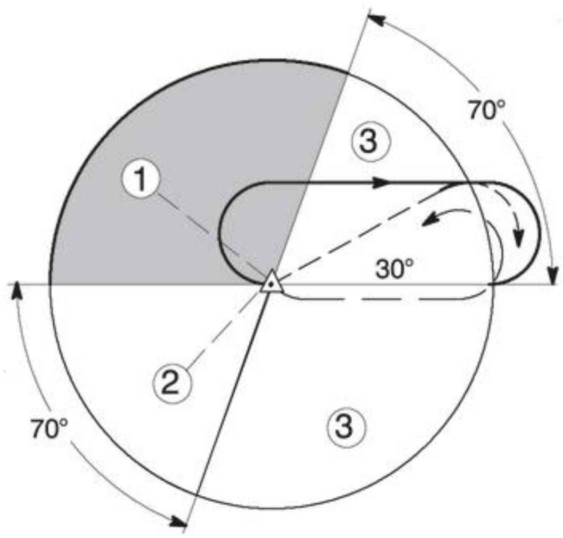
WIZZ AIR Interview Preparation

010 – AIR LAW

HOLDING (standard right holding):

- All turns are to be made at a bank angle of 25° or at a rate of 3° per second, whichever requires the lesser bank.
- An additional buffer area extends **5.0NM** beyond the boundary of the holding area.
- Related to the three entry sectors in a holding pattern, there is a zone of flexibility on either side of the sectors boundaries of 5°
- Outbound time **≤ 14.000ft = 1 minute**
- Outbound time **> 14.000ft = 1 minute 30 sec**
- **MHA** – minimum holding altitude

F fix
L level
I inbound
R right/left
T time



The ICAO Maximum holding speeds:

Up to 14000 ft:	230kts
14000 ft to 20000 ft:	240kts
20000 ft to 34000 ft:	265kts
Above 34000 ft:	M0.83

The MSA, which must be established around a navigation facility, is in general valid within a sector of: **25NM** (1000ft clearance; mountainous area 2000ft)
An aircraft is considered to be maintaining its assigned level as long as the SSR mode C derived level information indicated that it is within: **+/- 300 ft of the assigned level**
An aircraft intercepted by another aircraft shall immediately attempt to establish radio communication with the intercepting aircraft on the following frequencies: **121.5 MHz - 243 MHz**
What is the maximum speed adjustment that a pilot should be requested to make when under radar control and established on intermediate and final approach: **± 20KT**

APPROACH SEGMET = STAR / initial / intermediate / final / missed approach

- **Initial approach:** The segment between the initial approach fix (IAF) and the intermediate fix (IF), or the point where the aircraft is established on the intermediate course or final approach course.
- **Intermediate Approach:** The segment between the IF or point, and the final approach fix (FAF).
- **Final approach:** The segment between the FAF or point, and the runway, airport, or missed approach point (MAP). Max descent gradient CAT C,D and E = 6,1% (3,5°). For CAT II/III glide angle must be 3,0°.
- **Missed approach:** The segment between the MAP or the point of arrival at decision height and the missed approach fix at the prescribed altitude.

TRANSPONDER
7700 – Aircraft in distress
7600 – Communication failure
7500 – Unlawful interference

PAPI - Precision Approach Path Indicator
ATIS – Automatic Terminal Information Service
AIC – Aeronautical Information Circular
VASI – Visual Approach Slope Indicator

AOC - Air Operator Certificate
ACC - Air Carrier Certificate
FIR - Flight Information Region

An AIP shall contain the following parts:

- GEN
- ENR
- AD

VMC MINIMUMS:

- For airspace class C, D and E

Altitude	Visibility	Distance from clouds
10.000 ft (3.050 m) or more	8 km	1.500 m horizontal and 300 m vertical
Below 10.000 ft	5 km	

- For airspace class G

Altitude	Visibility	Distance from clouds
10.000 ft (3.050 m) or more	8 km	1.500 m horizontal and 300 m vertical
below 10.000 ft	5 km	
At and below 3.000 ft QNH or 1.000 ft AGL (whatever is higher)	5 km	Outside clouds and terrain in sight

VFR minimum levels:

- over the congested areas of cities, towns or settlements or over an open-air assembly of persons at a height less than 1.000 ft above the highest obstacle within a radius of 600 m from the aircraft;
- elsewhere than as specified above, at a height less than 500 ft above the ground or water.

IFR minimum levels:

- over high terrain or in mountainous areas, at a level which is at least 2.000 ft above the highest obstacle located within 8 km of the estimated position of the aircraft;
- elsewhere than as specified above, at a level which is at least 1.000 ft above the highest obstacle located within 8 km of the estimated position of the aircraft.

