# Operations

Aircraft Legislation is divided into several major areas:
First is Civil vs State. State is any aircraft used by the state's military, police, customs etc.

Civil can be further broken down to commercial and private (or general aviation). If a pilot is paid then it is commercial work
.
Commercial – Scheduled Air Transport – Mainly passengers and cargo. Regular Service.
Air Work – Other work – e.g. crop dusting.
General Aviation is everything else.

ICAO was established at the Chicago convention in 1944. It is a specialised UN organisation dealing with aviation, with 190 member states. Its purpose is to make flying safe, orderly and economical. It produces and updates sets of standardised regulations. There are currently 19 such annexes.

There are 3 relevant to OPS – 6 – Aircraft Operation, 17 – Security, 18 – Dangerous goods.
All published documents have a document number.

ICAO also produces standards and recommended practices (SARPs). Standards must be followed by all member states (by including them in their law). Recommended standards are advised but not required.

Differences – National authorities must adopt the laws laid down by ICAO as a minimum. However, they may make them more stringent. These differences are laid down in the AIP and filed with ICAO (filing a difference).

National Civil Aviation Authorities – Each state also has its own aviation authority to manage differences and apply ICAO law.

JAA - 1st attempt at European standardisation through JAR-OPS.
EASA – Superseded JAA in 2008. Can set laws in member states (has legal authority). States can no longer create legislation alone. Laid down in EU-OPS, and covers commercial air transport.

EASA is the only authority that can certify new aircraft (states cannot). Even non European aircraft must get EASA certification to fly in Europe.
CS 25 – Large Aircraft (>/=10 seats, >4700kg). CS 23 – Small Aircraft.

Dangerous Goods – Materials that are capable of posing a risk to the health and safety of property or the environment when transported by air. Covered by annex 18.

Accident due to dangerous goods – transport of dangerous goods which results in fatal or serious (greater than 48 hours hospitalisation, fracture (not including digits or nose), burns >5%, internal injury) injury, or major property damage.

Incident – Occurrence that seriously jeopardises the safety of an aircraft or its occupants.

Any incident or accident must be investigated. File a report within 72 hours with local authority and your authority.

Undeclared / Misdeclared by passenger – report within 72 hours.

Technical Instructions – Dangerous goods list as part of annex 18 (Doc 9284) – Technical Instructions for the Carriage of Dangerous Goods by Air. Describes quantities, packaging, packing etc.

UN Number – Unique identifier for each listed dangerous good. Allows quick identification. In an emergency the UN number should be given to ATC.

IATA Dangerous Goods Manual – Working document that deals with dangerous goods. Contains UN Numbers (Blue section) and Packing instructions (Yellow section).

Drill Code – Given in the manual. This gives instructions on how to deal with spillages and emergencies. This takes into account its properties and assigns it a class that tells you how to deal with it. This can be found in the ICAO red book.

ICAO Red Book – Emergency Response Guide.
ICAO Blue Book – Cabin crew procedures.

Goods must be correctly packed and clearly labelled. All individuals involved must also be trained. For flight crew this is initial training and 24 monthly re-checks.

Permitted dangerous goods – Can be carried by operator (technical equipment), carried by passengers, or goods.

Include – Dry Ice, Sporting Ammo, Electric wheelchairs, vented fuel canisters, mercury thermometer/barometer, medical oxygen, life jackets (with inflatable cannisters), avalanche rescue packs (with pyrotechnic triggers), medicines, toiletries, non-flammable aerosols, gas operated limbs, pacemakers, safety matches, safety lighter, alcoholic drinks.

Can only be carried by permanently approved operators.

Captain must be informed via a NOTOC (Notice Of Carriage). This contains UN number and Shipping name, hazard class, number, location, radioactive category and transport index.

Packaging must be as per regulations.
Must be packed correctly.
Correct labelling and documentation.
Special labels for liquids and magnetic materials (must be away from compass).
“For Cargo Aircraft Only” - Cannot be carried on passenger flights. Must be accessible in flight.
Incompatible goods must be kept in separate holds.
Explosives must be segregated.
Spillable goods – Properly packaged. Must have ullage to allow for expansion with low pressure.
Forbidden goods – too dangerous to be carried by aircraft. e.g. unstable explosives, dangerously corrosive materials.

Classification:
1 = Explosives; 2 = Gases; 3 = Flammable Liquids; 4 = Flammable Solids;
5 = Oxidisers and Peroxides; 6 = Toxic or Infectious; 7 = Radioactive;
8 = Corrosive; 9 = Miscellaneous.

Also have sub categories dependant on other properties.

Radioactive materials must be carried in “freight containers” in a specialised aircraft.

EASA standards for operators are laid down in EU-OPS. An operator must be approved by the national authority who follow EU-OPS with the issue of an air operators certificate (AOC).

To get an AOC must fulfil several requirements:

The premises, records, equipment and personnel must be inspected by the authority.

Must have defined compliant operating procedures in place, covering all aspects of operation.

Procedures must be described in the operations manual. Failure to follow this is illegal.

A certain company structure is required. There must be an accountable manager (usually MD) who has overall responsibility for operations and finance. There are 4 other roles that must be assigned. These are head of flight operations, head of maintenance, head of crew training and head of ground operations. One person can hold more than one post, within limits.

Operators responsibilities – All procedures must be followed by employees. Crew members must be able to communicate in a common language, and understand the language used in the operations manual (which is English unless otherwise authorised). A quality system must be in place to maintain and improve standards. There must also be an accident prevention and flight safety programme in place (trend monitoring, incident analysis, ASR reporting).

Maintenance – procedures must be approved. Can use your own existing maintenance or outsource, in either case the organisation performing the maintenance must have part 145 approval. They will be regularly inspected. Aircraft must maintain a valid CoA.

When all of this is satisfied, an AOC is issued. Regular re-inspections are required to retain the AOC.

AOC certificate specifies – Name and place of business of the operator; date of issue and validity; description of the types of operations authorised (e.g. cargo or passenger); type and registration markings of aircraft authorised for use; authorised areas for operations; special limitations and operations (e.g. ETOPS, CAT III).

Operations Manual:

Part A – General / basic – generic information and all non type related operational policies, instruction and procedure. e.g. fuel policy, hiring requirements.

Part B – Type specific – information for that particular aircraft type. Includes SOPs, limitations, QRH and MELs.

Part C – Route and aerodrome instructions and information – relating to airfields, e.g. categories and detailed briefings.

Part D – Training, e.g. syllabus exams etc.

All employees must have access to the parts of the manual relevant to their role. All flight crew members must have personal copies of parts A and B.

Quality system – must have monitoring in use, and a feedback system (just culture).

Flight safety programme – to establish risk awareness for all personnel. Use an occurrence reporting scheme (air safety report). For >27,000kg MTOM flight data monitoring is used. Should establish corrective actions based on the gathered data.

Safety Definitions:

Incident – occurrence other than an accident that affects or could affect operational safety.

Serious incident – near accident.

Accident – serious injury or fatality inside the aircraft or in contract with parts (even detached), or directly due to jet blast. Can also be major structural damage or aircraft missing/completely inaccessible (e.g. sunk).

The commander must submit a report to the authority for incidents and accidents within 72 hours, usually via an ASR or MOR. Also inform ATC at the time of bird strikes, TCAS RA, dangerous goods spillage, poor ATC or hazardous conditions. AIRPROX – special report for traffic proximity.

Defect reporting – must be reported in aircraft technical log. If a serious defect (e.g. 787 battery fires) then the operator must inform the organisation responsible for design (or the supplier) and the relevant authority.

Aircraft leasing may be done to avoid buying aircraft outright, in periods of rapid expansion, busy seasons or for unscheduled serviceability failures. May be leased from a specialised leasing company, or from another operator with an AOC.

Lessee – person or company which is given use of the aircraft.
Lessor – person or company providing the aircraft.
Dry lease – aircraft without crew, operated under AOC of the lessee.
Wet lease – aircraft with crew, operated under AOC of the lessor.

