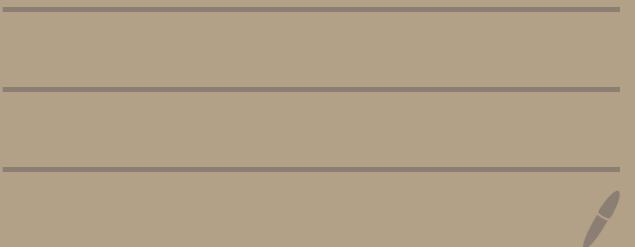


Operational Procedures



General Requirements

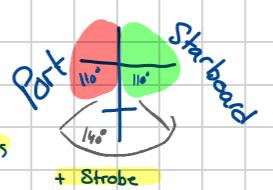
ICAO Annex 6

Applicable to International Commercial Air Transport: Aeroplanes

Definitions:

Departure aerodrome can be used as en-route and destination diversion

Take-off alternate: $\leq 1\text{h}$ flight time with 1 engine



General:

Turbojet landing distance 60% factor 0.6

Turbo prop landing distance 70% factor 0.7

Compliance of operation \rightarrow operator

Safety and Management System (SMS)

$\rightarrow >1$ aircraft with MTOM $> 27'000\text{ kg}$

Flight Safety document system

\rightarrow ensures easy access to information for flight and ground ops

\rightarrow protect sources according to ICAO Annex 19

Violation: notify local authority without delay

Operational Requirements

General

Only take parts of Operation Manual required for flight and crew duty

Information to be retained on ground

Wet lease: responsibility to lessor

Dry lease: responsibility to the operator whom

II - Part ARO - Authority Requirements for Air Operations

III - Part ORO Organization Requirement for air Operation - all of the above

CAT + comm. spec ops

non-comm w/ complex mult-pow
non-comm spec w/ complex

low visibility

Annex 10 - Communication \rightarrow SSR

Operator certification and supervision

Accountable manager (compliance monitoring system)

Safety manager

• Accountable Manager
• Line captain

passes information and resources on to other managers

function:

• Facilitate hazard identification

• Provide periodic report

• Monitor implementation

Operational procedure (except preparation for long range flight)

SAR not available with no survival equipment

No greater than 90 min at cruising speed

ETOPS

Non-ETOPS

- > 20 PAX \rightarrow 60 min
- ≤ 19 PAX \rightarrow 120 min

ETOPS diversion time to takeoff alternate 120 min

Class	MOPSC	Mass	Time / Distance
A	20 or more	45'360 kg or more	60 min
A	19 or less	45'360 kg or less	120 min (up to 180)
B & C		120 min / 300 NM (whichever is less)	

All weather operation

SVFR: min vis 1500 m

Low visibility takeoff (LV TO)

- Edge lights only 300
- + Center lights 200
- + multiple RVR 150
- + high intensity light 725
- + CAT3 75

No meteo at destination \rightarrow two destination alternate

Precision approach	DA/H + 200 ft RVR/VIS + 800 m
Non precision approach or circling	MDA/H + 400 ft RVR/VIS + 1500 m

Speed at threshold

$$VAT = V_{SO} \cdot 1.3$$

Aircraft category	VAT kts
A	< 91
B	91 - 120
C	121 - 140
D	141 - 165
E	166 - 210



Circling

Category	MDH ft	Visibility m
A	400	1500
B	500	1600
C	600	2400
D	700	3600

MDH not lower than obstacle clearance height (OCH)

Non-precision approach

Facility	Lowest DH/MDH ft
ILS/MLS/GLS	200
GNSS/SBAS (LPV)	200
GNSS (LNAV)	250
GNSS/Baro-VNAV (LNAV/VNAV)	250
LOC with or without DME	250
SRA (terminating at 1 NM or more)	300
SRA (terminating at 2 NM or more)	350
VOR	300
VOR/DME	250
NDB	350
NDB/DME	300
VDF	350

Planning minima

If weather $\pm 1\text{h}$ of ETA below applicable minima \rightarrow select 2 destination alternate

