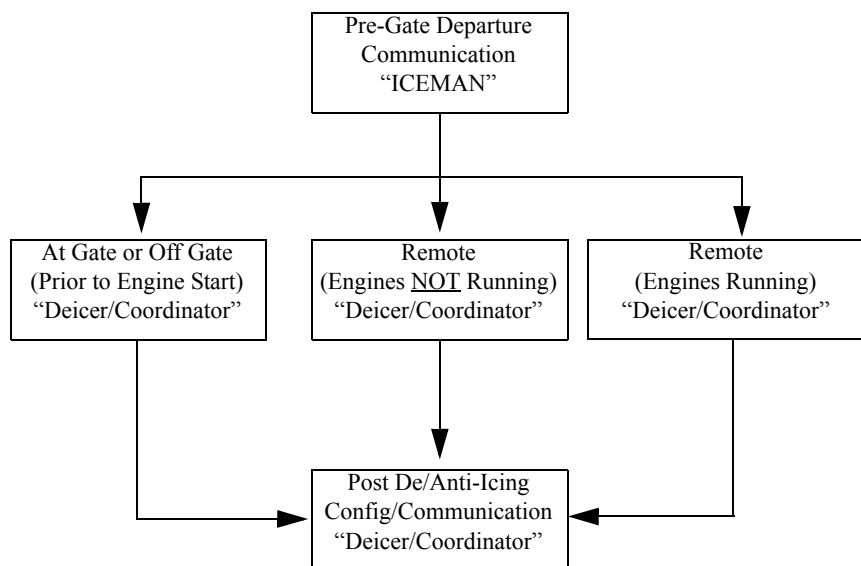
Aircraft Configuration and Communication

Prior to departure from the gate, when conditions warrant, the captain will contact “Iceman” and follow the Pre-Gate Departure Communication. The Iceman will describe one of three de/anti-icing scenarios:

- At Gate or Off Gate (Prior to Engine Start)
- Remote (Engines Not Running)
- Remote (Engines Running)

Follow the communication and configurations described in the appropriate procedure. Once complete, follow the Post De/Anti-Icing configuration and communication.

Note: If the APU is inoperative, advise Iceman.



At Gate or Off Gate (Prior to Engine Start)

Make a PA to the passengers regarding the deicing process.

Approximately one minute prior to deicing:

PRE-DEICING COMMUNICATION	
DEICER/COORD:	"Ship # ____, brakes set?"
CAPTAIN:	"Roger, ship # ____, brakes set."
DEICER/COORD:	"Ship # ____ Type II / IV with (fluid brand name) will be used for anti-icing (if anti-icing required)."
CAPTAIN:	"Roger, ship # ____."
DEICER/COORD:	"Ship # ____, ready for deicing?"
CAPTAIN:	"Stand by." (Follow procedure below).

OR

PRE-DEICING COMMUNICATION USING FORCED AIR	
DEICER/COORD:	"Ship # ____, brakes set?"
CAPTAIN:	"Roger, ship # ____, brakes set."
DEICER/COORD:	"Ship # ____, the final process used will be forced air with Type I fluid (or forced air only) with no holdover time."
CAPTAIN:	"Roger, ship # ____." OR "Negative, ship # ____, holdover time required."
DEICER/COORD:	"Ship # ____, ready for deicing?" OR "Ship # ____, Type II / IV with (fluid brand name) will be used for anti-icing (if anti-icing required). Ready for deicing?"
CAPTAIN:	"Stand by." (Follow procedure below).

Prior to de/anti-icing:

Aircraft configuration for de/anti-icing:

CAUTION: Snow, slush, or ice ingestion in the APU inlet duct while the APU is running can cause serious damage. Coordinate with ground personnel to ensure that APU inlet area is clear before starting APU. Ingestion of deicing fluid causes objectionable fumes and odors to enter the airplane.

No. 1 and No. 4 HYD DEMAND pump selectors AUTO
Verify hydraulic systems 1 and 4 are pressurized.

Flaps Extend
Extend the flaps to the anticipated takeoff position.

No. 1 and No. 4 HYD DEMAND pump selectors OFF
APU or external power As required

Note: If the APU is not available, use external air to lower the flaps. Disconnect the air prior to deicing.