Community operator – company established within the EU.
Non community operator – company established outside the EU.

Dry lease in – any community operator can dry lease in an aircraft from another community operator. If from a non community operator then more stringent checks are required and approval must be given by the national authority.

Aircraft instruments and equipment:

Mostly complies with ICAO standards. EU-OPS is at least up to ICAO or more stringent, and operators must comply. Some items do not require EU-OPS approval (fuel, torches, time piece, first aid kit). Everything else is approved in accordance with European technical standards orders (ETSO).

Master minimum equipment list (MMEL) – list established by the manufacturer for a particular aircraft type and approved by the state of design. Specifies items allowed to be unserviceable at the start of the flight.

Minimum equipment list (MEL) – approved by the local authority. Consists of an MMEL adapted for the optional extras chosen by that airline. In the case of a failure before flight, the commander must consult and comply with the MEL. May give operational restrictions, allowed durations and no dispatch items.

Required general equipment:

Windscreen wipers or equivalent – required if more than 5700kg weight.

Anti-collision lights – illuminated prior to start up and movement.

Illumination of instruments, equipment and the passenger compartment.

An electric torch for each crew member, accessible from their seat.

At night:
Navigation / position lights – red and green covering 110 degrees each, white covering 70 degrees each side of the tail (140 degrees total).
2 separate landing lights, or one with 2 separate filaments.

Circuit protection devices – must carry spare fuses – 10% or at least 3 of each rating.

Minimum flight equipment (day VFR):

- Magnetic compass, pressure altimeter, ASI, VSI, turn and slip, attitude indicator, stabilised DI (basic flight instruments).
- Clock and OAT gauge.
- Headset with microphone for each flight crew member.
- If there are 2 pilots then the co-pilot must have duplicates off all instruments EXCEPT clock and magnetic compass.
- If more than 5700kg, more than 9 passengers of CoA issued after 1st April 1999 then must have a heated pitot system.

Night and IFR, in addition require:

- 2 altimeters.
- Heated pitot with failure warning.
- 2 independent static pressure systems (large a/c usually have 3).
- Chart holder.
- PTT on control wheel.
- Mach meter if required.
- Standby attitude indicator for class A usable from either pilot station with 30 minutes independent power.

IFR single pilot – require an autopilot with at least altitude and heading hold.

Altitude alerting system – class A turboprops and all turbojets. Aural alert when deviating or approaching selected altitude.

GPWS/TAWS – Class a aircraft. Needs at least terrain and configuration warnings.

ACAS 2 / TCAS 2 – MTOM >5700kg and >19 PAX seats. Need TA and RA.

Radio altimeter – MTOM >27,000 kg.

Weather radar – all pressurised aircraft, and all unpressurised class A aircraft.

Operations in icing conditions – must be certified and equipped to fly in icing. Must be able to be light icing surfaces at night time and in IMC.

Interphone - >15000kg, >19 passengers then must have crew member interphone. Multi crew aircraft must have a flight crew interphone system including headsets and microphones. This must be independent of the cabin PA system. Must provide 2 way communications (including between ground crew and flight crew), readily usable and have a way to distinguish between normal and emergency calls. A visual / aural alerting system must be employed.

Public address system – >19 PAX. Clearly audible in the cabin including in the toilets.

CVR – MTOM > 5700 kg – 2 hours, Multi engine turbine < 5700kg 30 minutes. Any aircraft before 1998 – 30 minutes.

FDR – stored at rear, durable, water and fire resistant, ELT fitted. 25 hours unless NOT a ME turbine and less than 5700kg or before 1998, in which case it is 10 hours.

Seat belts and harnesses – seat required for everyone aged 2 and above. Infants are required to use a child restraint device. Shoulder harnesses for crew. Must be worn when fasten seat belt sign illuminated.

Internal doors – all >19 passenger seat aircraft must have a door between the PAX compartment and the flight deck with a crew only placard. This door must be lockable to prevent entry without permission.

There must be a means of opening each door or curtain that separates a compartment from an emergency exit. This must also be able to be secured in the open position for take off and landing.

First aid kits – inspected and replenished regularly, easily accessible. Must have bandages, compresses, antiseptic swabs, splints, tape and scissors
0-99 PAX = 1; 100-199 = 2; 200-299 = 3; 300+ = 4.

Emergency medical kit - >30 seats or routing more than 60 minutes flying time from qualified medical assistance. Commander must authorise use by qualified personnel. Must include a stethoscope, BP cuff, airways, GTN, dextrose, epinepherine, diphenydramine HCL (antihistamine), needles, gloves.

First aid oxygen – required for pressurised aircraft designed to operate above 25,000ft. To be used for passengers requiring aditional oxygen after cabin depressurisation. Need enough for 2% of PAX or at least 2 units. 2L/min low, 4l/min high.

Flight crew oxygen – aircraft designed to fly >25,000ft. Must be in immediate reach and have a quick donning mask.
<25,000ft – enough to descend from max certified altitude to 10,000ft in 10 minutes and stay there for 30 minutes.
>25,000ft – enough to descend from max certified altitude to 10,000ft in 10 minutes and stay there for 110 minutes.

PAX > 25,000ft oxygen required at every seat. At least 10% extra dispensing units for PAX not at

their seats found in toilets and evenly distributed throughout the cabin. Must last t least 10 minutes. Must have an auto deploy when passing 14,000ft cabin altitude. Run using chemical oxygen generators.

Crew protective breathing equipment - >5700kg, >19 PAX. Protect eyes, nose and mouth, and provide oxygen for not less than 15 minutes. Usually a closed loop breathing system with chemical oxygen. Must have one for each flight crew member on deck duty, and for cabin crew. Need to be easily accessible next to cabin crew stations. Also located next to hand fire extinguishers. Where the extinguisher is in another compartment (e.g. cargo aircraft), the smoke hood should be just outide the entrance.

| PAX | 7-30 | 31-60 | 61-200 | 201-300 | 301-400 | 401-500 | 501-600 | 600+ |
|---|---|---|---|---|---|---|---|---|
| Extinguishers | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |

Plus at least one on the flight deck. All halon.

Crash axes and crow bars - >5700kg, >9 PAX. At least one on light deck. If >200 seats then additional one in rearmost galley (hidden from PAX).

Break in points – red on light pain, yellow on dark. If >2m then connected with dashed lines. Easy points for rescue services to break into the fuselage.

Evacuation chutes/slides – required if exit more than 1.83m (6ft) above the ground with gear down or with the collapse of any of the gear. Ropes for flight crew in high cockpits.

Megaphones – 66-99 = 1, 100+ = 2. Used in PA failure, for crowd control, and have a siren.

Emergency lighting - >9 PAX powered from independent source.
>19 PAX must include source of general illumination. Must have internal floor lighting leading to an emergency exit, which is marked with lighted exit and direction signs. At night exterior lighting is required at all overwing exits, and at exits where there is equipment required to assist the descent.

Automatic emergency locator – 121.5MHz or 406 MHz. Accurate to 2km. 48 hour battery. Activated by water or by a g force. After 1 Jul 08 – 19 or fewer then need 1 automatic ELT, more than 19 require 2 ELTs one of which must be automatic. Before 1 Jul 08, 19 or fewer require any ELT, more than 19 requires 1 automatic or 2 normal ELTs.

Life jackets – required when flying >50nm from the coast, or when take off or approach is over a significant body of water.

Life raft – 120 minutes at cruise or 400nm, whichever is least if the aircraft can continue with 1 engine inoperative. Must be enough for all passengers. At leas 2 ELTs on the aircraft.

Radio and navigation equipment – suitable for routes flown. Easily usable from crew station, must be able to transmit on 121.5MHz. If 2 systems required must have independent antennae. For IFR need a selector panel.

VFR flight – must have equipment to allow ground communications, capable of receiving met info.