Precision approach

RVR / visibility in accordance with AIR OPS, Part - CAT

Category	DH ft	RVR m
CAT I	>200	550
CAT II	100-199	300
CAT IIIA	<100	200
CAT IIIB	No DH	75

Category	Decision Height (DH)	Runway Visual Range (RVR)
CAT I	DH 200 ft or higher	RVR not less than 550 m (helicopters 500 m)
CAT II	DH 199 - 100 ft	RVR not less than 300 m
CAT IIIA	DH 99 - 50 ft	RVR not less than 175 m
CAT IIIB	DH 49 - 0 ft	RVR not less than 50 m
CAT IIIC	No DH	Europe 75m (ICAO Sarps: 0 m)

CAT II or CAT III require radio altimeter height call out below 200 ft above aerodrome threshold

planning minima destination alternate with non-precision approach

\rightarrow Non-precision minima (RVR and the ceiling at or above MDH) $+ 1000\text{ m} / 200\text{ft}$

planning minima destination alternate with circling approach

\rightarrow circling visibility, MDH and ceiling for $\text{ETA} \pm 1\text{h}$

MDH referred to RWY THR if 2m (7ft) below aerodrome elevation

Instruments and equipment

SSR in Annex 10

IFR: 2 independent radios

10% number of fuses or 3 of each rating

Emergency lighting for 10 min

Windshield wipers if $> 5700\text{ kg}$

Interphone if $> 15'000\text{ kg} > 14\text{ PAX}$

Monitoring if $> 27'000\text{ kg}$

+ seat belt

No smoking sign if seats not visible from cockpit



Cockpit Voice Recorder

Before 1998: 30 min

> 5700 after 1st April 1998: 2h

record prior to moving under own power until no longer capable of moving

MTOM $> 27'000$ after 2021 record 25h

\hookrightarrow otherwise 2h

Flight Recorder (FDR)

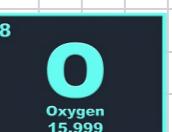
Required in airplane $> 5700\text{kg}$

Retain info for 60 days

Crash axes and crowbar

$< 200\text{ PAX}$, 1 crash axe or crowbar

$> 200\text{ PAX}$, 2 crash axes



Crew protective breathing equipment (PBE)

15 min

2h for aircraft over 25'000ft

Oxygen

First aid oxygen

mass flow to each user: at least 4l STPD/min

1 PAX if cabin alt $> 8000\text{ft}$

Cabin oxygen mask: 110% of seating capacity

Only needed above 25'000ft

Supplemental oxygen for pressurized

Supply for Duration

Flight crew • Entire flight > 10000
• 30 min between 10000 and 13000
1. 30 min not exceeded 25000 ft
2. 2h > 25000 ft

Cabin crew • Entire flight > 13000
• > 30 min between 10000 and 13000

100% PAX Entire flight > 13000

10% PAX > 30 min between

Communication and navigation equipment

RVSM operations

- 2 independent altitude measurement
- 1 altitude control
- An altitude alerting

• Standby artificial horizon power supply for 30 min

Flight Crew

- only 1 inexperienced crew
- IFR or night requires 2 pilots for all turbo-jet and turbo-prop > 9 seats

Conversion, training and checking

- Difference training requires:
 - Variant of type within one class or type rating; knowledge + training

- Familiarization training requires:
 - acquisition of additional knowledge (no training) Same type aircraft or another version

• ZFFT start flying not later than 21 days

- Operator proficiency check: 2 within a year, more than 4 months btw checks
(line check) ↳ valid for 12 months
 - if took place on 15th → valid 31st (last day of the month)

Upgrade to commander

- At least 10 sectors
- Engine failure during take-off
- OEI landing
- OEI go-around and missed approach