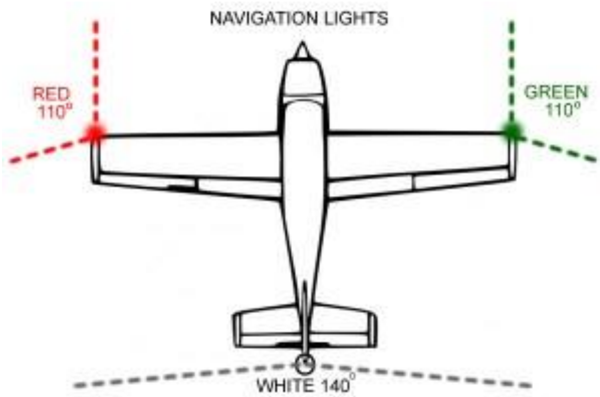
SEPARATION

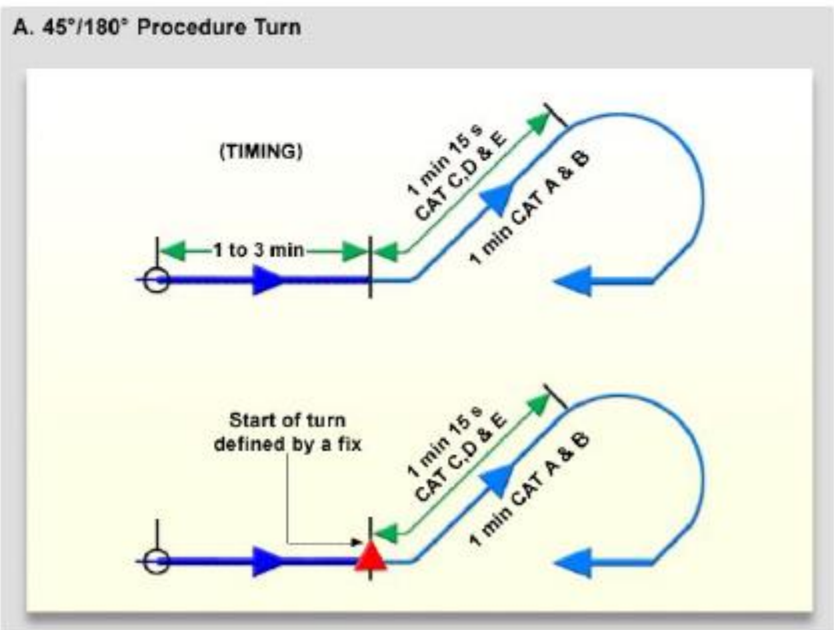
Departing aircraft:		Arriving aircraft:
Same runway:	Light/medium – heavy = 2min Light – medium = 2min	Medium – heavy = 2min Light – medium/heavy = 3min
Intersection:	Light/medium – heavy = 3min Light – medium = 3min	Heavy – heavy = 4NM Heavy – medium = 5NM Heavy – light = 6NM
Displaced THR:	2min	
Opposite direction:	2min	Medium – heavy/medium = 3NM Medium – light = 5NM

ICAO annexes (18 annexes)

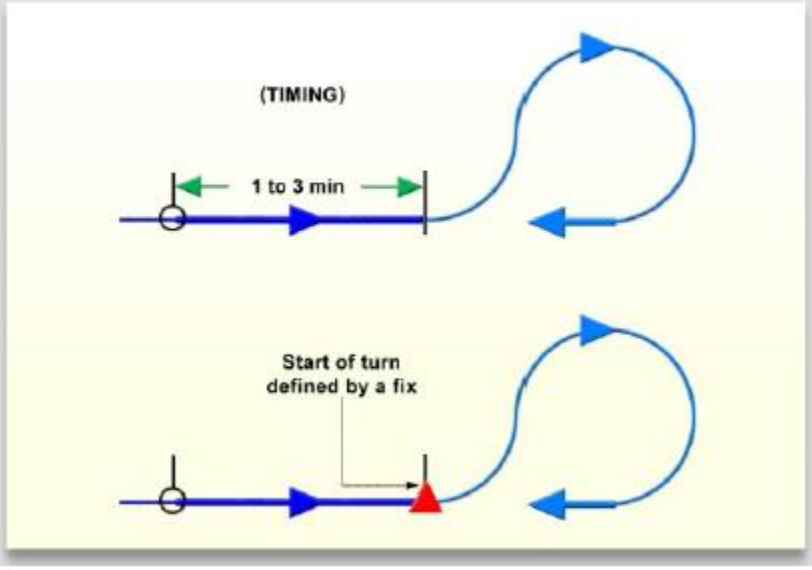
Annex 1	**Personnel Licensing**
Annex 2	**Rules of the Air**
Annex 3	Meteorological Service for International Air Navigation
Annex 4	Aeronautical Charts
Annex 5	Units of Measurement to be Used in Air and Ground Operations
Annex 6	Operation of Aircraft
Annex 7	Aircraft Nationality and Registration Marks
Annex 8	Airworthiness of Aircraft
Annex 9	Facilitation
Annex 10	Aeronautical Telecommunications
Annex 11	**Air Traffic Services**
Annex 12	Search and Rescue
Annex 13	Aircraft Accident and Incident Investigation
Annex 14	**Aerodromes**
Annex 15	Aeronautical Information Services
Annex 16	Environmental Protection
Annex 17	Security
Annex 18	The Safe Transport of Dangerous Goods by Air

Airplane navigation lights:

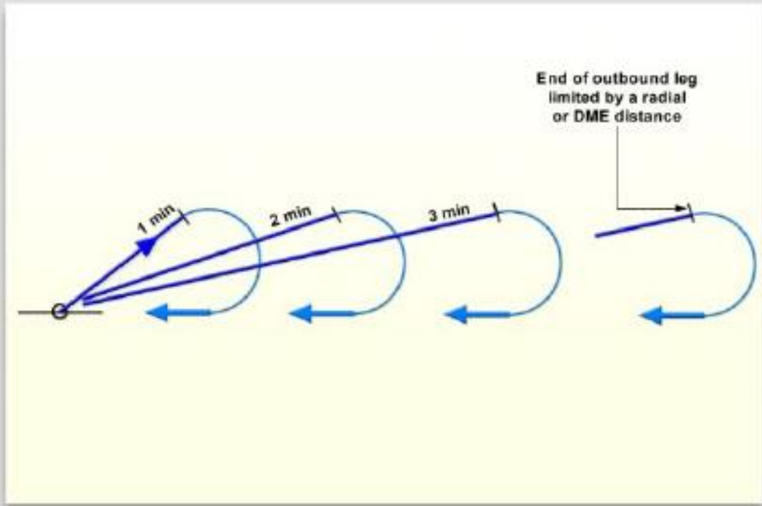




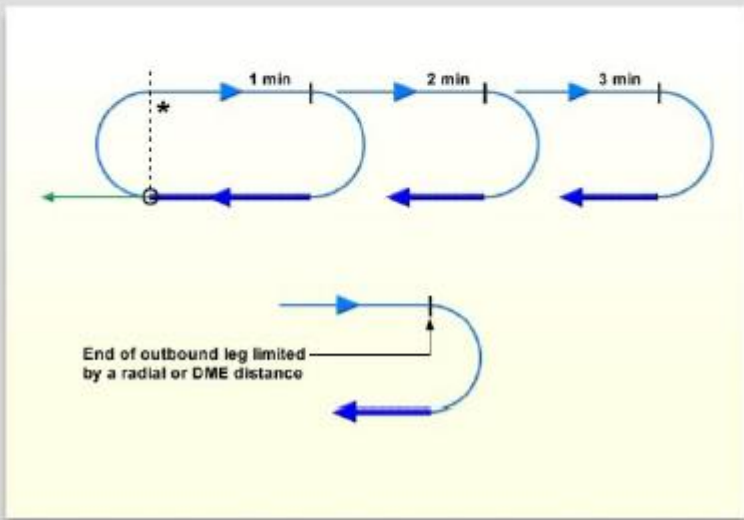
B. 80°/260° Procedure Turn



C. Base Turns



D. Racetrack Procedures



Minimum En-route Altitude (MEA)
MEA represents the lowest published altitude between radio fixes that assures acceptable navigational signal coverage and meets obstacle clearance requirements between those fixes. (TERR clearance on AWY and NAV signal coverage)

Minimum Holding Altitude (MHA)
MHA represents the lowest altitude prescribed for a holding pattern which assures navigation signal coverage, communications, and meets obstacle clearance requirements.

Minimum Obstruction Clearance Altitude (MOCA) [6500T]
(TERR clearance on AWY, no signal)

Minimum Off Route Altitude (MORA) [1500a]
MORA provides reference point clearance within 10NM of the route centerline (regardless of the route width) and end fixes. (obstacle clearance within 10nm of AWY centerline)

Minimum Sector Altitude (MSA)
MSA represents the safe altitude around a navigation station or aerodrome reference point. If no other information is present, the radius is 25NM and may be valid for a specific sector or approach runway. In case of an RNAV approach, MSA may be replaced by a Terminal Arrival Altitude (TAA) based on one of the procedure fixes. The borders of each sector are defined by bearings in regard to the originating point of the arc. MSAs and TAAs are used for airport navigation and provide a 300m (1000ft) obstacle clearance down to the intermediate approach segment.

Minimum Descent Altitude (MDA) or Minimum Descent Height (MDH)
A specified altitude or height in a non-precision approach or circling approach below which descent must not be made without the required visual reference.

- Minimum descent altitude (MDA) is referenced to mean sea level and minimum descent height (MDH) is referenced to the aerodrome elevation or to the threshold elevation if that is more than 2m (7ft) below the aerodrome elevation. A minimum descent height for a circling approach is referenced to the aerodrome elevation.
- Required visual reference means that section of the visual aids or of the approach area which should have been in view for sufficient time for the pilot to have made an assessment of the aircraft position and rate of change of position, in relation to the desired flight path. In the case of a circling approach, the required visual reference is the runway environment.
- **OCH and DH/MDH reference for:**
  - Precision APP = threshold elevation
  - Non-precision APP = aerodrome elevation OR threshold elevation if more than 7ft bellow aerodrome elevation
  - Circling APP = aerodrome elevation

Decision Altitude/Height (DA/H)
A Decision Height (DH) or Decision Altitude (DA) is a specified height or altitude in the precision approach at which a missed approach must be initiated if the required visual reference to continue the approach has not been acquired.