IFR – 2 independent radios, mode C SSR, VOR and DME (ADF and marker beacons if required). Flight in MNPS (minimum navigational performance airspace)is not approved unless aircraft is

equipped with navigation equipment meeting the requirements that is usable by either pilot. Minimum of 2 long range navigation systems (LRNS) required for unrestricted MNPS operations. Along special routes you only require one.

RVSM airspace – 2 independent altimeters, altitude alerting system, automatic altitude control, mode C SSR.

Seaplanes and amphibians – cannot operate at sea unless fitted with a sea anchor and mooring equipment. Also need equipment to make maritime sounds.

Operation of commercial aircraft is laid down in EU-OPS 1, and in commission regulations no 955/2012.

Annexes: 1 – definitions; 2 – authority requirements; 3 – operator requirements;
4- commercial air transport operations (PART-CAT); 5 – specific approvals (PART-SPA).

National authorities are responsible for ensuring compliance.

Carriage of persons:
No person shall be carried in any part of the aircraft that is not designed for PAX carriage. The commander can grant temporary access (e.g. for checking cargo compartment on cargo aircraft).

Persons with reduced mobility (PRMs) – operator must establish procedures. Must not be seated anywhere where they may impede crew or obstruct access in an emergency. Commander must be notified.

Departures / persons in custody – must have procedures to ensure the safety of the aircraft and its occupants. Commander must be notified.

Baggage – only hand baggage that can be securely stowed is allowed in the cabin. Checked before OT and landing, and when fasten seatbelts sign illuminated. Under seat storage only allowed if there is a restraining bar.

Crew responsibilities:

Each crew member is responsible for executing their duties relating to safety. The commander must also be informed of any defects or deficiencies.

Must not perform duties if – under the influence of any drug, following deep sea diving (unless suitable time gap), following blood donation, if unwell or if suspected of fatigue.

No alcohol within 8 hours of duty report time or standby. Blood alcohol limit 0.2 promille. No alcohol on duty.

Commander – responsible for piloting, conduct of flight. When cruise / heavy crew employed then may take rest, but remains the legal commander. Responsible for the safety of crew, passengers and cargo on board from the time she arrives to the time to the time she leaves. Has the authority to disembark any person or cargo if a potential safety hazard exists. Can also refuse transport.
Must ensure all PAX are given the emergency briefing. Ensures all SOPs and checklists are

complied with. Must not allow carriage under the influence of drugs / alcohol if they will pose a risk to safety.

Must not delete or disable CVR or FDR in flight. Ensures pre flight inspections carried out. Decides whether or not to accept any unserviceable items in the CDL or MEL.

In an emergency the commander can deviate from any rules for safety reasons.

Admission to flight deck – only flight crew members assigned to the flight, operating crew members, representatives of authorities or if authorised according to the operations manual.

Crew members at stations – mandatory during TO and landing. At least 1 pilot at controls at all times. Cabin crew must be seated at assigned stations at critical phases.

Safety belts and harnesses must be worn at TO and landing, and whenever deemed necessary. Flight crew must keep safety belt fastened.

Documentation carried – CoA, CoR, noise certificate (including English copy), AOC copy, radio licence, 3rd party liability insurance, flight crew licences.

Manuals – relevant parts of A and B easily accessible.

Info/Forms carried – operational flight pan, tech log, NOTAM/AIS/Met, load sheet, notice of special categories of passengers, NOTOC, current maps and charts, other documentation required by the state (e.g. general declaration forms).

Retained on ground – flight plan copy, relevant parts of tech log, load sheets, special loads notification, company NOTAMs.

Production of documentation to authority within 10 days.

CVR and FDR can only be looked at with permission or after an incident / accident.

Journey logs – crew, registration, date, dep/arr, times, nature, incidents/observations, commanders signature.

Tech log – information about each flight for safety, current certificates of release, current maintenance schedule, outstanding deferred defects.

Icing:

Requires liquid water and air temperature or airframe temperature less than 0c.

Icing is most dangerous on the upper surfaces of the wings, on both sides of the horizontal/vertical stabilisers, primary control surfaces, pitot static, engine intakes, props, fans and windscreens.

Issues – Reduced thrust (engine icing), weight decreases performance. frost on the upper surface can reduce lift by 30% and increase drag by 40%. $V_S$ is reduced by 5% and critical AoA by 3 degrees. Asymmetric icing is particularly dangerous as it can lead to uncommanded roll/pitch

deviations. Elevator effectiveness is reduced, and controls may jam. Erroneous sensor information may occur. Ice can also cause direct impact damage, either as hail or by breaking off.

Some aircraft have icing vanes. These vibrate, and when ice forms on them the frequency of vibration is changed. This then triggers an alert.

Any flight that is made in known icing conditions is subject to limitations, found in part B of the operations manual. The commander must not intentionally fly into icing conditions unless the aircraft is certified to do so. At night, there must be a means of illuminating icing surfaces or otherwise detecting ice formation.

Clean aircraft concept – all control surfaces must be completely free of ice before take off. Some frost may be allowed on the underside of the wing as long as no more than 3mm. Hoar frost is acceptable on the upper fuselage (not wing upper surface) up to 3mm, and must not obscure the markings. All other areas must be completely free of contamination.

Hoar frost is formed when a sub zero surface comes into contact with moist air. Sublimation occurs directly to ice. This may occur when parked, when descending into warm air or when climbing through an inversion. You should also avoid landing with full tanks as the cold fuel causes icing on the top of the wings.

Decision is ultimately down to the commander. There are 3 times when others also have responsibility:

- Pre flight inspection.
- De icing / anti icing procedures.
- Post de/anti icing checks.

De icing -process of removing frozen water from the aircraft's surfaces. May be via heated fluid, pneumatic or mechanical.

Anti icing protects a clean surface from becoming contaminated for a limited period.

Holdover time – The effective time of the fluid. Begins when final application of anti icing fluids commences. Varies depending on the meteorological conditions and the type/dilatation of the fluids. It is assumed that conditions are moderate. The fluid manufacturer produces a table of times, and there is also a generic table from the association of european airlines (AEA).

De icing fluids come in 4 types. All are glycol based:

Type 1 – Thin fluid used mainly for de icing. Relatively short holdover time due to rapid fluid failure. Clear or orange coloured.

Type 2 – Thickened fluids. Used for de icing and anti icing. Straw coloured.

Type 3 – Between 2 and 4. Moderate holdover. Designed for aircraft with low rotation speeds. No assigned colour.

Type 4 – Advanced thickening with a high holdover time. Requires a relatively high airspeed to remove. Green.

All fluids can be diluted with water. This reduces their effectiveness.
Pre step process removes the bulk of accumulated contamination mechanically before de icing.

One step process – carried out with heated anti icing fluid used both to de ice and anti ice the aircraft.

2 step - 1st step is de icing. 2nd step is anti icing. Anti icing should commence no more than 3 minutes from de icing completion. Timing of holdover begins at the start of the 2nd step.

Limitations – each fluid is restricted by a lowest operational use temperature (LOUT). If the holdover time is exceeded, the aircraft must first be cleaned before another coat of fluid is applied. The fluid itself can lead to accumulation of residue with repeated use. This can cause control restrictions. Type 4 is worst for this, as it is thickest.

Following de/anti icing, the pilot in command is given information as to:

- The fluid type and brand name.
- Fluid dilution ratio.
- Start time of holdover.
- Confirmation that the aircraft is clean.

Before take off, the aircraft must be ensured to be clean. The pre take off checks ensure that the critical surfaces are clear, and are done visually as close to takeoff as possible. The commander is responsible.

Fluid failure – precipitation (especially wet snow) can dilute the fluid. The fluid may freeze, become cloudy/opaque/milky, lose its gloss, become viscous or crystallise. If this is suspected, return for washing and re-application.

Cabin Crew:

Cabin crew are responsible for passenger safety. They must ensure all emergency equipment is in working order and be able to use it. They must also explain and demonstrate relevant safety procedures and equipment to passengers.

