Ops numbers & things to remember:

CAT operations:

- Height call outs **200ft** above **threshold elevation** with RA
- 1 RA & 2 pilots

CAT	Decision Height	Guidance	RVR
I	>200ft	200ft	550m
II	>100ft	50ft	300m
IIIA	<50ft or none	To runway	200m
IIIB	<50ft or none	To runway	>75m
IIIC	None	To runway	No limit

Type of approach	Planning minima
CAT II & III	CAT I RVR
CAT I	NPA RVR, ceiling at or above MDH
NPA	NPA RVR/VIS + 1000m, ceiling at or above MDH + 200ft
Circling	**Circling visibility, MDH & ceiling for ETA +/- 1 hour**

MDH:

Facility	Lowest DH/MDH
ILS/MLS/GLS	200
GNSS/SBAS/LPV	200
GNSS (LNAV)	250
GNSS/BARO-VNAV	250
ILS LOC(LLZ **only**)	250
VOR/DME	250
SRA (0.5NM)	250
NDB/DME	300
VOR	300
SRA (1NM)	300
SRA (>2NM)	350
NDB	350
VDF	350

Circling	A	B	C	D
MDH(ft)	400	500	600	700
Min met visibility	1500	1600	2400	3600

	DH	Rollout control guidance	RVR
IIIA	<100	Not required	200
IIIB	<100	Fail-passive	150
IIIB	<50	Fail passive	125
IIIB	<50 or nil	Fail operational	75

Terrain elevation	MOC
0	300m(1000ft)
>900m(3000ft) <1500m(5000ft)	450m(1476ft)
>1500m	600m(1969ft)

MDH is referred to runway threshold elevation & not to aerodrome elevation if threshold is more than **2m below aerodrome elevation**

$V_{AT} = V_{SO} \times 1.3$

Aircraft category	V_{AT}
A	<91
B	91 – 120
C	121 – 140
D	141 – 165
E	166 – 210

Approach criteria (Precision or NPA):

- **1000ft above aerodrome** or into **final approach segment** in the case **DA/H or MDA/H** is more than **1000ft above the aerodrome** (Also when there is no outer marker)
- **MINIMUM Visual approach minima RVR = 800m**
- **NON-PRECISION: Threshold RVR >750m**

IFR

- **Single pilot operations**:**5 IFR flights, including 3 instrument approaches preceding 90 days**
- Minimum **crew** of **2 pilots**: For **turbo-props** of more than **>9 seats** & **all turbojets**
- Minimum IFR requirement: **1 VOR, 1 ADF, 1 DME**

VFR:

- Minimum VFR without visual reference to landmarks: **1 VOR 1 DME**
- **VFR radio: 1 radio & 1 transponder**

Take-off alternate:

- **2 engines: 1 hour flight time with OEI**
- **3 – 4 engines**: **2 hours flight time with OEI**

Destination alternate:

- **2 destination alternates**: **1 hour before & 1 hour after estimated time of arrival OR when no meteorological information is available**
- **Alternate fuel** can be used provided**: 2 independent runways are available** & weather conditions **500ft above MDA/2000ft AAL, & visibility >5km**

Visibility:

- Low visibility take-off: **RVR <400m**
- **Additional procedures**: Permit continued operations when ground visibility **<800m**

Navigation equipment:

- AWR: Non-pressurized MTOM >5700kg & MOSPC >9
- **ACAS: MCTOM > 5700kg & MOPSC > 19**

Passengers	Megaphones
0	0
61 – 99	1
>100	2

Extinguishers, depends on **seats** *(3-6-23456)*:

Seats	Extinguishers
7 – 30	1
31 – 60	2
61 – 200	3
201 – 300	4
301 – 400	5
401 – 500	6
501 – 600	7
>601	8

+1 in flight deck (If QN asks for total)

Black	CO_2
Blue	Dry powder
Cream	Foam
Green	Vaporising liquids
Red	Water
Yellow	Wet chemical

Regulations

- "Emergency demonstration": **Not more than 50% of emergency exits available**
- "Complex operations" when **>20 full time employees**
- **Dry lease**: Proof to national authority includes **operational need** & a dry lease-in does **not exceed 7 months in any 12 consecutive month period**
- **Operator proficiency check: 6 months**

Documents

- **Operational flight plan** kept for **3 months**
- **Dangerous goods** kept for **3 months**
- **M&B** kept for **3 months**
- **Tech log** kept for **36 months**

Aircrew

- Rest period
  - Away from home base: 10 hours
  - At home base: 12 hours
- **1 cabin crew member for 50 passengers** can be **exempted provided a report is sent to the AUTHORITY** after flight
- At least **1 cabin crew** required for planes >**19 seats** & when carrying **one or more passengers**
- **Senior cabin crew: 12 months experience**
- **Min age 18 years**