ATS comprises 3 services:

1. Air traffic services; Area Control Service / Approach Control Service / Aerodrome Control Service
2. Flight Information Service
3. Alerting Service

021 – AIRCRAFT GENERAL KNOWLEDGE

$\boldsymbol{hydroplaning\ speed\ (kt) = 9 * \sqrt{p(psi)}}$ $(bar * 14{,}5 = psi)$ A320=210-220psi → 134kt

Electricity:

- Parallel = vzporedno; Series = zaporedno
- AC – alternate current; DC – direct current

$$R = \frac{V}{I} \rightarrow I = \frac{V}{R} \rightarrow V = I * R$$

- R= resistance (ohms, Ω), I = current (amperes, A), V = voltage (volts, V), P = power (watts, W)

$$P = V * I \ \rightarrow P = R * I^2 \ \rightarrow P = \frac{V^2}{R} \ \rightarrow P = \frac{E(Joule)}{t(s)}$$

Engine instruments:

Main primary engine instruments [Airbus setting]:

- **EPR** – engine pressure ratio; is the core engine exhaust pressure compared to the intake pressure to the gas turbine engine (thrust measurement)
- **EGT** – exhaust gas temperature (engine temperature)
- **N1** – low speed rotor rpm [%]
- **N2** – high speed rotor rpm [%]
- Fuel flow indicator

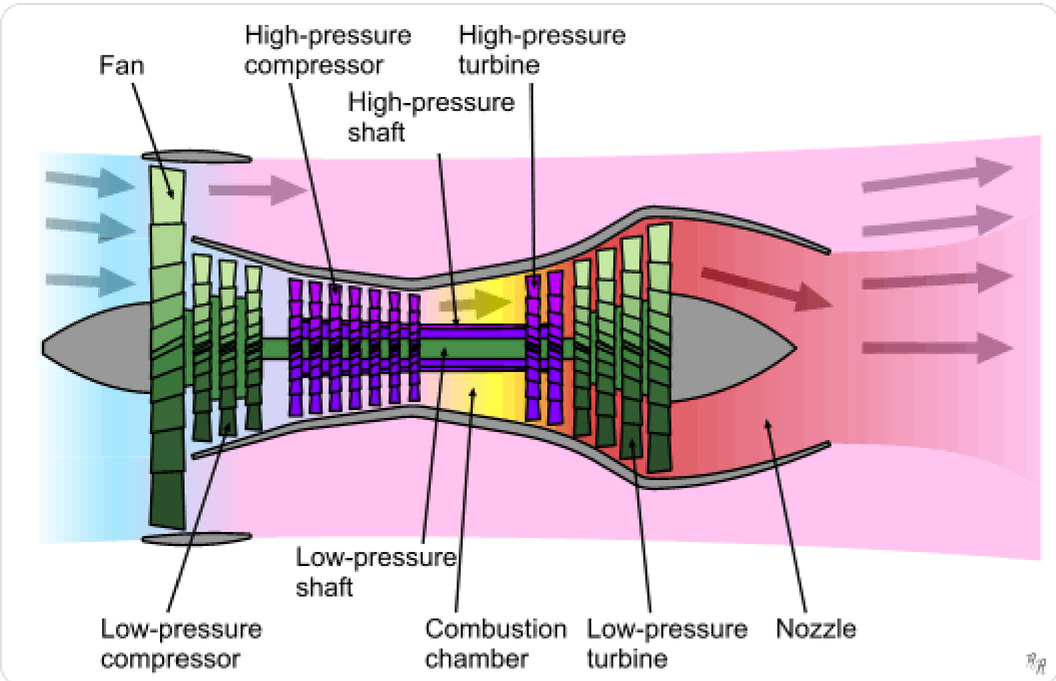
Secondary engine instruments:

- engine vibration meter, oil temperature/pressure/quantity

TURBOFAN ENGINE

First stage compressor greatly enlarged to provide bypass airflow around engine core.

Advantages: Quieter due to greater mass flow and lower total exhaust speed, more efficient for a useful range of subsonic airspeeds for same reason, cooler exhaust temperature.



Jet/gas turbine engine is most efficient at high altitudes and high rpm speeds (90 to 95%). At high altitudes there are two main consequences: Minimum cruise airframe drag and Best engine SFC.
The advantages of flying at high altitudes are:

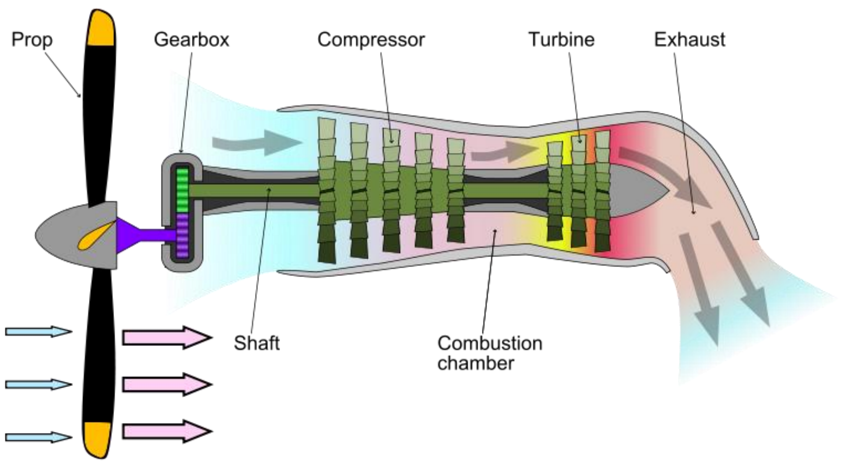
- Best SFC / increased (maximum) endurance
- Higher TAS for a constant IAS

(Thrust) Specific fuel consumption (TSFC) or sometimes simply specific fuel consumption (SFC), is an engineering term that is used to describe the fuel efficiency of an engine design with respect to thrust output. TSFC may also be thought of as fuel consumption per unit of thrust.