Cabin crew are required to wear a uniform for easy identification. Cabin crew must be assigned to aircraft with more than 19 PAX seats, and there must be at least 1 for every 50 passenger seats (or fraction of 50) on each deck. In unforeseen circumstances, you may fly with less than the required number, provided a suitable number of passengers are offloaded (or less are booked).

Minimum qualification requirements:

- 18 years old.
- Regular medical exam.
- Initial training completed and hold safety certificate.
- Completed appropriate conversion and/or differences training for variants.
- Undergo recurrent training.
- Must perform duties as per SOPs.

Senior cabin crew members – required whenever more than one cabin crew member. Responsible to commander for safety/emergency procedures. 1 year experience and passed a training course. Single crew training – has to focus on extra areas. Responsible to the commander. Areas include – how to manage unruly PAX, operator/legal requirements, documentation handling. Must have 20

hours and 15 sectors of familiarisation time.

Only allowed to operate on 3 aircraft types at a time. Exceptionally this may be increased to 4.

Flight duty times:

Set to prevent chronic fatigue and to ensure sufficient sleep and rest. The operator may be more lenient in their timetable (more restrictive on the company).

Operator – nominates a home base for each crew member. Must publish duty rotas sufficiently in advance to allow crew members to plan adequate rest.

Block time – from starting moving off blocks to coming to rest on stand.

Duty – Any task a crew member is required to carry out. Includes training and paperwork.

Flight duty period – from required report time for a flight until the on blocks time of the final flight of the duty day.

Home base – nominated by the operator. Where the crew member always starts and ends the duty period or series of duty periods. Normally, the operator is not responsible for providing accommodation here.

Local day – a 24 hour period commencing at 00:00 local.

Local night – period of 8 hours falling between 22:00 and 08:00.

A single day free of duty shall include 2 local nights.

Positioning – transfer from place to place of non operating crew at the operators request. Excludes travelling time.

Travelling time – time frame from home to reporting place or vice versa. Also the time from local place of rest when away from base.

Night duty – any duty containing a time between 02:00 and 04:59.

Rest period – must be free from all duties and standby, uninterrupted.

Standby – a period when crew are required to be available for duty without intervening rest.

Cumulative duty hours – 190 duty hours in any 28 consecutive days; 60 hours in 7 consecutive days.

Block time – 900 hours in one calendar year. 100 hours in 28 days.

Maximum daily flight duty period – 13 hours, reduced by 30 minutes to minimum of 11 hours for every sector over 2.

Maximum daily duty can be extended by up to 1 hour except for a basic FDP of 6 or more sectors. Maximum 2 extensions in 7 days.

Any time spent positioning counts towards duty hours.

Minimum proceeding rest period is at least as long as the duty period, or 12 hours (whichever is greater). Starting away from home, this shall be at least as long as the duty, or 10 hours.

Unforeseen circumstances in flight – limits on flight duty and rest may be modified in the event of unforeseen circumstances. Maximum FDP may be increased by up to 2 hours, unless prior to the final sector, in which case it may be increased by 3.

On the final sector, once you have taken off, you can extend the period to continue to the planned destination (don't need to divert) or alternate. Commander must report discretion to the operator.

Airport standby – counts as duty hours. Still require rest. Operator must provide a quiet and comfortable non public area to rest.

Nutrition – need to have the opportunity to get a drink and meal (not necessarily provided) when FDP exceeds 6 hours.

All duty must be recorded by the operator, with copies available on request to the crew. The crew must present records on request to any operator who employs his services before he commences a flight duty period.

Flight Crew:

Training is split into 3 stages, specified in part D of the operations manual.

Initial – Human factors (if have not previously completed a HPL course), CRM (often combined with, or done after, the HPL course).

Conversion:
Ground training – aircraft systems and procedures.

CRM sim work.

Emergency training – must be completed before spending any time on the actual aircraft.

Operator proficiency check (OPC) – Done in a full flight simulator or in the aircraft. Tests for competence in both normal and abnormal procedures. Must complete at least – 1 RTO on the sim or a touch drill in the actual aircraft; engine failure between $V_1$ and $V_2$; Engine out precision approach to minimums; Non precision approach to minimums; missed approach at minimums with one engine out; landing with an engine out OR forced landing if single engine. The OPC is valid for 6 months, however you can take it from 3 months until refresh, and an extra 6 months is then added to the original date (therefore can theoretically be 9 months between completing).

Line proficiency check (LPC) – On the aircraft or in the sim with a suitably qualified commander (operator selected, authority approved). Must complete a full sector including pre and post flight.

Must be done for both PF and PNF duties. Valid for 12 months.

Recurrent:

Annually – systems and procedures refreshers; review of incidents and accidents; aircraft and sim training (engine out, combined with OPC); emergency and safety (life jacket, breathing equipment, extinguishers); equipment locations; exits; security.

Tri-annual – Exits training; slide training; fire fighting; smoke; pyrotechnics; life rafts; CRM.

Route and aerodrome competence – routes, destinations and alternates. Valid for 12 months plus the remainder of the qualification month and the month of latest operation.

Other – dangerous goods (24 months), all weather operations.

Recency – 3 TO and landings in 90 days as PF in the aircraft or the sim. If no IR qualification then cannot be commander if you have not completed 1 night landing in 90 days. Recency can be extended to 120 days if flying under the supervision of a type rating instructor/examiner. Outside this you must re-qualify (training flight or sim).

Additional training is required for a new variant of the same type (e.g. 737-800 vs 737-300).
Familiarisation – knowledge based – when very similar handling and equipment.
Differences – significant differences in handling. Sim or aircraft training required.

Operation on more than one type / variant – must be deemed competent to do so. Operator must assess whether the differences justify the operations. Must still comply with all the requirements for each type, unless the authority gives approved credits (e.g. for dangerous goods and CRM). There should be minimum experience requirement, based on overall and type time. Procedures must be put in place for qualifying. Recency must be maintained on each type. When operating helicopters and fixed wing, you can only hold 1 type of each.

There must be suitable training and checking if operating in either seat (e.g. training captain).

Composition of the crew:

IFR/night – at least 2 pilots required if a turboprop with 9 or more seats, or any turbojet.

Single pilot (not operating under the above conditions) – must undergo a training programme, must have 50h IFR, 10h as commander, all on type. 5 IFR flights and 3 instrument approaches in last 90 days, or and instrument approach check. If does not fulfil this then 2 pilots are required.

In flight relief / heavy crew – FO may be relieved by a suitably qualified (CPL/IR, type rating, training current but not necessarily recent experience (sim every 90 days if not)) once at or above FL200. This person is the 3$^{rd}$ officer. The captain can hand over flying duties to 3$^{rd}$ officer once over FL200, but can only hand over command to another qualified commander.

Commander – must have suitable experience (as designated by the authority. Must then attend a command course – sim/flight training, OPC as commander, instruction on responsibilities, 10

sectors observed flight training, check and route competence, CRM.

CPL – cannot command an aircraft for single pilot operations unless:
VFR >50 nm from base – at least 500h, holds IR.
Multi engine under IFR – 700h total, 400h PIC, 100h IFR. PIC time can be substituted 2:1 with co pilot time.
If there is a potential for multi pilot operations then the potential commander must complete a command course.

Training records must be kept and available to crew members.

Planning:

ETOPS – requires – suitable aircraft with required equipment and fulfilling maintenance requirements; crew with suitable experience and ETOPS training; planning including weather, alternates fuel etc.

Governed by ICAO annex 6 part 1 and EU OPS part CAT.OP.MFA 150. Fuel policy.

Departure / take off alternate – an alternate where the aircraft can land if weather or performance reasons prevent a return to the departure airport.

En route alternate – adequate aerodrome along the route where the aircraft can land after experiencing abnormal or emergency conditions.

Adequate aerodrome – satisfactory to the operator, taking into account performance, runways and equipment. Must have the required services and equipment (lighting, communications, emergency facilities, navaids, ATSU), and must be fully active at the likely time of diversion.

ETOPS en route alternate – adequate aerodrome which at the expected time of use has an ATS facility and at least 1 instrument approach.