PACK selectors OFF

APU bleed air switch
(when APU running) OFF

Reduces the possibility of fumes entering the air conditioning system.

WARNING: Once the deicing operation begins, any aircraft movement or changes in configuration must be coordinated with the ground crew.

CAPTAIN:	“Ship # ____, aircraft ready for deicing.”
POST DE/ANTI-ICING COMMUNICATION	
DEICER/COORD:	“Ship # ____ de/anti-icing and aircraft inspection complete.” OR “Ship # ____ de/anti-icing and aircraft inspection complete. The final process used was forced air with Type I fluid (or forced air only) with no holdover time.”
CAPTAIN:	“Roger, ship # ____.”
DEICER/COORD:	“Ship # ____ Type I fluid application started ____ minutes ago. The freeze point is ____°C”. No Type II or IV was used.” OR “Ship # ____ Type II/IV fluid application with (fluid brand name) started ____ minutes ago.” OR (Non-US locations): “Ship # ____ Type II/IV fluid application (fluid brand name) started ____ minutes ago using a fluid mixture of ____ (% concentrate).”
CAPTAIN:	“Roger, ship # ____ Type I started ____ minutes ago. The freeze point is ____°C. No Type II or IV was used.” OR “Roger, ship # ____ Type II/IV (fluid brand name) started ____ minutes ago.” OR (Non-US locations): “Roger, ship # ____ Type II/IV (fluid brand name) started ____ minutes ago using a fluid mixture of ____ (% concentrate).”
DEICER/COORD:	“Ship # ____, clear to start engines (when applicable). Do not move the aircraft under power until you have been given the all clear salute.”
CAPTAIN:	“Roger, ship # ____.”

Post de/anti-icing:

WARNING: An All Clear salute is required to verify de/anti-icing procedures are complete.

Aircraft configuration post de/anti-icing:

Complete the Pushback procedure, if not already accomplished.

APU As required

Wait approximately 1 minute after deicing is complete to restore bleed air for pack operation to ensure deicing fluid has been cleared from the engines and APU.

APU bleed air switch ON

Engines Start

Accomplish the After Start procedure.

PACK control selectors As required

Accomplish the Taxi procedure.

Remote (Engines Not Running)

If remote deicing with engines not running is anticipated, the APU should be left operating. If the APU or a portion of the APU is inoperative, confirm that electric and/or air carts are available at the remote location before departing the gate.

CAUTION: Snow, slush, or ice ingestion in the APU inlet duct while the APU is running can cause serious damage. Coordinate with ground personnel to ensure that APU inlet area is clear before starting APU. Ingestion of deicing fluid causes objectionable fumes and odors to enter the airplane.

Approaching the icepad:

- Contact “Iceman”.
- Start the APU if it is not already operating.
- Make a PA to the passengers regarding the deicing process.

Just prior to entering the deicing area:

- Verify flaps are in the intended takeoff position.

When the aircraft is in position for deicing:

PRE-DEICING COMMUNICATION	
DEICER/COORD:	“Ship # ____, brakes set?”
CAPTAIN:	“Roger, ship # ____, brakes set.”
DEICER/COORD:	“Ship # ____ Type II / IV with (fluid brand name) will be used for anti-icing (if anti-icing required).”
CAPTAIN:	“Roger, ship # ____.”
DEICER/COORD:	“Ship # ____, ready for deicing?”
CAPTAIN:	“Stand by.” (Follow procedure below).

OR

PRE-DEICING COMMUNICATION USING FORCED AIR	
DEICER/COORD:	“Ship # ____, brakes set?”
CAPTAIN:	“Roger, ship # ____, brakes set.”
DEICER/COORD:	“Ship # ____, the final process used will be forced air with Type I fluid (or forced air only) with no holdover time.”
CAPTAIN:	“Roger, ship # ____.” OR “Negative, ship # ____, holdover time required.”
DEICER/COORD:	“Ship # ____, ready for deicing?” OR “Ship # ____, Type II / IV with (fluid brand name) will be used for anti-icing (if anti-icing required). Ready for deicing?”
CAPTAIN:	“Stand by.” (Follow procedure below).

Prior to de/anti-icing:

Aircraft configuration for de/anti-icing.