TSFC = Fuel burn (lbs/hour) / Engine Thrust (lb)

The bypass ratio (BPR) of a turbofan engine is the ratio between the mass flow rate of air drawn through the fan disk that bypasses the engine core (un-combusted air) to the mass flow rate passing through the engine core that is involved in combustion to produce mechanical energy. For example, a 10:1 bypass ratio implies that 10 kg of air passes around the combustion chamber through the ducted fan for every 1 kg of air passing through the combustion chamber.
High bypass engine produces more FAN thrust than jet thrust.

AIRBUS IAE V2500 engine:
Bypass: 4,8:1
Thrust: 26.400lbs
Weight: 2.359kg

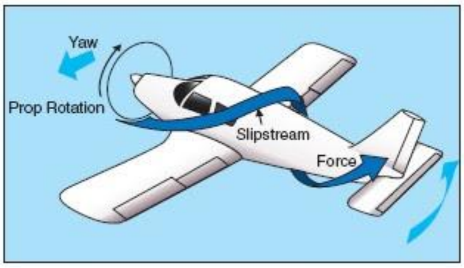


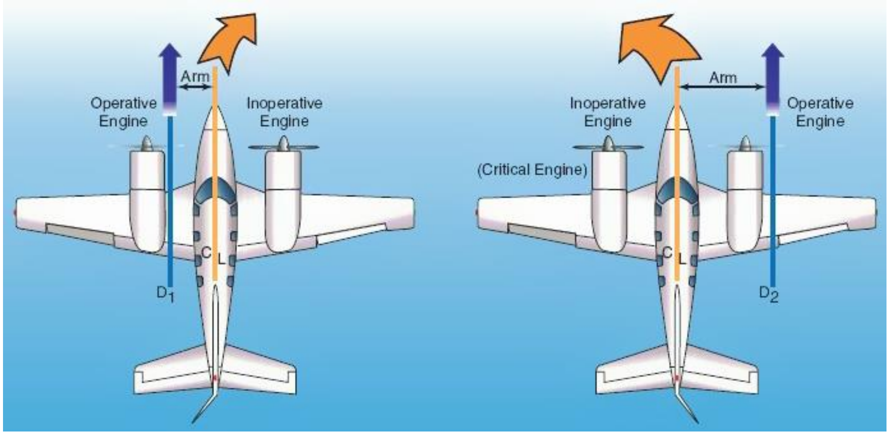
Compressor stall
Is a situation of abnormal airflow through the compressor stage of a jet engine, causing a stall of the vanes of the compressor rotor.
All compressor stalls result in a loss of engine power. This power failure may only be momentary (occurring so quickly it is barely registered on engine instruments), or may shut the engine down completely (that is, causing a flameout). When a compressor stall affects the airflow through the entire engine it is also known as a compressor surge

Critical engine
The critical engine of a multi-engine, fixed-wing aircraft is the one whose failure would result in the most adverse effects on the aircraft's handling and performance. On propeller aircraft, there is a difference in the remaining yawing moments after failure of the left or the right (outboard) engine when all propellers rotate in the same direction due to the P-factor. An engine can also be called critical when it is the only engine that drives a hydraulic pump for augmenting/ boosting flight controls.

Slipstream effect – [picture]

Asymmetric blade effect – the P-factor [picture next page]





On aircraft with counter-clockwise-rotating propellers, the right engine would be the critical engine.

PISTON ENGINE

"Stroke" refers to the movement of the piston in the engine. 2 Stroke means one stroke in each direction. A 2 stoke engine will have a compression stroke followed by an explosion of the compressed fuel. On the return stroke new fuel mixture is inserted into the cylinder.

A 4 stroke engine has 1 compression stroke and 1 exhaust stoke. Each is followed by a return stroke. The compression stroke compresses the fuel air mixture prior to the gas explosion. The exhaust stroke simply pushes the burnt gases out the exhaust.

Four stroke engine sequence: intake – compression – power – exhaust

TURBOCHARGER

Is a turbine-driven forced induction device that increases an engine's efficiency and power by forcing extra air into the combustion chamber.

SUPERCHARGER

Is an air compressor that increases the pressure or density of air supplied to an internal combustion engine. This gives each intake cycle of the engine more oxygen, letting it burn more fuel and do more work, thus increasing power.

SHUTTLE VALVE

Is a type of valve which allows fluid to flow through it from one of two sources. Generally a shuttle valve is used in pneumatic systems, although sometimes it will be found in hydraulic systems.

HIGHEST ENGINE PERFORMANCE

- LOW humidity
- LOW temperature
- HIGH pressure density

Worst case: <u>hot and high</u> is a condition of low air density due to high ambient temperature and high airport elevation.

Reduced engine thrust (FLEX):

- To protect engine life and improve reliability
- To reduce the noise

Even an airplane at MTOW can use FLEX, provided that TODR is not limiting.