Destination alternate – alternate where aircraft may proceed if impossible/inadvisable to land at the intended destination.

ETOPS – extended operations. For 2 engine aircraft approved by the authority to operate beyond the normal threshold distance from an alternate.

3% en route alternate – selected to allow a reduction in contingency fuel to 3%.

Operator must ensure that - flight plan is completed, limitations complied with, ATS is used for all flights when it is available.

Commander ensures – aircraft serviceability (tech log, configuration deviation list (CDL) checked against MEL), required documentation, charts/maps, ground facilities at destination, fuel/oil/oxygen, MSA, load sheets signed, CG and mass limits, ATC flight plan.

Flight plan – commander / ops / dispatcher forwards to ATS. If unable to submit or to close the plan then must have procedures for alerting SAR with at least the same information as is found in the

VFR flight plan. Must be retained until completion of the flight.

Instrument procedures must always be used when available. The commander may accept ATC clearance to deviate from procedures provided obstacle clearance is maintained.

The operator must specify minima for each departure / destination / alternate. May add an increment onto the authority minima. Minima can be used if – ground equipment serviceable, performance met and crew qualified.

Alternates:

The operator must establish procedures for the selection of alternates.

TO alternate required in not possible to return for meteorological or performance reasons.

Destination alternate must be selected unless – flight time no longer than 6 hours AND 2 separate runways where ceiling is at least 2000ft or circling altitude + 500ft (whichever is greater)and visibility 5 km between ETA -1 and +1.
OR destination is isolated and no adequate alternates exist.

TO alternate – 2 engine – within 1 hour still air distance with 1 engine out OR ETOPS time up to 2 hours (cruise, single engine, still air).

¾ engine – 2 hours at 1 engine out cruise speed or that speed achieved with remaining engines at MCT if no specified speed in AFM.

VFR minima are as they are for air law.

SVFR – 3000m RVT to take off, 1500m once airborne.

Cat A/B aircraft may be operated down to RVR 3000m as long as ETS permits, there is a low chance of traffic encounters and IAS no more than 140kts.

IFR planning minima:

TO alternate – weather at or above minima from ETA -1 to +1. Only need to account for cloud ceiling when only non precision of VM (C) approaches are available.

Destination aerodrome – forecast from ETA -1 to +1. Precision – RVR to minima. Non precision ceiling at minima and RVR at mininima. These restrictions do not apply if you have 2 acceptable destination alternates selected.

Minima for destination alternate, isolated aerodromes and 3% ERA or required en route alternates:

| Approach capability | Minima set to use | Components to use |
|---|---|---|
| ILS CAT 2/3 | ILS CAT 1 | RVR |
| ILS CAT 1 | Non precision | RVR & MDH |
| Non precision | Non precision | RVR + 1000m, MDA +200ft |
| VM (C) | Circling | Visibility minima, MDA. |

ETOPS en route alternates:

Precision – DA + 200 and RVR + 800m.
Non precision – MDA 9 400ft and RVR + 1500m.

Do not take off or continue beyond the point from which a revised flight plan applies unless minima are met. Do not continue if the meteorological reports suggest that at ETA minima will not be met at destination or at least 1 alternate.

VFR – commander must ensure whole route can be flown in VMC.

Operator must establish minimum flight altitudes to give required terrain clearance. Methods must be approved by the authority and take into account – navigation accuracy, altimeter accuracy, terrain characteristics, unfavourable meteorological probability and chart accuracy. Must also consider temperature / pressure variations, ATC requirements and any foreseeable contingencies.

Fuel management:

Commander must ensure regular fuel checks – compare actual consumption with planned consumption, confirm fuel remaining sufficient to complete the flight, calculate expected fuel on arrival at the destination.

On arrival you must have final reserve and alternate fuel, or just final reserve if not alternate.

If the calculated fuel is less than the commander must decide whether they can proceed (perhaps by flying at $V_{MR}$ or requesting the optimum flight level).

If there is no alternate then must divert to land with not less than the final reserve.

If less than final reserve then must declare an emergency.

Isolated aerodrome – must have a last point of diversion. Before reaching this must have enough fuel, adequate weather and have considered traffic and operational conditions.

Fuel policy must take into account – ops manual, manufacturer and current fleet data, operating conditions with realistic fuel consumption, mass, weather, ATC procedures and restrictions. Must have trip fuel, reserves (contingency, alternate, additional (ETOPS), extra) and taxi fuel.

In flight replanning – trip fuel for remainder, reserve fuel made up of contingency, alternate, additional and extra fuel.

When 2 destination alternates are required fuel must be carried to reach the furthest one, and conduct 1 missed approach.

Final reserve – piston 45 minutes, turbine 30 minutes holding 1500ft above the alternate.

Additional fuel – to descend and fly to the alternate after loss of pressure or an engine failure (whichever is more) at the most critical point. The must have enough for 15 minutes holding at 1500ft and to make an approach and landing.

Contingency – greatest or 5 minutes at 1500ft holding, OR 5% trip. This can be reduced to 3% if there are adequate en route alternates. Can instead use 20 minutes of planned consumption (if the aircraft is part of a fuel consumption monitoring scheme) or fuel based on an approved statistical calculation for specific city pair / aircraft combinations.

Reduced contingency – decision point procedure. At this point the commander must decide to proceed to destination 1 (planned) or destination 2 (alternate). Can then just use the contingency from the decision point to the destination.

3% ERA – To take only 3% contingency you must have a 3% en route alternate. ERA must be within a circle of 20% total flight path distance. This must be located 25% of distance, or 20% + 50nm away from the destination, whichever is larger. All distances are in still air.

Performance:

General requirements – under EU common technical requirements must take notice of factors that affect performance. This includes temperature, wind etc. and other expected adverse conditions (including contaminated runways and engine failure in all flight phases).

En route – 2,000ft drift down, 1,000ft stabilised obstacle clearance.

Landing – within 70% of the runway for a turboprop, within 60% for turbines.

Passenger briefings:

Before take off – smoking, seat upright, tray table stowed, emergency exit locations, stowage of hand baggage, escape markings, restricted use of electronics, location of the safety card. Demonstration of safety belts, oxygen and life jackets.

After take off – smoking, keep safety belts on when seated.

Before landing – smoking, seatbelts on, seat upright, tray table stowed, re stowage of baggage, electronics.

After landing – smoking, keep belts on.

Smoking on board – not on the ground, outside designated areas, in cargo compartments without a flame cover, in areas where O2 is being provided.

Persons with reduced mobility (PRMs) should not be seated near emergency exits, as they could block the passage of other passengers.

Refuelling with PAX onboard – Only allowed with JET A1 and AVTUR. Not allowed for AVGAS, JET B, AVTAG. Someone must be in 2 way communications with a crew member or qualified person. This person must be at a specified location and capable of handling an emergency. The seatbelt sign must be off, and passengers instructed to keep belts unfastened. Crew, staff and PAX must be warned. No smoking signs must be illuminated. The required number of cabin crew must be present for an emergency evacuation, and exit areas must be kept clear. In the event of fumes being detected in the cabin, the refuelling must be stopped.

Take off minima – based on visibility or RVR limits. If there is a need to see and avoid obstacles on the climb out, additional conditions (for example cloud base) must be specified. DO NOT take off unless you can land again at the aerodrome (above landing minima), unless there is a suitable TO alternate nominated.

When reported meteorological visibility is below the requirements, but no RVR is given, then you can take off if you determine the RVR along the TO runway is at/above minima. This also applies if there is no visibility or RVR provided.

Required RVR:
No lighting (day only) – 500m .
Runway edge OR centreline – 250m (300m for cat D).
Runway edge AND centreline – 200m (250m cat D).
Runway edge AND centreline AND multiple RVRs – 150 (200m D).

For night operations you need edge lights and runway end lights. These figures apply to aircraft that are able to climb to 1,500ft with an engine failure at $V_1$. The operator can restrict these minima even more if they wish.