Flaps Extend

Extend the flaps to the anticipated takeoff position.

APU or external power As required

PACK control selectors OFF

APU bleed air switch OFF

Reduces the possibility of fumes entering the air conditioning system.

Engines Shut down

WARNING: Once the deicing operation begins, any aircraft movement or changes in configuration must be coordinated with the ground crew.

CAPTAIN:	“Ship # ____, aircraft ready for deicing.”
POST DE/ANTI-ICING COMMUNICATION	
DEICER/COORD:	“Ship # __ de/anti-icing and aircraft inspection complete.” OR “Ship # __ de/anti-icing and aircraft inspection complete. The final process used was forced air with Type I fluid (or forced air only) with no holdover time.”
CAPTAIN:	“Roger, ship # ____.”
DEICER/COORD:	“Ship # __ Type I fluid application started ____ minutes ago. The freeze point is ____ °C”. No Type II or IV was used.” OR “Ship # __ Type II/IV fluid application with (fluid brand name) started ____ minutes ago.” OR (Non-US locations): “Ship # __ Type II/IV fluid application (fluid brand name) started ____ minutes ago using a fluid mixture of ____ (% concentrate).”
CAPTAIN:	“Roger, ship # __ Type I started ____ minutes ago. The freeze point is ____ °C. No Type II or IV was used.” OR “Roger, ship # __ Type II/IV (fluid brand name) started ____ minutes ago.” OR (Non-US locations): “Roger, ship # __ Type II/IV (fluid brand name) started ____ minutes ago using a fluid mixture of ____ (% concentrate).”
DEICER/COORD:	“Ship # ____, clear to start engines (when applicable). Do not move the aircraft under power until you have been given the all clear salute.”
CAPTAIN:	“Roger, ship # ____.”

Post de/anti-icing:

WARNING: Do not move aircraft until ATC taxi clearance and the All Clear Salute have been received.

Aircraft configuration post de/anti-icing:

APU As required

Wait approximately 1 minute after deicing is complete to restore bleed air for pack operation to ensure deicing fluid has been cleared from the engines and APU.

APU bleed air switch ON

Engines Start

Accomplish the After Start procedure.

PACK control selectors As required

Accomplish the Taxi procedure.

Remote (Engines Running)

Note: Deicing with the engines running is authorized only at stations identified in the Company Pages.

Approaching the icepad:

- Contact “Iceman”
- Make a PA to the passengers regarding the deicing process.

Just prior to entering the deicing area:

- Verify flaps are in the intended takeoff position.

When the aircraft is in position for deicing:

PRE-DEICING COMMUNICATION	
DEICER/COORD:	“Ship # ____, brakes set, engines at idle?”
CAPTAIN:	“Roger, ship # ____, brakes set, engines at idle.”
DEICER/COORD:	“Ship # ____ Type II / IV with (fluid brand name) will be used for anti-icing (if anti-icing required).”
CAPTAIN:	“Roger, ship # ____.”
DEICER/COORD:	“Ship # ____, ready for deicing?”
CAPTAIN:	“Stand by.” (Follow procedure below).

OR

PRE-DEICING COMMUNICATION USING FORCED AIR	
DEICER/COORD:	“Ship # ____, brakes set, engines at idle?”
CAPTAIN:	“Roger, ship # ____, brakes set, engines at idle.”
DEICER/COORD:	“Ship # ____, the final process used will be forced air with Type I fluid (or forced air only) with no holdover time.”
CAPTAIN:	“Roger, ship # ____.” OR “Negative, ship # ____, holdover time required.”
DEICER/COORD:	“Ship # ____, ready for deicing?” OR “Ship # ____, Type II / IV with (fluid brand name) will be used for anti-icing (if anti-icing required). Ready for deicing?”
CAPTAIN:	“Stand by.” (Follow procedure below).

Prior to de/anti-icing:

Aircraft configuration for de/anti-icing:

- Thrust levers IDLE
- Flaps Extend
 - Extend the flaps to the anticipated takeoff position.
- APU OFF
- APU bleed air switch OFF
- PACK control selectors OFF
- ENGINE BLEED air switches OFF
- Reduces the possibility of fumes entering the air conditioning system.
- Engines 1 and 4 Shut down

WARNING: Once the deicing operation begins, any aircraft movement or changes in configuration must be coordinated with the ground crew.