• Commander holding a CPL: 700h flight time, including 400h as PIC

CPL

- Single IFR + Night: 50h under IFR + 15h at night
- Cross-country = 10h

Recent experience

• Single pilot IFR: 5 IFR flights, 3 instrument approach, last 90 days

• Combination of recent experience

• 3 TO + 3 LDG day @ IR

• 3 TO + 3 LDG day @ 1 TO + 1 LDG at night

• 3 TO + 3 LDG night

• Personnel records stored for 3 years

• Emergency and safety equipment training every year

- ACAS in turbine airplane
- MCTOM > 5700 or MOPSC > 19

- VFR flight - day - visual landmarks
- 1 radio, 1 transponder

Cabin crew other than flight crew

- > 25 staff → complex organisation
- Promotion to senior cabin crew
 - 1 year experience + senior cabin crew course
- At least 18 years old
- 1 cabin crew per 50 Pax

Flight duty time limitation and rest requirement

Flight duty and limitation

- Total duty period
 - 190h in 28 consecutive days
 - 110 h in 14 days
 - 60 h in 7 days

daily Flight Duty Period (FDP)

- Max 13h
 - +1 basic (twice in 7 days)
 - +2 acclimated to time zone 15h
- (+ 3) 16h with augmented crew

Block time

- 900h in a calendar year
- 1000h in 12 consecutive calendar months

Rest

- Min rest away from home base: 10h
- " at home base: 12h
- Window of circadian low 02:00 - 05:59

Long-range flights

Flight management

MNPS (Minimum Navigation Performance Specification)

- FL 285 - FL 420 → you can plan below if no MNPS
- extends from 27° N to 90° N
- State of operator approve aircraft with 2 LRNS for MNPS
- RVSM between FL 290 - FL 410

Separation in MNPS

Longitudinal

- 5 min (preceding aircraft faster)
- 10 min (same speed) diverging track
- 15 min non-diverging track

Lateral

- 60 NM

Vertical

- 1000 ft (RVSM)

• Failure of INS: notify ATC

• Transponder 2000 after 30 min

Transoceanic and Polar flights

• Near Canada and Magnetic Pole: compass unreliable; basic inertial navigation requires NO special procedure

• VOR in Canada refer to True North

• Air to air communication 123.45 MHz (if 121.5 unavailable)

• Failure from UK to New York: deviate 30° right in direction of next alternate

Defining track

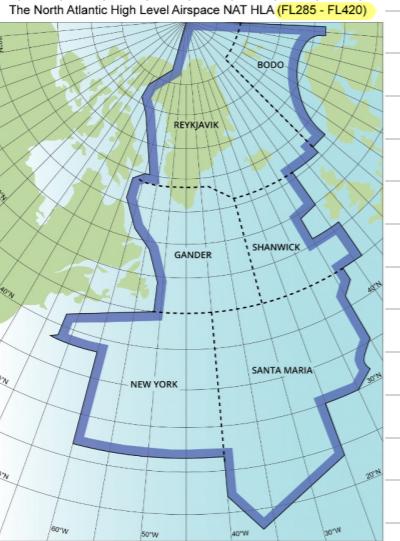
- At interval of 10° of longitude for flights south of 70° N
- " 20° " north of 70° N

• Minimum time track → determined with wind condition
→ calculated from departure to destination

• Polar track: 6 μT

NAT region North Atlantic operation and airspace manual

- Regulated by ICAO doc 7030
- Fly IFR > FL60 or 2000 ft AGL
- Failure of LRNS → climb/descend 500ft

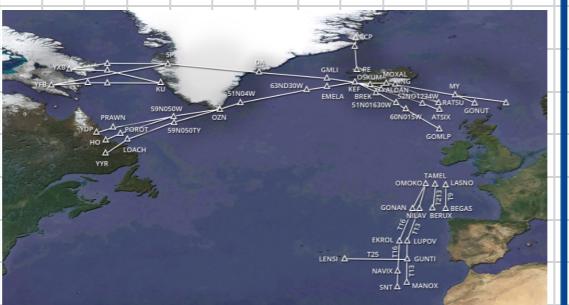


Organised Track System (OTS)

- Check on SELCAL: at or prior entering airspace
 - Westbound Daytime 1130 to 1900 UTC at 30°W
 - Eastbound Nightime 0100 to 0800 UTC at 30°W
 - SOTAs: Shannon Control; NOTAs: Shannon Control
- ↳ is NAT HLA, hence instrument requirement like in NAT