If you cannot climb to 1500ft after failure at $V_1$, a different set of RVRs apply. Use the lowest of these and the runway based RVR.

| Minimum height of engine failure | <50 ft | 51-100ft | 101-150ft | 151-200ft | 201-300ft | >300ft |
|---|---|---|---|---|---|---|
| RVR | 200m | 300m | 400m | 500m | 1000m | 1500m |

Reduced minima operations – Can further reduce RVR to 125m (150m CAT D). Need low visibility procedures to be in force at the airfield, high intensity runway centreline and edge lights, flight crew trained in the sim. There must also be a 90m visual segment at the start of the TO run. The required RVR is required to be met in all 3 segments.

This can be reduced again to 75m (all categories) if using an approved lateral guidance system or HUD / HUDLS (HUD landing system). Must also have CAT 3 facilities at the aerodrome.

Noise abatement procedures:

Inadvisable when – runway contaminated, horizontal visibility < 1900m, landing cloud ceiling < 500ft, crosswind >15 kts (including gusts), tailwind >5kts (including gusts), windshear or TS reported, engine or systems failure.

A NADP can be ignored whenever safety requires.

NADP 1 – close proximity of noise sensitive area to the DER. Thrust reduced at above 800ft, continue climb at V2 + 10kts and then accelerate at 3,000ft.

NAPD 2 – distant noise sensitive area. Accelerate to $V_{ZF}$ (zero flap) between 800ft and 1500ft, then climb to 3,000ft before accelerating to climb speed. Reduce thrust either on first flap retraction, at $V_{ZF}$ or at a specific altitude, depending on type.

Type specific instructions are given in the SOPs.

Other noise factors – use noise preferential runways whenever possible. Noise preferential routes can also be used. There are not allowed to be – any turns below 500ft, bank angles greater than 15 degrees (except when acceleration allows), no turns are allowed to coincide with a reduction in power, and they must be compatible with SIDs and STARs. Noise abatement procedures should not prohibit the use of reverse thrust on landing.

ETOPS:

Normal operations only allow twins a maximum of 60 minutes from an adequate aerodrome at one engine out speed. This applies to aircraft that are class A, >19 seats, MTOM 45,360kg or over. 120 minutes for class A with 19 seats or less, and MTOM , 45,360kg. With approval this may be increased to 180 minutes.

Class B and C aircraft are allowed 120 minutes at one engine out or 300nm, whichever is less.

ETOPS area – area containing airspace for which ETOPS approval is required (outside 60 minutes).

Maximum distance is based upon single engine TAS. Engine out cruise speed and maximum distance from an adequate aerodrome should be included in the OPS manual.

ETOPS approval is required from the relevant authority. Need to prove that specific engines and systems on a specific aircraft (of a certain type) are reliable, safe and efficient. This also includes having an appropriate maintenance programme. If approval is granted, it forms part of the AOC. Initially, approval is normally given for 90 minutes. This can then be extended after route proving. 138 minutes is typical for the North Atlantic, 180 minutes for the Pacific.

ETOPS alternate must be reachable within approved diversion time, or MEL restricted time, whichever is shorter.

ETOPS rules apply between ETOPS entry and exit points. This is the ETOPS segment.

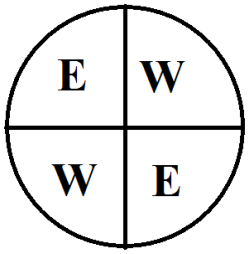
Minimum time route – gives the shortest flight time between departure and destination, adhering to all ATC and airspace restrictions. Computer calculated to adjust heading and route for winds.

Polar navigation:

INS is based on true direction. The manufacturers recommend keeping the aircraft in LNAV in polar areas.

Standard gridded chart – grid north is aligned to true north at the prime meridian.

Grid convergency – difference in longitude between the aircraft and the datum meridian/




True direction + grid convergency = grid direction.

Convergency west, true best.
Convergency east, true least.

Gyrocompass drift:
Earth rotation – apparent drift, due to movement of the Earth through space.
Transport – apparent drift, due to movement of the aircraft relative to the Earth.
Random – real drift, as a result of mechanical imperfections.
Latitude compensation – real drift, intentionally introduced to counter Earth rotation at a set latitude.

Earth rotation = 15 x Sin (lat) x Time
Transport = Ch long x Sin (mean lat)

| | Northern Hemisphere | Southern Hemisphere |
|---|---|---|
| Earth rotation | - | + |
| Latitude compensation | + | - |
| Transport (eastbound) | - | + |
| Transport (westbound) | + | - |

Negative means that the true heading decreases when the actual heading is held constant. If you follow the indicated heading then you will turn to the right.

Organised track system – to regulate Atlantic traffic flow. Traffic is concentrated around 30N. Peal eastbound traffic is between 0100 and 0800, and peak westbound between 1130 and 1900 UTC.

NAT airspace is established by ICAO doc 7030 – regional supplementary procedures.

OCA – oceanic control area.
OTS – organised track system.
PRM – preferred route message.
PTS – polar track structure.
RVSM – reduced vertical separation minima.
LRNS – long range navigational system.
MASPS – minimum aircraft system performance specification.
SLOP – strategic lateral offset procedure. The captain can elect (not told to) fly on track, 1nm to the right, or 2nm to the right. This is to avoid wake turbulence. The aircraft returns to track at the exit of the OTS.
WATRS – west atlantic route system. Airway system taking aircraft from the exits of the NATS to the North American airway system.
MNPS – minimum navigation performance specification.

To enter MNPS airspace, you need a HF radio, aprroved navigational equpment and you must have received an oceanic clearance.

MNPS areas – Reykjavik, Shanwick, Gander, Santa Maria, New York.

In order to enter OTS unrestricted you need at least 2 serviceable LRNS. These must be of a different type. They can be an INS, GNSS, or a navigation system using the inputs of an IRS or other sensors complying with MNPS.

Special routes are published for aircraft with only one LRNS.

Flight deviations are monitored and followed up.

OTS is based on the time at which an aircraft will pass 30W. The westbound, morning stream is from 11:30 to 19:00. The eastbound, evening, stream is from 01:00 to 08:00.

OTS construction - operators submit their preferences via a preferred route message, by 1900 for the day track, or 1000 for the night track. A proposed track system is then published online and the operators have 1 hour to contest it. The final routes are published at 2200 (day) and 1400 (night). Addressees and format are published in the UK and Canadian AIPs and NOTAMs.

OTS use is not mandatory.

Over the high seas the tracks are class A airspace above FL55. IFR rules apply. RVSM and mach number techniques are used for separation.

Westbound day – most northerly is NAT A.
Eastbound day – most southerly is NAT Z.

Changeover gap is from 0801 to 1129, and at 1901-0059.

TMI – track message indicator – must be included on the flight plan.
Other routes are found in NAT MNPS:
M201,202 and 203 – found in the western New York OCA. For going N/S along the eastern

seaboard, e.g. for going to the Caribbean.

Blue spruce routes – for aircraft with only 1 LRNS. State approval is required.

Tango routes – from Northern Europe to Spain, Canaries and Lisbon. Useful when French on strike.

Routes to the Azores.

Routes between Iceland, Greenland and Canada.

Special routes of short stage lengths when equipped with short range navigational equipment that can meet MNPS criteria. State approval is required.

Procedures:

Separation – lateral separation relies upon accurate LRNS. Longitudinal is via timing of waypoints, and therefore any time errors can erode separation.

The master document lists all waypoints, including route, track and timing, and must be available on the flight deck. The crew must also have a simple plotting chart showing the route.

Pre flight:
IRS must be aligned and positioned before moving. Any GPS LRNS must be approved as part of the MNPS approval. Manual entry of waypoint information into a navigation system must be a simultaneous co-ordinated operation by 2 persons working independently. Cannot just watch. One inputs from the flight plan / clearance, the other reads from their own FMC and checks it against the plan.

Both crew members should record every ATC clearance and agree on it. Check the LRNS before entering MNPS.