CAPTAIN:	“Ship # ____, aircraft ready for deicing.”
POST DE/ANTI-ICING COMMUNICATION	
DEICER/COORD:	“Ship # __ de/anti-icing and aircraft inspection complete.” OR “Ship # __ de/anti-icing and aircraft inspection complete. The final process used was forced air with Type I fluid (or forced air only) with no holdover time.”
CAPTAIN:	“Roger, ship # ____.”
DEICER/COORD:	“Ship # __ Type I fluid application started ____ minutes ago. The freeze point is ____ °C”. No Type II or IV was used.” OR “Ship # __ Type II/IV fluid application with (fluid brand name) started ____ minutes ago.” OR (Non-US locations): “Ship # __ Type II/IV fluid application (fluid brand name) started ____ minutes ago using a fluid mixture of ____ (% concentrate).”
CAPTAIN:	“Roger, ship # __ Type I started ____ minutes ago. The freeze point is ____ °C. No Type II or IV was used.” OR “Roger, ship # __ Type II/IV (fluid brand name) started ____ minutes ago.” OR (Non-US locations): “Roger, ship # __ Type II/IV (fluid brand name) started ____ minutes ago using a fluid mixture of ____ (% concentrate).”
DEICER/COORD:	“Ship # ____, clear to start engines (when applicable). Do not move the aircraft under power until you have been given the all clear salute.”
CAPTAIN:	“Roger, ship # ____.”

Post de/anti-icing:

WARNING: Do not move aircraft until ATC taxi clearance and the All Clear Salute have been received.

Taxi may be commenced prior to restoring bleed air and pack operation.

Aircraft configuration post de/anti-icing:

APU As required

Wait approximately 1 minute after deicing is complete to restore bleed air for pack operation to ensure deicing fluid has been cleared from the engines and APU.

APU bleed air switch ON

ENGINE BLEED air switches ON

PACK control selectors As required

Engines 1 and 4 Start

Start the engines using the normal start procedures.

Accomplish the After Start procedure.

Accomplish the Taxi procedure.

Hot Weather Operation

During ground operation the following considerations will help keep the airplane as cool as possible:

- If a ground source of conditioned air is available, the supply should be plugged in immediately after engine shutdown and should not be removed until just prior to engine start.
- If a ground source of conditioned air is not available, use all air conditioning packs and ensure recirculation fans are off.

Note: Turning on the recirculation fans has a negative effect on passenger comfort. This introduces hot ambient air from around the cargo compartments to the mix manifold. This impedes the flow of cool air from the ground conditioned air or packs into the cabin air distribution system.

- All doors, including cargo doors, and windows should be closed as much as possible.
- Electronic components which contribute to a high temperature level in the flight deck should be turned off while not needed.
- All flight deck air outlets should be opened.
- All passenger cabin gasper outlets should be opened and all window shades on the sun-exposed side of the passenger cabin should be closed.

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

During takeoff performance evaluation consider the following:

- High temperatures inflict performance penalties which must be taken into account on the ground before takeoff.
- Alternate takeoff procedures (Packs Off Takeoff, etc.)

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 also be avoided.

If moderate to heavy rain, hail or sleet is encountered:

If TAT 10°C or below:

NACELLE ANTI-ICE switches ON

Provides continuous ignition for flameout protection and maintains a minimum thrust setting of approach idle.

During descent:

Autothrottles Disconnect

If TAT above 10°C:

CON IGNITION switch ON

Provides flameout protection. Confirm CON IGNITION Memo message is displayed.

During descent:

Autothrottles Disconnect

Thrust levers Set

Set minimum of 50% N1 at or above 10,000 feet, 45% N1 below 10,000 feet, except for landing.

Note: In heavy precipitation, engine parameter fluctuations may occur, particularly a noticeable drop in EGT. Engine parameters will return to normal immediately upon leaving the area of heavy precipitation.

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.

Exterior Inspection

Although removal of sand and dust contaminants is primarily a maintenance function, during the exterior inspection, the captain or first officer should carefully inspect areas where accumulation of sand or dust could change or affect normal system operations.