Northern Europe and Spain/Canaries/Lisbon FIR

- T9, T14 and T16 routes are North-South
- 1 LNRS: T9
- 2 LNRS: T13, T16 (not part of OTS)
- HF with Santa Maria, Shanwick, Bodø and Iceland radio
- Transponder → 2000



Oceanic ATC clearance

- boundary window tolerance (estimate oceanic entry): 3 min
- Oceanic clearance to be requested at least 40 minutes prior to Oceanic entry point ETA

PBCS (Performance-Based Comms and surveillance) routes requirement:

- ADS-C and CPDLC

Lateral navigation requirement:

- State of Registry grants RNP 10 and RNP 4

Deviation around severe weather

- Deviation > 5 NM north of track: descend 300 ft
- Deviation > 5 NM south of track: climb 300 ft

North American Routes (NARs): routes between NAT oceanic and North American domestic airspace

Minimum communication equipment: HF 2.8 to 18 MHz 24 frequencies

Strategic Lateral Offset Procedure (SLOP)

- Three position can be flown
- Centre line
 - 1 NM right
 - 2 NM right
 - never left

Extended range operation with two engine airplane (ETOPS)

Precision approach	DH/A + 200 ft RVR/VIS + 800 m
Non-precision approach or circling approach	MDH/A + 400 ft RVR/VIS + 1500 m

- Prior to ETOPS → operator ensure 1 ETOPS route alternate available or diversion time based on MEL
 - Max allowable time flying with OEI in OM or MEL

- Non-ETOPS → only follows routes 1h OEI

Special Operational Procedures and Hazards

Operation Manual

Part A:

- Fuel policy
- Policies and procedures
- Dangerous goods
- TCAS and ACAS
- Use of HEC

Part C:

- Routes, aerodrome and operating site
- Store OFP for 3 month
- Amended MEL submission 3 month (90 days)
- Mass and balance stored for 3 month
- Dangerous good documentation 3 month
- Store technical log 36 month

Journey log: log aircraft operation, crew names and duty assignment

25° bank angle or 3/s; whichever is lesser

- If one autopilot fails → RNP AR approaches below 0.3 RNP are forbidden
- If two autopilot fail → RNP AR forbidden
- Can use NMEL if approved by competent authority
 - created by manufacturer and accepted by authority
- MEL created by operator can be more restrictive than MEL
 - used before taxiing
 - after taxiing use abnormal procedures

Icing conditions

Ground de-icing/anti-icing

- De-icing: remove ice
- Anti-icing: prevention of ice
- 1-step de-icing/anti-icing: de-icing and anti-icing at the same time
- 2-step procedure: first de-icing then anti-icing
- Holdover time HOT:
 - estimate time during which de-icing/anti-icing fluid will be effective
 - Starts at the start of anti-icing
 - longest HOT with frost

Clean aircraft concept

- no operation of aircraft if any ice or snow is present on aircraft body
- external check of critical surfaces by commander

De-icing / anti-icing fluids

- Types of de-icing/anti-icing fluids
 - De-icing is applied hot to melt
 - Anti-icing is applied cold
 - Type 1: thin, limited HOT, additional HOT not possible
 - Type 2: thick, longer but limited HOT (can be increased with increased concentration, max HOT if undiluted)
 - Type 3
 - Type 4

- Factors that can reduce the fluid protection time

- Aircraft has to be treated symmetrically

- Requirement for operations in icing conditions
 - procedure found in Operations Manual

Bird strike risk

- IBIS (ICAO Bird Strike Information System)
- Most efficient is broadcasting of recorded distress calls
- Found in AIP section ENR 5.6 (Bird migration areas and route)
- 90% of bird strike happen under 1500ft (500m), 0 - 150m
- In case of bird strike:
 - written report
 - Inform local ATS unit as soon as flight crew workload allows
- Pilot means of prevention
 - ATIS
 - NOTAM
 - report by another crew
- Conditions that attract birds
 - 20 cm long grass (least attractive)
 - A refuse tip (landfill)