Just before a waypoint, check co ordinates from each system against the cleared route in the master document, and check the next 2 waypoints. At the waypoint, check distance and track to next waypoint, and confirm the aircraft is turning in the expected direction.

Position reports – before transmission verify the co ordinates against the master document, and those in the steering navigation box. When feasible in the position report, also give the next 2 waypoints from the nav system linked to the autopilot.

You should regularly plot position and check it at each waypoints and 10 minutes thereafter.

SLOP = only FMC and autopilot aircraft, NOT to be flown manually. 0, 1 or 2nm to the right. Main purpose is to reduce the collision risk. It also reduces wake turbulence.

RVSM in MNPS – altimeter cross checks every 60 minutes, on reaching a waypoint or on reaching a new cleared level. Required to be within +/- 200ft inclusive of each other. If outside this then inform ATC ASAP. Report when leaving and reaching levels (300 ft or more deviation).

If one unit in a triplex system fails, then the aircraft is still MNPS capable. If there are only 2 and one system fails, certain procedures must be followed:

Before take off – delay until repairs or plan to fly above/below MNPS, or via a blue spruce route.

Before OCA reached – land, divert to a blue spruce route, or obtain re clearance above and below. Talk to local ATC to arrange clearance to the new entry point.

In OCA airspace and can still communicate – assess options, propose to ATC and consult to fine the most suitable action. Obtain a re clearance before deviating.

Remaining system fails in MNPS – immediately notify ATC, assess the the situation, attempt to establish radio contact with other aircraft to warn them. Keep a look out visually and with TCAS, use all possible lights. If no instructions received consider climbing/descending to an intermediate level, and broadcasting such action on 121.5 MHz.

Oceanic clearances are required in NAT airspace at and above FL55. Must receive them 40 minutes before entering airspace, so may be requested on the ground. This is reduced to 20 minutes from Reykjavik to Scottish / Stavanger. On requesting, notify them of the maximum acceptable flight level. If ETA changes by more than 3 minutes then update ATC as to new ETA. Clearances may differ from the filed flight plan.

Change in clearance – if the entry/exit point changes, obtain a domestic airspace re clearance.
3 elements – route, mach number and flight level.

In the event of an in flight critical equipment failure on rote to the OCA or before departure, then must advise ATC on initial contact or when requesting clearance.

HF communications – conducted on single side band HF frequencies. Ground radio stations have no executive ATC authority. Lower HF bands are used at night. You are allocated a primary and secondary frequency. On initial contact, give the HF frequency that you are using.

SELCAL – each aircraft has a code that is given to ATC, ATC then use this to set of a chime within the aircraft when they want to contact said aircraft.

SATCOM can be used to contact the radio station, should not be used to talk directly to controllers.

Data link – on first contact, the aircraft will receive “voice position reports not required”.

Emergency frequency is 121.5MHz. Air to Air frequency once beyond VHF range – 123.45 MHz.

Position reports are made at significant points or whenever ATC requires. ATC usually want at least hourly reports. Latitude and longitude unless overhead a named point. All times are 4 digit UTC.

Longitudinal separation is obtained by flying at the cleared mach number. Use true mach number. Maintain this mach on leaving unless ATC authorise otherwise.

HF communications failure – select 7600 and mode C. Use SATCOM to contact a radio station. If cannot, then use 123.45MHz and request another a/c or ATC to relay messages. Give position reports regularly on 123.45.

Poor propagation/signal – as above but don't select 7600.
HF communications failure before entry – strongly recommended not to enter the NAT airspace, follow AIP procedures and land at a suitable airport. If an oceanic clearance cannot be obtained the

enter OCA at first entry point, level and speed in the filed flight plan and follow the plan until landfall.

HF communications failure after entry – proceed with last clearance and confirm to local AIP. Rejoin filed plan on the other side using ATS routes if cleared differently to the plan. If the destination is within a NAT region, proceed to the clearance limit and follow ICAO standard procedures.

Maintain the last assigned code for 30 minutes after NATS entry, and then change to squawk 2000.

TCAS 2 is required for all aircraft >5,700kg and >19 PAX.

Equipment failures must be reported to ATC ASAP after loss on any primary altimeter, or of all automatic altitude control systems.

Procedures for inability to maintain level secondary to turbulence, performance and pressurisation. Ultimately the commanders choice:

- Obtain a revised clearance. Until then broadcast position and intentions on 121.5 and 123.45.
- Fly at a level and or track to avoid aircraft, with all lights on and a good lookout including TCAS. Consider declaring an emergency.
- Turn left or right not less than 45 degree, with the direction appropriate given position in NATS. Establish on an offset of 15nm.
- Fly +/-500ft (below FL410) or +/-1000ft (above FL 410). If at FL410, climb 1000ft or descend 500ft.
- If unable to maintain level, then minimise rate of descent until you have left the track, and then expedite your descent.

Weather deviations – request a revised ATC clearance. If unable, then deviate away and broadcast on 121.5 and 123.45. Switch on all lights and maintain visual and TCAS lookout. If deviating >10nm then stay on the same level. If within 10nm then climb 300ft (if deviating north) or descend 300ft (if deviating south). On return regain assigned flight level once within 10nm. Inform ATC when no longer require deviation, or when completed and returning to track.

Decompression:

Slow is more dangerous as it is insidious. Rapid is time pressured, but very obvious. The aircraft is required to have warning systems to indicate when the cabin altitude passes 10,000ft, usually by means of a horn.

Slow decompression indications – hissing around a door or window, slow steady rise in cabin altitude, ears popping, mild abdominal discomfort.

Rapid decompression – load bang followed by misting, loose items rapidly ejected from the aircraft, cabin warning triggered rapidly and $O_2$ deploys. Crew may feel very cold, hypoxic, get decompression sickness or barotrauma.
Actions – don $O_2$; switch packs to manual or semi automatic to close outflow valves (according to checklists); rapid descent to MSA or 10,000ft.

Legal minimum for chemical $O_2$ is 10 minutes.

TUC – 20,000ft = 10 minutes; 30,000ft = 90s; 35,000ft = 45s; 40,000ft = 30s.

For > 25,000ft need quick donning masks. Normal communications with a built in microphone. Easy reach and fit within 5 seconds without disturbing glasses. Over FL410 one pilot must be on $O_2$ at all times. At 8,000ft cabin altitude, you are not impaired.

Cabin crew should don the nearest mask and then make their way to their stations by going mask to mask. Inform the cabin crew of the rapid descent.

Fuel jettison – to lower the landing weight allowing slower approach speed and a shorter landing roll. May be for an emergency, technical problem or unruly passengers. Should be done at or above 6,000ft.

EU OPS – at MTOM you must be able to take off, fly for 15 minutes back to the departure airport, and have the approach climb performance to enable it to land. Therefore, large, long haul aircraft tend to have a fuel jettison system.

Criteria – free of fire hazards, clear of the aircraft, no fumes may enter the aircraft, no controllability issues (therefore flaps and slats must often be retracted).

Procedure – inform ATC who will route you clear of built up areas; switch off non essential electrics and the HF radio; inform crew and PAX; no smoking sign on; stay clear of clouds; tell ATC once complete.

Adverse conditions:

Windshear – sufficient intensity and duration to displace the aircraft, thus requiring large input corrections to maintain control.

Vertical and horizontal – changes in horizontal wind vector.
Updraughts and downdraughts – changes in vertical wind vector.

Lowe level – along runway, take off, initial climb out, final approach.

Hazards – handling problems, flight path deviations, loss of airspeed, structural damage.

Jet stream CAT is most severe where the stream curves.

Microbursts – 5 minutes, 5nm, 60kts, 3000fpm, splays at base and can reach 90kts.
Wet – from CB base, intense precipitation, detectable.
Dry – from the anvil, undetectable.

Sequence – headwind (IAS increase, climb), downdraught (IAS back to previous, rapid descent), tailwind (IAS decreases, continue to descend).

Recognition – IAS variations of 15 kts, unexpected 5 degree + pitch changes, heading variation of 10 degrees, 1 dot glideslope deviation, loss of control, excessive rate of descent (500fpm

variations).