Do the normal Exterior Inspection with the following additional steps:

Windshield Check

Verify that the windshield has been cleaned.

Note: Do not use windshield wipers for sand or dust removal.

Surfaces Check

Verify that the upper surfaces of the wings and other control surfaces are free of sand.

CAUTION: Particular care should be taken to ensure that the fuselage and all surfaces are clean after a sand storm that occurs with a rain storm.

Probes, sensors, ports, vents,
and drains (as applicable) Check

Verify that all are free of sand and dust.

Pack inlets Check

Verify that the pack inlets are free of sand and dust.

Outflow valves	Check
Verify that the outflow valves are free of sand and dust.	
Positive and negative pressure relief doors	Check
Verify that all doors are free of sand and dust.	
Leading edge flaps	Check
Verify that all leading edges are undamaged.	
Engine inlets	Check
Verify that the inlet cowling is free of sand and dust.	
Verify that the fan is free to rotate and fan blades are undamaged.	
Fuel tank vents	Check
Verify that all vents are free of sand and dust.	
Landing gear	Check
Verify that gear struts and doors are free of sand and dust build-up.	
Vertical and horizontal stabilizers	Check
Verify that all leading edges are undamaged.	
APU air inlet	Check
Ensure that the APU inlet door is free of sand and dust before APU start.	

Preflight Procedure - Pilot Monitoring

Do the normal Preflight Procedure - Pilot Monitoring with the following modifications:

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

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

APU bleed air switch Off

APU START

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

APU bleed air switch ON

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.

Engine START switch Pull

Verify that the N2 RPM increases.

Allow maximum motoring for 2 minutes to help remove contaminants.

Note: Maximum motoring occurs when N2 does not increase for five to ten seconds.

FUEL CONTROL switch RUN

After engine start:

After Start Procedure

Do the normal After Start Procedure with special emphasis on the following steps:

Conditions permitting, use the APU-to-Pack Takeoff or Packs Off Takeoff procedure.

If the APU-to-Pack Takeoff procedure will be used:

Limit APU bleed air use as much as possible to reduce sand and dust ingestion.

If the APU is not running:

APU bleed air switch Off

APU START

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

APU bleed air switch ON

Flight controls Check

Verify that 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:

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

Takeoff

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

- Use the maximum fixed derate and/or assumed temperature thrust reduction that meets performance requirements.
- Prior to 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 permit.
- Use maximum climb power to minimize time spent in dusty conditions.

Landing

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

- Use autobrakes on landing to help minimize the need for reverse thrust.
- Performance permitting, 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 Procedure

Do the normal After Landing Procedure with the following modifications:

Note: Use external power and ground air carts as much as possible.
Start the APU only if it is needed to provide electrical power or bleed air after engine shutdown.

If the APU must be started:

APU bleed air switch Off

APU START

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

APU bleed air switch ON

Taxi-In

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

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

Shutdown Procedure

Do the normal Shutdown Procedure with the following modifications:

Note: If the APU must be used for air conditioning, maintain a temperature as high as possible while still providing a tolerable flight deck and cabin environment.

Secure Procedure

Do the normal Secure Procedure with the following modifications:

Outflow valve manual switches ON

Outflow valve manual control CLOSE

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.

Turbulence

During flight in light to moderate turbulence, the autopilot and/or autothrottle may remain engaged unless airspeed, altitude or attitude deviations require use of manual control. Increased thrust lever activity can be expected when encountering wind, temperature changes and large pressure changes. Short-time airspeed excursions of 10 to 15 knots can be expected.

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 the Limitations section for the turbulent air penetration speed.

Passenger signs ON

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

In moderate to severe turbulence:

CON IGNITION switch ON

Provides flameout protection and maintains a minimum thrust setting of approach idle. Confirm CON IGNITION Memo message is displayed.