Noise abatement

Noise abatement procedure

- Procedure should be the same for all aerodromes for one airplane type
- Safety has priority over noise requirement
- Minimize effect of noises during departure and arrival/approach
- AIP section AD2 (Greek)
- ICAO Doc 8168
- The operator should establish its own NADPs by complying with NADPs published by the authority
- Noise abatement not required when:
 - RWY is contaminated
 - No ILS/VASI guidance
 - Horizontal visibility < 1 NM (1.9 km)
 - Crosswind > 15 kts
 - Tailwind > 5 kts
 - Windshear
 - Adverse weather expected
 - < 500 ft ceiling
 - Aircraft has a failure
- Influence of the flight procedure
 - NADP1
 - Noise protection near departure
 - Power reduction not below 800 ft for departure
 - Reduce thrust at 1000 ft and acceleration at 3000 ft
 - Climb at V2 + 10 to 20 kts until reaching 3000 ft
 - Flaps slats retraction and smooth transition to en-route climb at 3000 ft
 - Pilot has authority to disregard the noise abatement procedure
 - Biggest noise relief
 - NADP2
 - Noise protection to distant areas
 - Flaps slats retraction and power reduction not below 800 ft
 - Smooth transition to en-route speed climb at 3000 ft
- Influence by the pilot
 - Noise abatement procedure should not preclude use of thrust reversers
 - No turns should be required coincident with a reduction of power associated with a noise abatement procedure

Fire and Smoke

Carburetor fire

- Carburetor fire are type specific
- In case of carburetor fire, leave the engine running, if fire continues, do the engine fire in ground check-list/drill
- Engine fire
 - Type specific
 - On ground → Dry cranking
 - Pulling the handle cuts the fuel
 - Twisting the handle fires the extinguisher
 - Piston → turn off fuel
 - Turbojet:
 - close engine thrust
 - Engine H/O cock to off
 - Pulse engine fire warning switch
 - Red light that can't be cancelled
 - Audio warning that can't be cancelled

Fire in the cabin, in the flight compartment and in the cargo compartment

BCF (Halon) extinguishers

- not suitable for reactive metals (potassium, sodium, magnesium, titanium, zirconium, uranium and plutonium), material with oxygen, metal hybrids.
- act as a flame inhibitor by replacing the air's oxygen

Most used in gas turbine engine!

Carbon dioxide (CO₂) extinguishers

- not suitable for reactive metals (potassium, sodium, magnesium, titanium, zirconium, uranium and plutonium), material with oxygen, metal hybrids.

Can be used for:

- Paper fire
- Hydrocarbon fire
- Fabric fire
- Electrical fire
- Wood fire

H₂O extinguisher: can fight carbonaceous materials

Fire classification:

- Class A = All normal things (water, foam, dry powder, CO₂/halon)
- Class B = Beer is liquid (foam, dry powder, CO₂/halon)
- Class C = "C" looks like "G" from Gas (foam, dry powder, CO₂/halon)
- Class D = gold is a metal (dry powder, sand)
- Class E = Electrical (dry powder, CO₂/halon)
- Class F = Fat & Oil (dry powder, halon)



Shut off ventilation airflow in affected compartment

Smoke in the flight crew compartment and in the cabin

- Initial action put on the oxygen mask and goggles
- Electrical smoke: isolate the defective circuit by cutting power off using circuit breaker
- Action in case of overheated brakes
 - Reach maximum temperature up to 30 min after their use
 - Set parking break off with chocks and ventilate brakes
 - Approach wheels from aft and fore
 - In case of fire, you don't want to cool to fast so use dry powder or water spray atomizer
- Carbon
 - Small number of long firm brake application
 - High speed and long braking
 - Best to land in a tailwind (resistant to heat)
- Steel
 - Many small light brake application (prevent temperature build-up)
 - Frequent light taps because brakes limited by heat