022 – INSTRUMENTATION

The pressure altitude: is the altitude shown on altimeter with standard (1013) setting
The density altitude: is pressure altitude corrected for temperature and humidity

AIRSPEED INDICATOR
IAS → (**p**osition/instrument error) → CAS → (**c**ompressibility) → EAS → (**d**ensity) → TAS
MEMO: ICE Tea Preferred Cold Drink (ICET **PCD**)

	ASI	**VSI**	**Altimeter**
Pitot source blocked	Increases in CLIMB; Decreases in DESCEND	Unaffected	Unaffected
ONE static source blocked	Inaccurate while side slipping; very sensitive in turbulence		
BOTH static source blocked	Decreases in CLIMB; Increases in DESCEND	Does NOT change; frozen	Does NOT change; frozen
Static and pitot blocked	ALL indications remain constant		

TCAS (Traffic Collision Avoidance System):
- Resolution advisory (RA) (red full square + arrow)
- Traffic advisory (TA) (yellow full circle)
- Proximate traffic (blue or white diamante)

RECORDING DEVICES:
FDR – flight data recorder
Required for ALL airplanes:
- Multiengine turbine with more than 9 passenger seats or
- MTOW more than 5.700kg.

Data must be kept for 25 hours.

CVR – cockpit voice recorder.
Requirement: the same as for FDR. Data must be kept for 2 hours.

Slipping
- too much bank,
- or too little rudder

Skidding
- insufficient bank,
- or too much rudder

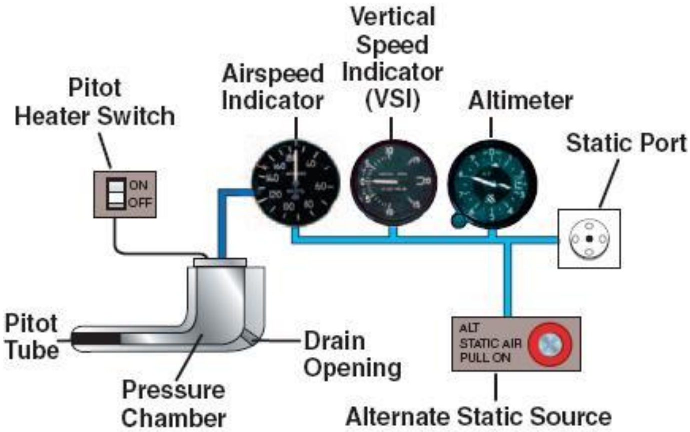
MAGNETIC COMPASS errors
MEMORY AID: Turn to N, Under Shoot. Turn to South, Over Shoot.
MEMORY AID: A N D S - Accelerate North, Decelerate South

Mach meter errors:

- Instrument error, which is caused by inaccuracies in meter construction
- Pressure error, also known as position error

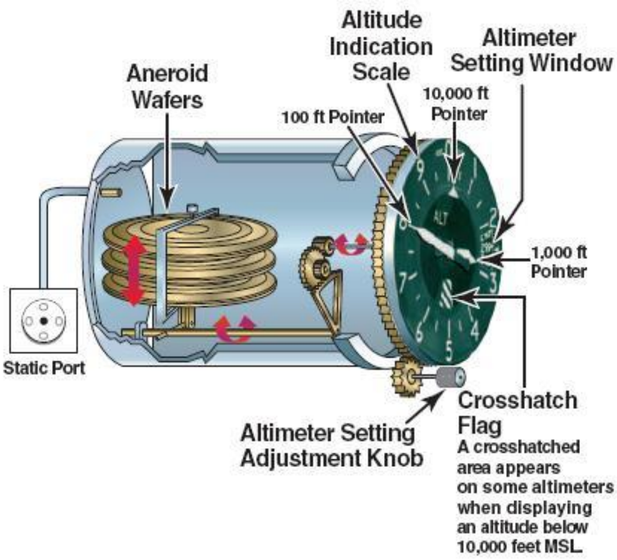
PITOT-STATIC SYSTEM

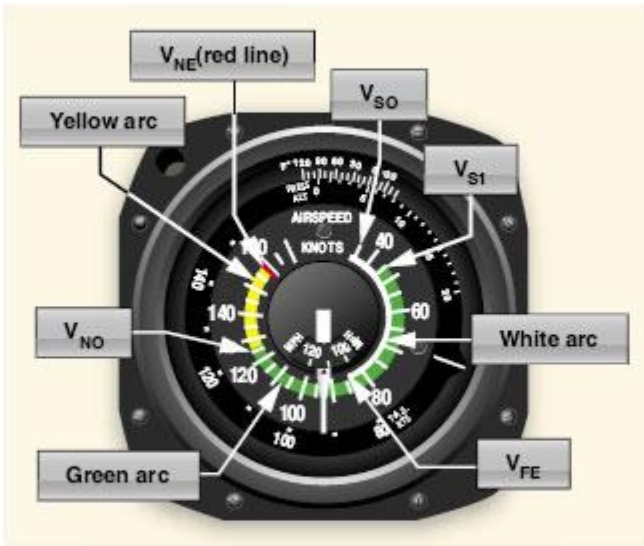
Total pressure (static and dynamic): also called pitot pressure, which is measured by pitot probe
Static pressure: which is measured on static port of pitot tube or by separate static vent
Dynamic pressure = total pressure – static pressure