Severe Turbulence

PHASE OF FLIGHT	AIRSPED/AUTOFLIGHT MODE
CLIMB/CRUISE	290-310 KIAS or .82-.85 Mach After takeoff and when established in a clean climb configuration, the autoflight system is recommended for flight through turbulence. To reduce pitch changes as the AFDS attempts to fly speed with elevators, climb using vertical speed (speed on thrust), and cruise using altitude hold. During cruise, VNAV and altitude hold modes each fly speed on autothrottles and can be used in turbulence. In extreme turbulence, it may be necessary to disconnect the autothrottles. With autothrottles disconnected, the FMC generates a target thrust setting for cruise which is displayed on EICAS. Set thrust at or slightly above the target thrust indicator. Change thrust setting only if required to reverse an unacceptable speed trend.
DESCENT	To reduce pitch changes as the AFDS attempts to fly speed with elevators, descend using vertical speed (speed on thrust). If severe turbulence is encountered at altitudes below 15,000 feet and the gross weight is less than the maximum landing weight, the airplane may be slowed to 250 KIAS in the clean configuration. Adequate stall margin exists under these conditions.

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.

Note: If an approach must be made into an area of severe turbulence, delay flap extension as long as possible. The airplane can withstand higher gust loads in the clean configuration. Diversion to another airfield is the best policy if severe turbulence persists in the area.

Volcanic Ash Encounter

Ground Operations

Aircraft should not operate into or out of airports where there is falling ash and/or ash-covered runways/taxiways. If an airport's operational surfaces are contaminated with ash, the taxiways and runways to be used must be swept prior to use, and if possible, sprayed with water to minimize aircraft contamination from any remaining ash.

Restrict ground use of the APU to engine starts. Use ground starting air and electrical power, if available.

Do not use windshield wipers for dust removal. Coordinate with Maintenance to hose off ash deposits with water and wipe residue away with a soft cloth.

Avoid the use of air conditioning packs on the ground as long as recirculation fans will maintain adequate cabin comfort. If air conditioning is required, operate at full cold setting. Use preconditioned air at the terminal from a filtered ground cart, if available. If possible, keep engine bleeds off.

Avoid static operations of engines above idle power.

To prevent contamination of air conditioning system, consider a takeoff with packs off.

Use rolling takeoff procedures to minimize engine dust ingestion.

During landing, limit reverse thrust to avoid impairing visibility and minimize ingesting dust into the engines. Exercise caution as braking may be less effective than normal due to contamination on the runway.

In Flight

CAUTION: If volcanic ash is encountered in flight, refer to the QRH, section 0, Volcanic Ash.

Differences

Chapter DF

Table of Contents

Section 0

747-400 Differences.....	DF.10
Airplane General, Emergency Equipment, Doors, Windows ..	DF.10.1
Air Systems	DF.10.1
Communications	DF.10.1
Electrical	DF.10.1
Engines, APU.....	DF.10.2
Flight Controls.....	DF.10.2
Fuel.....	DF.10.2

Intentionally
Blank

Differences

747-400 Differences

Chapter DF

Section 10

Airplane General, Emergency Equipment, Doors, Windows

Item	Ships 6301 - 6310	Ships 6311 - 6314	Ships 6315, 6316
Oxygen Mask assembly	Oxygen mask only (smoke goggles separate)		Oxygen mask/smoke goggles combined
Pilot Seat Headrest	Not installed		Installed
Waste Quantity Indicator (Attendants Panel Door 2R)	Not installed	Installed	

Air Systems

Item	Ships 6301 - 6310	Ships 6311 - 6314	Ships 6315, 6316
Landing Altitude Control Switch/Selector	Analog System Combine switch/selector	Digital System Separate switch and selector	
Side Window Air Flow Control	Not installed		Installed

Communications

Item	Ships 6301 - 6310	Ships 6311 - 6314	Ships 6315, 6316
Backup Audio System	Observer Audio System Installed	Captain Audio System Installed	

Electrical

Item	Ships 6301 - 6314	Ships 6315, 6316
APU Standby Bus	Not installed	Installed

Engines, APU

Item	Ships 6301 - 6310	Ships 6311 - 6314	Ships 6315, 6316
APU oil quantity display	Displayed only when APU is running		Displayed continuously
APU fuel supply	Main Tank 2	Main Tanks 2 and 3	