Training

- Proficiency checks: **2 within a year more than 4 months between checks**
- **Line check: 12 months**
- Recurrent flight & ground training: **12 months**
- Zero flight time training (ZFTT) shall commence flying not later than **21 days**

(FDP) flight duty period:

- Basic maximum can be extended by max **1 hour**
- **Unforeseen circumstances by 3 hours**
- **Stopover:** Made due to **cumulative duty hours**
- **Total duty periods shall not exceed**:
  - **60 hours in 7 days**
  - **110 hours in 14 days**
  - **190 hours in 28 days**
- **Some elements** of **standby time** are counting for **duty time**
- **Total flight time of sectors:**
  - **100 hours in 28 days**
  - **900 hours in a calendar year**
  - **1000 hours in 12 months**
- **Night duty: 0200 – 0459 in time zone crew is acclimatized**

Oxygen:

- First aid oxygen:
  - Operating **>25000ft** ***(Important)***
  - **2%** of passengers **carried**
  - **Cabin altitude >8000ft**
  - For passengers with **physiological problems**
  - **For passengers or crew when required**
  - **4 litres** STPD/min
- Supplemental oxygen for **pressurized** aircraft:
  - Crew (flight crew & cabin crew): **10000-13000ft** oxygen is needed if period is exceeding **30 min**, above 13000ft is needed immediately
    Pilots: **Up to 25000** ft for **30 mins**, over **25000 ft** it should be enough for **2 hours**
  - **Above 41000ft: At least 1 crew member must wear oxygen**
  - **10%** of the passengers between **10000-14000ft** after the first 30 min
  - Aircraft will be equipped with a warning system indicating cabin altitude is higher than *3000m*
- Supplemental oxygen for **non-pressurized** aircraft:
  - Pilots/flight deck crew on duty shall be supplied with oxygen **at all times above 10000ft**
  - Cabin crew shall be supplied with oxygen if period exceeding **30 min** above **10000** but not exceeding **13000ft**, and entire flight above **13000ft**

- **10%** of passengers between **10000-13000ft** (Some passengers)
- 100% of passengers above 13000ft (10000-13000ft 30 min rule does not apply here as with cabin crew)

Cabin compression failure:

- Flight crew are able to fly with no supplemental oxygen with no time limit is 10000ft
- All crew member (flight crew & cabin crew) above 13000ft
- Passengers: 100% of the passengers: the entire flight when pressure altitude is above **15000ft**, but in no case less than 10 min

Oxygen masks/inhalers:

- 110% of seating capacity above 25000ft
- Above FL410 one pilot must wear an oxygen mask
- Quick donning type oxygen masks are compulsory above 25000ft

- PBE: 15 minutes

Life jackets & rafts:

- Life rafts: If flying more than (i)**2 hours** or (ii)**400NM to coast**
- Number of life rafts carried on board allows transport of occupants **in case of a loss of one raft of largest capacity** (+1 raft for spare)
- **Life jackets** for anywhere **50NM from land**, when using **departure & arrival paths over water**

Emergencies:

- Passenger emergency exit provided if exit sill height is **> 1.83m**
  Before 2000: 6 feet with landing gear extended
  After 2000: 6 feet with landing gear collapsed
- **Accident** involved with **dangerous goods**: Report within **72 hours**

Emergency equipment:

- **Crash axe & crowbar:**
  - **>5700kg one on flight deck**
  - Max operating seating capacity (MPOSC) **>200** includes one more at rearmost galley (+1)
- ELT:
  - Battery at least 48 hours
  - Transmits **simultaneously** on **121.5MHz & 406MHz**
  - >19: (i)After 2008 **2 ELTs**, **1** of which is **auto ELT-----(ii)**Before 2008 **1 auto ELT or 2 ELT of any type**
  - <19: (i)After 2008 **1 auto ELT-----(ii)**Before 2008 **1 ELT of any type**
- **FDRs**: **Last 25 hours, >27000kg or >5700kg,** kept for **60 days**
- **CVRs: Last 30 minutes or <u>2 hours</u>**
- **Emergency lighting system**:
  - **10 minutes**
  - MOSPC > 9 seats:
  - Always **ARMED**
- **Spare fuses: 10%** of number of fuses or **3 for each rating**

First aid-kits:

- **<u>Emergency</u> medical kits:**
  - **One** required when **MOPSC > 30** and **route > 60mins**

Seats	Kits
0 – 100	1
101 – 200	2
201 – 300	3
301 – 400	4
401 – 500	5
>501	6

Fuel:

- **Final reserve fuel (Turbine engines)= 45 minutes**
- **Final reserve fuel (Reciprocating engines) = 30 minutes 1500ft above aerodrome**
- **Isolated aerodrome: 2 hours with normal cruise consumption including final reserve fuel**

Seats:
- Child restraint device: Younger than 24 months
- Seats allocated for each person on board **aged 24 months or more**

Other equipment:
- **Interphone/PA system**: CREW> 1, MCTOM of more than **15000kg** & **MOPSC <u>> 19</u>**
- Time piece requirement: **1 time piece**
- **Windshield wiper**: Aircraft with **MTOM> 5700kg**
- Standby artificial horizon power supply: **>5700kg = 30 minutes**

RVSM: Deviation alert equipment tolerance: **+/-90m (300ft)**

Remote areas:
- Flying in remote areas where **SAR is difficult**: **90 minutes at cruising speed**
- Equipped with at least **signalling equipment, <u>1</u> ELT & additional survival equipment for the route**

Turboprops:
- >5700kg equipped with **altitude alerting system** capable of alerting crew when **deviating from preselected altitude**
- **2 min crew when MOSPC >9**

Window of circadian low (WOCL): 0200 – 0559 hours

ETOPS:
- **60 minutes at cruising speed with OEI**
- **180 minutes rule: 180 minutes with OEI**
- **Non-ETOPS:**
  - CLASS **A more** than **45tons /20MOPSC**: **60 mins** OEI from airport
  - CLASS **A** with **less** than **45tons/20MOPSC**, **B & C: 120 mins** or **300nm** OEI whichever is less

En-route ETOPS alternate aerodrome:

Type of approach	Planning minima
Precision	DA/H + 200ft, RVR/VIS + 800m
Non-precision/Circling	MDA/H + 400ft, RVR/VIS + 1500m

- Flight can be commenced when forecasts indicate that at arrival or **1 hour** after conditions exists **at or above <u>planning</u> minima**

Longitudinal separation:
- Turbojet:
  - 15 mins **same track & same Mach no.**
  - 10 mins if mach no. technique is used
  - 5 mins **absolute minimum**/leading aircraft higher speed
- Turbo-prop:
  - 20 mins
  - 30 mins in western area of NATs (North Atlantic tracks)

Lateral separation:
- Standard: 60NM
- Absolute minimum: 30NM

Conversion angle = Change of longitude x sin latitude
Departure = Change of longitude x cos latitude
Conversion angle = Earth convergence ÷ 2

Cross-track difference = (Conversion angle x distance/departure) **÷ 230**
GTAP NH, TGAP SH

Precession:

- Astronomic precession (Apparent wander):
  - Right NH (Gyro reading shows **negative value, corrected by a positive value**)
  - Left SH (Gyro reading shows **positive value, corrected by a negative value**)
  - **15^{o} x h x sin Lm**
  - **15^{o}/h x sin Lm**
  - Exists when aircraft is on the ground or flying
- Chart precession: Gyro north precess in relation to **grid north** for a given chart
- Transport precession:
  - Gyro north in relation to **true north**
  - **Change of longitude x sin mean latitude**
- **Conversion angle: Longitude difference/2 x sin average latitude**
- Total wander = Astronomic + transport wander + mechanical precession
- Heading adjustment for **constant gyro heading**: From **RL** track +/- (0.5 total wander)

Flight plan: Intercontinental flights NAT: Flight plan filed **3 hours** before start up

RVSM:

- 60NM lateral & 1000ft vertical
- Between FL290 & FL410
- Vertical speed **not exceeding 1500ft/min**
- **Pre-flight** altimetry accuracy check within **75ft**
- **Overshoot /undershoot tolerance: 150ft**
- **Primary altimeter cross-check: 200ft**
- RVSM emergencies/contingencies **without ATC clearance**
  - Engine failure: Fly **offset 15NM** left or right
  - A**t FL410**: Climb **1000ft** descend **500ft,** turn **left/right**
  - **Within RVSM <FL410:** Climb/descend 500ft
  - **Above FL140**: Climb/descend 1000ft
  - Diversion without ATC clearance **offset 15NM**

NAT airspace:

- According to **ICAO document 7030**
- **VHF out of range**: Use frequency **124.35Mhz**
- Code to be set **30 minutes** into NAT: **2000**
- Code to be set **before 40 minutes** entering NAT: **As requested** by ATC
- **Revised estimate** to time for next position transmitted when it has changed **3 mins or more**
- **Tolerance boundary window = 3 mins**
- Clearances: **Oceanic clearance** requested **40 mins prior**
- **IFR** when operating at or above **FL60 or 2000ft** above ground whichever is greater

Polar track system: **Horizontal** component of magnetic field less than **6 micro Teslas**

Min navigation performance specification (MNPS):