Decompression of pressurized cabin

- Max cabin altitude = 8000 ft
- Warning alert = 10'000 ft
- Automatic mask don = 15'000 ft
- Quick donning > 25'000 ft
- 100% oxygen = 32'000 ft
normal position

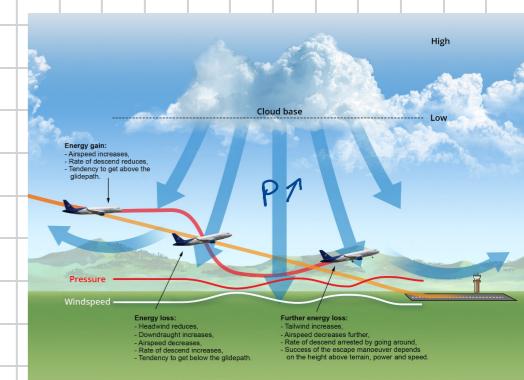
Malfunctioning → change in environmental sound

Explosive decompression → put oxygen mask

TUC 10 sec at 40'000 ft

Wind shear and microburst

- downdraught initial stage same effect as decreasing headwind / loose lift increasing tailwind



Wake turbulence

- Start when nose wheel lifts off
- Greatest wake turbulence: large, heavy, low speed + clean
- Roll toward preceding aircraft + downdraft

Arriving	Opposite
H ⇒ J	2 min
M ⇒ H	2 min
M ⇒ J	3 min
L ⇒ M	3 min
L ⇒ H	3 min
L ⇒ J	4 min
M ⇒ J	4 min

Departing	Departing (intermediate)
H ⇒ J	2 min
L ⇒ H	2 min
M ⇒ H	2 min
L ⇒ M	2 min
L ⇒ J	3 min
M ⇒ J	3 min

Security (unlawful event)

- Contracting State provide ICAO with information
- Security restricted area: btw screening checkpoint and aircraft + airside catering and cleaning
- CRM training before unsupervised line training
- Last bag on carousel → unidentified baggage (with or without tag)
- Notify: State of registry of aircraft, State of Operator, ICAO

Fly ± 500 ft in 1000ft
± 1000ft in 2000ft

ICAO Annex 17

- Operator security search procedure:
 - Aircraft special checklist
 - Action if discover bomb
 - Removal of bomb
 - Sabotage procedure

Emergency and precautionary landing, and ditching

Emergency landing

- Forest: Flaps down, gear down, aim for low trees
- Evacuate in 90 sec

Ditching

- Gear up, nose up + max flaps

Fuel jettison

- 4-engine must meet 2.7% climb gradient OEI and 3.2% in landing config
- 15 min
- Straight line at high altitude
- Above 1800 m / 6000 ft ASL

Transport of Dangerous Goods

- Annex 18 and Doc 9284
- air operator certificate
- Dry ice
 - PAX and Cabin crew allowed to carry dry ice
 - PAX ice subject to restrictions (as opposed to catering)
- UN number is 4 digits
- must report within 72h
- Radioactive
 - Safety of: Aircraft / Ground staff / General public (not flight crew)
- Digit is the hazard class

* technical instruction

- Keep acceptance checklist for 3 month



Contaminated Runways

Hydroplaning

Start when water height equal tire groove depth

Calculating hydroplaning speed

Dynamic (rotating)

$$V = 24 \cdot \sqrt{P \text{ [bar]}}$$

$$V = 9 \cdot \sqrt{P \text{ [PSI]}}$$

Static non-rotate

$$V = 7.7 \cdot \sqrt{P \text{ [PSI]}}$$

Viscous hydroplaning

→ when runway smooth and dirty

Snow TAM

- Uncleared part reported in plain language at item T
- Less than published → four figure group added to item D, gives length in meters
- Slush = 6
- Validity 8h
- Braking information (H) on each third of the runway

Coefficient	Surface friction
> 0.40	Good brake 5
0.39 - 0.36	Medium / Good brake 4
0.35 - 0.30	Medium brake 3
0.29 - 0.26	Medium/ poor brake 2
0.25 and below	Poor
9	Unreliable