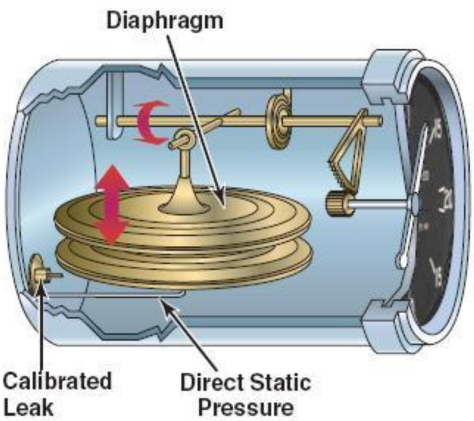
When air temperature is 0°C or colder temperature correction MUST be added to:
DA/DH or MDA/MDH and step down fixes inside the FAF AND all low altitude approach procedure altitudes in mountainous regions (terrain of 3.000ft or higher).

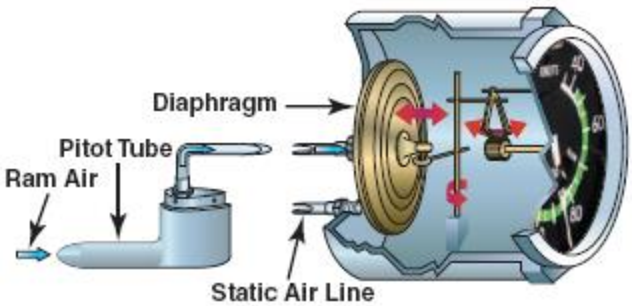
ALTIMETER (calibrated to ISA conditions) **AIR SPEED INDICATOR**





VERTICAL SPEED INDICATOR **AIR SPEED INDICATOR**





031 – MASS & BALLANCE

FACTS
CG is the point through which the total weight of a body will act. CG is usually in front of CP (centre of pressure). CG optimum is near AFT limit.
A tail heavy airplane is less stable and stalls at a lower speed than a nose heavy airplane.

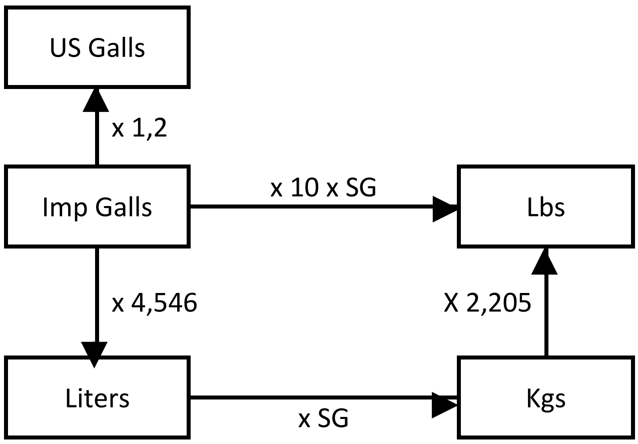
CG is outside forward limit:

- stalling speed will be increased
- longitudinal stability is increased, leading to higher stick forces in pitch
- range and endurance are decreased
- nose up pitch is decreased
- difficulty in rotating for take-off

CG is outside aft limit:

- Longitudinal stability is reduced, and if the CG is too far aft, the aircraft will become unstable.
- stick forces in pitch will be light, leading to the possibility of over stressing the aircraft
- recovering from the spin may be more difficult
- range and endurance are increased (due to LESS trim drag)
- glide angle will be more difficult to sustain

	Stall Speed	**Cruise Speed**	**Stability**	**Endurance / Range**
Forward CG	Faster IAS	Slower	More	Reduced
Aft CG	Slower IAS	Faster	Less	Increased