- MNPS airspace:
  - From **27^{o} North to 90^{o} North**
  - Vertical separation **1000ft**
  - **60NM** separation between aircraft meeting MNPS
  - Requires **at least one LRNS & at least 2 inertial navigation units**
  - Between **FL285 & 420**
- **Westerly** headings: **Even** FLs between **285 & 420**
- **Report position:**
  - Every **20^{o}** of longitude north of 70N

    - Every **10°** of longitude south of 70N
- Long range navigations:
    - **LRNS failure** before flight: **File special routes** or **fly above/below** MNPS
    - **2 LRNS fails:** Only **T9 can be used**
    - **All LRNS fail** while flying, climb/descend **500ft**
- **Organised track system**
    - Day (Westbound): 1130-1900UTC
    - Night (east bound): 0100-0800UTC
    - 1901 – 0059 UTC or 0801 – 1129 UTC: **Out of validity period**
- Non-MNPS aircraft: Can plan routes **at FL280 or less**
- Deviations around severe **weather**: Deviations **>10NM**, aircraft is **10NM** from track, level change of **300ft**.
  Westbound & deviating **left: Climb 300ft**, deviating **right: descend 300ft**
  Eastbound & deviating **left: Descend 300ft**, deviating **right: climb 300ft**

Minimum equipment list (MEL): Amended MEL **90 days**

Icing conditions: Decrease of lift by **30%**

Stable clouds: Icing occurs favourably at **0° to -10°C**

Bird hazard areas:
- Below **2500ft or under 1500ft (Under 500m or 0 to 150m)**
- **Least likely to attract birds:** Maintaining grass at least **20cm long** on airfield
- Information & prevention: AIP section **ENR 5.6**

Noise abatement procedure (NAP):
- According to **ICAO** doc 8168
- Found in **AIP Part AD 2** publication
- NADP 1 = V_2 + 10kts till 3000ft (NAP **near airfield**, flap retracted **after 3000ft**)
- NADP 2 = V_2 + 10kts till 800ft (Thrust reduction to climb power) & then V_{ZF} + 10kts till 3000ft
- **NAP not used: Contaminated runway,** ceiling **<500ft (150m)**, visibility **<1.9km (1NM)**, crosswind **>15kt, tailwind >5kt, wind shear reported**
- Minimum noise climbs for NAP: Min height power reduction allowed is **240m (800ft)**

Hold extinguisher: Approximately 1.5m – 2.5m from fire source

TUC: At 40000ft: **12 seconds**

Pilot:
- Physically affected due to lack of oxygen at **6000ft**
- **Crew efficiency** not impaired at **8000ft**
- **Quick don mask >25000ft**

Excessive cabin altitude warning at **10000ft**
Oxygen diluter-demand system: **Regulator supply mask pure oxygen above 32000ft**
Oxygen drop out masks: Automatically at 15000ft

Windshear range:
- Headwind/tailwind x 2
- At centre = 0)
- X thousand ft/min = X0kts
- 40kts headwind: Wind shear -80knots (Range & change)

Microburst: **1 to 5 minutes 4km**

Wake turbulence:

- Category aircraft
  - **HEAVY: >136 000kg**
  - **Medium: >7001kg <135 999kg**
- Wake dissipation time: **3 minutes**

Separation:

- Time:
  - Departure 2 min
  - Opposite 2 min
  - Displaced 2 min
  - **Intermediate point of departure** 3 min
  - Arrival 2 min [**3 for LIGHT behind heavy/medium**]
- Radar separation (NM):

	H	M	L
H	4	5	6
M	3	3	5
L	3	3	3

Unlawful interference:

- Attempt to **broadcast warnings** on **VHF** channel in use or **121.5MHz**
- **If ATS cannot** be established: Fly cruising levels differing from **500ft (IFR)** or **1000ft in RVSM**
- **Promulgated in Doc <u>7030</u>**

Number of emergency exits:

- Must be arranged to allow all passengers & crew members to leave in **90 seconds (>44 seats)** through **50% of available emergency seats**

Jettison:
Reduce aircraft weight in emergency **unless capable** to meet **2.7%** in a climb with **OEI** & **3.2% all engines**
Best **>FL60**
Within **15 minutes**

Hydroplaning speed = **34 x √P** (P = tyre pressure in bars) = **9 x √P** (P = tyre pressure in psi)

Wet runway:

- **25%** contamination of runway with **depth of 3mm or less**
- Covered with quantity of water <= 3mm

SNOWTAM:

- Friction measurement: H) X/X/X [5-4-3-2-1]
- Contamination: F) X/X/X
- **24 hours** validity

>3mm or **25%** covered = contaminated (**Shiny appearance does NOT mean contaminated)**
Slush lowest friction coefficient