Flight Controls

Item	Ships 6301 - 6316
Speedbrake operation	Refer to Limitations Chapter

Fuel

Item	Ships 6301 - 6310	Ships 6311 - 6316
Center Wing scavenge system	Electrical system Transfers fuel to Main Tank 2	Hydromechanical system Transfers fuel to Main Tanks 2 and 3
Defueling Panel	CWT SCAVENGE PUMP and RESERVE 2 & 3 TRANSFER switches	RESERVE 2 & 3 TRANSFER switches
	Ships 6302 - 6306	Ships 6301, 6307 - 6316
Fuel Transfer Main 1 & 4 switch	Switch contains a VALVE indicator light	Switch does not contain a VALVE indicator light

Vol 1 Index

Chapter Index

Additional FMC Entries.....	SP.11.40
AFDS	SP.4.1
After Landing Procedure.....	NP.20.66
After Start Procedure	NP.20.43
Air Conditioning Packs.....	SP.2.1
Air Systems.....	DF.10.1
Air Systems.....	L.10.3
Aircraft Communications Addressing and Reporting System (ACARS).....	SP.5.1
Aircraft Configuration Changes During Normal Procedures.....	NP.10.3
Aircraft Limitations in Normal Procedures	NP.10.5
Airplane General.....	L.10.1
Airplane General, Emergency Equipment, Doors, Windows	DF.10.1
Alternate Navigation.....	SP.11.54
Anti-Ice Operation	SP.3.1
Anti-ice, Rain.....	L.10.3
Approach Procedure.....	NP.20.60
Approach Selection Table.....	NOI.3.1
Assumed Temperature Thrust Rollback	SP.7.5
At Gate or Off Gate (Prior to Engine Start).....	SP.16.19
Automated Engine Reporting System.....	SP.7.4
Automation Guidelines	NP.12.1
Autopilot/Flight Director System	L.10.3
Before Takeoff Procedure.....	NP.20.50
Cabin Inspection	SP.1.1
Charted Visual Approach Guide (Procedure in FMS Database) LNAV & VNAV Modes.....	NOI.3.19
Checklist Challenges.....	NP.11.4
Checklist Content.....	NP.11.1
Checklist Initiation and Completion	NP.11.3
Checklist Response Designators	NP.11.4
Checklist Responses	NP.11.5
Circling Maneuver	NOI.3.21

Clearance Verification Procedures	NP.12.6
Climb Procedure	NP.20.54
Cockpit Voice Recorder Test.....	SP.5.1
Cold Weather Operation	SP.16.1
Communications	DF.10.1
Communications	L.10.4
Controller Pilot Data Link Communications and Automatic Dependent Surveillance (CPDLC/ADS-C).....	SP.5.70
Crew Duties and Responsibilities	NP.10.3
Cruise Procedure.....	NP.20.55
Delayed Start Procedure	NP.20.49
Departure or Landing Airport Not in the FMC Navigation Database	SP.11.46
Descent Procedure	NP.20.59
EICAS STATUS Messages	SP.15.1
Electrical Power Down	SP.6.2
Electrical Power Up	SP.6.1
Electrical	DF.10.1
Electronic Flight Bag (EFB) Mount	SP.1.3
Engine Continuous Ignition	SP.7.1
Engine Crossbleed Start.....	SP.7.3
Engine Ground Pneumatic Start	SP.7.1
Engine Start Procedure	NP.20.41
Engine/APU/Cargo Fire/Overheat Test (Fire Warning Test)	SP.8.1
Engines, APU.....	DF.10.2
Engines, APU.....	L.10.5
Event Record.....	SP.15.2
Exterior Inspection - Captain or First Officer or Relief Pilot.....	NP.20.5
First Flight of the Day and After Shutdown Reminders....	NP.11.4
Flight Controls	DF.10.2
Flight Controls	L.10.6
Flight Deck Door Access System Test	SP.1.5
Flight Instruments, Displays	L.10.7
Flight Management, Navigation	L.10.6
Flights with Nontraditional Call Signs	SP.5.94