Detection:
Airport – low level windshear alert system (LLWAS) – lots of sensors detecting 15kts change within 2nm; terminal doppler weather radar (TDWR) – detection of approaching windshear to give advanced warning.

Pilots reports – PIREPS – windshear 20kts, 500fpm below 1000ft.
Visual dust or rain.

Aircraft – predictive weather radar and GPWS.

Taking off in windshear – consider delaying take off, use weather radar, use TOGA and closely monitor.

Descent/approach – delay approach, use radar, select most favourable runway, use autothrottle (quicker to react).

Escape – TOGA, pitch initially to 15 degrees and then to stick shaker if no improvement, do not retract gear or flaps, unless a turn is required for obstacle clearance then level the wings.

Warnings – aural and on PFD.

Contamination – 25% with 5mm of moisture (water, slush, compact snow, ice). Braking coefficient measurement may be inaccurate. May need to reduce $V_1$ and TOM, check OPS B.

Hydroplaning – water patches, flooded or otherwise contaminated. Friction coefficient is 0 once over hydroplaning speed.

Dynamic – tyre rides up on a ridge of water. $9\sqrt{P}$ (in PSI, 14.5 PSI per Bar).

Viscous – damp surface with rubber/oil/dust deposits. NOTAM slippery when wet. Especially found at the touchdown zone. Can occur at much lower speeds.

Reverted rubber – wheel locks and becomes superheated on damp runways. Steam is produced, causing the rubber to revert to its uncured state. The tyre then skids.

Contaminated braking coefficient is only reliable for ice and compact snow.

| | | |
|---|---|---|
| 40 or more | 5 | Good |
| 36-39 | 4 | Moderate to Good |
| 30-35 | 3 | Moderate |
| 26-29 | 2 | Poor to Moderate |
| 25 or less | 1 | Poor |
| | 9 | Unreliable |

Requirements for operation on a contaminated runways:

- If poor, greater than maximal depth or a tailwind is present, then do not take off.

- Must have all stopping devices available and use full runway length.
- Strict crosswind limits.
- No tankering.
- Use a higher flap setting if possible.

SNOWTAM – valid for 24 hours or until significant change. May be as part of METAR , in which case last 2 digits show friction coefficient.

MUM = mu meter reading.

Wake turbulence – mainly from the wing tips. Worst at just after rotation and just before touchdown. Drifts slowly out (at 2-5kts) and down (up to 1,000ft) before dissipating. On the ground a light crosswind may hold one vortex on the runway.

Worst when heavy, low speed and clean configuration.

Effects 0 severe uncommanded roll, severe vibrations. Very dangerous at low level.

ATC maintains separation for IFR. VFR and visual IFR must maintain own. Commander's responsibility in the end.

Bird strikes:

Most occur at TO and landing, in the day. Large flocks or large single birds are highest risk.

Authorities must consider the environment within 13kms, and may object to planning permission for landfills etc.

Attractive to birds – Landfill, sewage, ponds (put netting over them), water courses (re route underground), short grass.

Long grass is less attractive.

Scaring – bird distress calls are most effective. Pyrotechnics and birds of prey also used.

Avoiding birds – landing gear out and lights on. Gently pitch up, as they tend to go down at the last second, delay take off if required.

Reporting – pilot reports (made immediately to ATC), ATIS, BIRDTAM.
If you hit a bird and there is severe damage – IBIS.

90% occur within the airfield vicinity. And the majority are under 2,500ft.

Security – safeguarding civil aviation against unlawful interference. Each state must have set procedures to prevent unlawful interference, and to respond. The operator must supply a training

programme.

Bomb on board – must be an onboard checklist with procedures for least risk bomb area. Descend to cabin altitude / MSA, go to landing configuration.

Flight deck door - >19 passenger seats require a lockable flight deck door. >60 seats or MTOM>45.500kg then must be lockable from pilot stations. Bullet proof. Locked prior to engine start and opened after shut down. It may only be opened for authorised personnel.

Monitoring system for area outside cockpit door, to detect threats. Usually a camera, with a visual port as a backup.

If there is unlawful interference, and you are safe behind the door, state “cockpit secure”.

Emergency landings:
Precautionary – no immediate danger but better to land at nearest suitable airfield. Expect to taxi to gate / stand. Pan Pan situation at most. Deal with the immediate issue, use the QRH, assess the problem, talk to ATC, talk to cabin crew, talk to PAX and prepare for landing.

Emergency – immediate danger, likely to end with evacuation on the runway. Deal with the issue as possible, then attempt to inform ATC, cabin crew and PAX.

3 yearly OPC cycle of all possible failures.

Evacuation – use evacuation checklist, which initially shuts down the engine. Captain gives command to evacuate. Evacuate via escape exits using escape slights.

Criteria - >44 seats evacuate within 90 seconds with only ½ available exits, in darkness, with emergency lighting only, normal attitude, ½ cabin baggage scattered about, none of passengers briefed.

Ditching – send distress with position report. Request intercept aircraft. Reduce fuel to decrease touchdown speed, but leave enough to maintain thrust. Prepare the cabin.
10-12 degree attitude, descent rate 200-300ft. Gear up. In light swell land parallel. In heavy swell (or 40kts wind), land into wind on the back of the crest.

Fire and smoke:

Electrical faults are most common cause of cabin fire.
Piston engine – carburettor is main source, normally due to a leak. Shut off the fuel.
Jet engine – most commonly a jet pipe fire due to a wet start. Shut down and perform a dry cranking.

Engine compartment fire – shut down, pull fire handle, discharge agent, land ASAP. In the case of a turboprop, feather as well.

Fire classes:

| Class | Source | Symbol | Extinguishing agents |
|---|---|---|---|
| A | Carbinaceous solids, brown/grey smoke | Bonfire | Water, Halon, Foam |
| B | Flammable liquids. Thick black smoke. | Petrol can | Halon, powder, foam $CO_2$ |
| C | Flammable gases. | Burner | Halon, $CO_2$ |
| D | Combustible metals | Wheel | Powder, atomised water |
| E | Electrical. Bluish acrid smoke. | Electrical | Halon, powder |

Halon does not cool the fire, and so it may re ignite.
Stand 1.5 to 2.5m away and aim at base for water, over the flame for $CO_2$, halon and foam.

Fire actions – find source (may need to use fire axe), assess danger, gain access and extinguish, report to captain.

Smoke in flight deck – don goggles, 100% oxygen, carry out checklists.

Smoke in cabin – keep cockpit door closed. Deal with fire if possible, and relocate passengers, keeping heads down.

Brake fires – approach from front or back, using powder or atomised water. In flight drop the gear and land.

All weather operations:

LVPs come into force when cloud ceiling is 200ft or less, RVR 600m or less. LV TO when RVR less than 400m. ILS sensitive areas must be specified.

| | | | |
|---|---|---|---|
| CAT 1 | DH 200ft | RVR 550m | 3 consecutive lights |
| CAT 2 | DH 100ft | RVR 300m | Plus some lateral element. |
| CAT 3 A | DH 50ft | RVR 200m | |
| CAT 3 B | DH 0ft | RVR 75m | |
| CAT 3 C | DH 0ft | RVR 0m | |

If RVR < 800m, then mandatory signs must be illuminated. Alternating green/yellow taxiway in ILS sensitive areas.

Radio altimeter safety area – 300m x 120m.

Low vis TO – minimum RVR 150m (200m  CAT D). Reduced to 125m if LVPs in force, high intensity centreline lighting every 15m, and high intensity runway edge lights every 60m. Must have a 90m visual segment at take off. Crew must be qualified, and company must be authorised.

System minima:

Localiser (with or without DME) – 250ft
SRA (2nm) – 350 ft. Reduced to 300ft for 1nm termination, or 250 ft for ½nm.
VOR/DME – 250ft.
VOR-300ft.
RNAV – 300ft.
NDB/DME – 300ft.
NDB – 350ft.
VDF – 350ft.