▲ DELTA
747-400 Operations Manual

FMC Lateral Navigation Entries and Conventions.....	SP.11.16
FMC Performance Data Entries.....	SP.11.36
FMC Preflight Procedures	SP.11.9
FMC Vertical Navigation Entries and Conventions	SP.11.30
FMC Worldwide Waypoint Position Reporting (FMC WPR).....	SP.5.94
Fuel Freeze Program.....	SP.12.5
Fuel Freeze Program.....	SP.16.1
Fuel Quantity Indication System (FQIS) - Main Tank	
Indicator Inoperative Procedures and Considerations	SP.12.1
Fuel System.....	L.10.7
Fuel	DF.10.2
Go-Around Procedure.....	NP.20.64
GPS, RNAV (GPS), or RNAV (GNSS) - Approach	
Guide LNAV & VNAV Modes	NOI.3.13
Ground De/Anti-Icing Procedure.....	SP.16.17
Guidelines for Takeoff on Contaminated Runways or	
Landing with Braking Action Less than Good	SP.16.10
Heading Reference Switch Operation.....	SP.10.1
HF System.....	SP.5.89
Hot Weather Operation.....	SP.16.31
ILS (GS Out), LOC, LDA, or VOR - Approach Guide	
LNAV or LOC & VNAV Modes	NOI.3.17
ILS CAT I, LDA with GS - Approach Guide	
APP Mode.....	NOI.3.5
ILS CAT II or SA ILS CAT II - Approach Guide	
APP Mode.....	NOI.3.9
ILS CAT III - Approach Guide	
APP Mode.....	NOI.3.11
ILS Precision Runway Monitor (PRM) Considerations	NOI.3.7
Interior Cabin Modifications	SP.1.7
Interior Inspection - First Officer or Relief Pilot.....	NP.20.1
IRS Fast Realignment	SP.11.8
IRS High Latitude Alignment.....	SP.11.8
Landing Airport Elevation Between 8,000 Feet and 10,000 Feet.....	SP.2.2
Landing Procedure.....	NP.20.61

Landing Roll Procedure	NP.20.65
Lights Usage	NP.12.8
Manual Override Start.....	SP.7.3
Moderate to Heavy Rain, Hail or Sleet.....	SP.16.32
Multi-Purpose Control Display Unit (MCDU).....	NP.12.1
Navigation Accuracy Checks.....	SP.11.44
Normal Checklist Use Policy.....	NP.11.1
Normal Ops Info	NOI.1.1
Normal Procedures and CRM/TEM	NP.10.1
Normal Procedures Construction.....	NP.10.6
Normal VHF Radio Management.....	NP.12.2
Operating Procedures in the QFE Environment	SP.10.1
Operation in a Sandy or Dusty Environment.....	SP.16.33
Oxygen Mask and Interphone System Test	SP.1.1
Packs Off Takeoff.....	SP.2.1
Philosophy and Compliance with Normal Procedures	NP.10.1
Pratt & Whitney 4056 Engine Oil Indications.....	SP.7.4
Preflight Procedure - Captain.....	NP.20.25
Preflight Procedure - First Officer	NP.20.30
Preflight Procedure - Pilot Flying.....	NP.20.12
Preflight Procedure - Pilot Monitoring	NP.20.16
Procedural Errors or Omissions.....	NP.11.2
Procedure versus Checklist.....	NP.11.2
Pushback Procedure	NP.20.37
Radar Operation	SP.11.2
RADIO/BARO Minimums Chart	NOI.3.23
Relationship Between Procedures and Checklists	NP.10.5
Remote (Engines Not Running).....	SP.16.23
Remote (Engines Running).....	SP.16.27
Runway, Intersection, Departure, Performance Data, Approach Changes, or Go-Around	NP.11.6
Satellite Communications (SATCOM) Operations	SP.5.56
Secure Procedure	NP.20.70
Sequence, Flow and Responsibility for Tasks	NP.10.4
Shutdown Procedure	NP.20.67
Squib Test	SP.8.2
Stabilized Approach.....	NP.12.2

Standard Callouts	NP.12.3
System Discrepancies during Ground Operations	NP.10.8
Takeoff Procedure	NP.20.52
Tasks Excluded from Normal Procedures	NP.10.3
Taxi Procedure	NP.20.44
Terminology	NP.10.2
Transferring Electrical Power To or From the APU Power	SP.6.2
Turbulence	SP.16.39
Use of Triggers	NP.10.4
Using VNAV to Meet Altitude Constraints Prior to the Published FAF/PFAF	NOI.3.3
Verification of Checklist Items	NP.11.5
Volcanic Ash Encounter	SP.16.42
Warning Systems	L.10.9
Weather Radar Test	SP.11.1

Intentionally
Blank