$$moment = mass * arm$$

$$CG = \frac{total\_moment}{total\_mass}$$

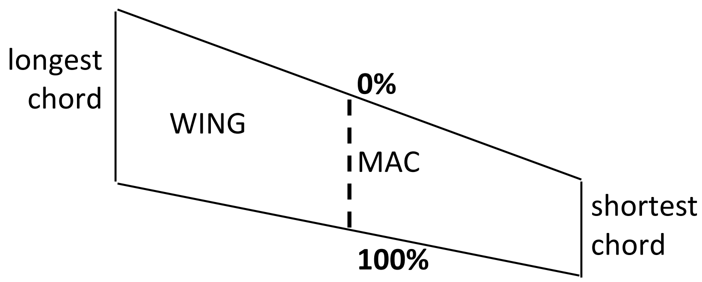
Weight of JET A1 = 6,71 lb/US gal

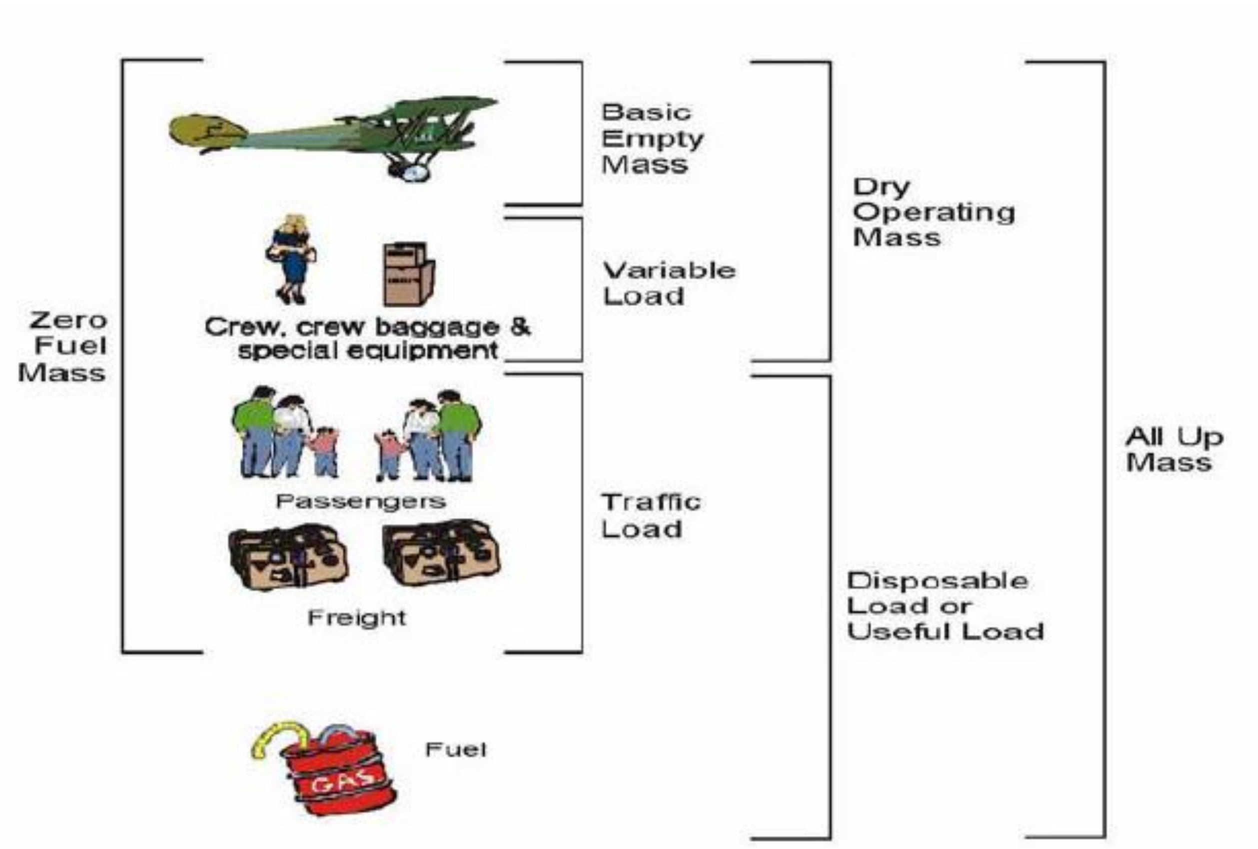
EU-OPS (1.620) - Mass values for passengers and baggage

Passenger seats:	**20 and more**		**30 and more**
	Male	**Female**	**all adult**
All flights except holiday charters	88 kg	70 kg	84 kg
Holiday charters	83 kg	69 kg	76 kg
Children	35 kg	35 kg	35 kg

ABBREVIATIONS

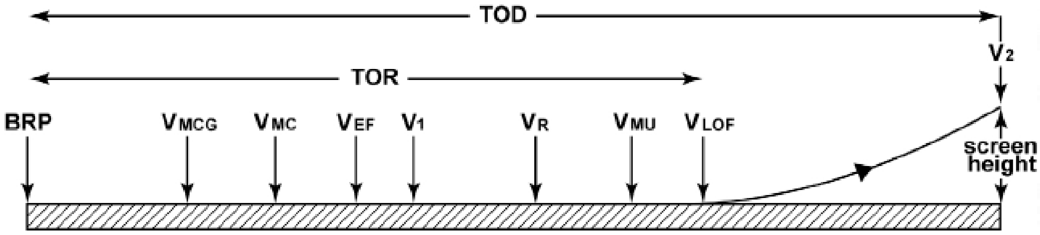
- **DOM** – dry operating mass (airplane – usable fuel and traffic load)
- **BEM** – basic empty mass (airplane + unusable fuel + engine oil + engine coolant)
- **OM** – operating mass
- **DOI** – dry operating index
- **Traffic load** – the total mass of passengers, baggage and freight
- **Variable load** - this includes the role equipment, the crew and the crew baggage
- **ZFM** – zero fuel mass
- **MZFM** – max zero fuel mass
- **TOM** – take-off mass
- **MTOM** – max take-off mass
- **MLM** – max structural landing mass
- **CG** – center of gravity
- **BA** – balance arm
- **RTOM** – regulated take-off mass
- **RLM** – regulated landing mass
- **MAC** – mean aerodynamic chord





032 – PERFORMANCE

V_1 must always be $>V_{MCG}$, $<V_{MBE}$, $\leq V_R$
V_R must always be $\geq V_1$, $>V_{MCA}$
V_2 must always be $>V_{MCA}$, $>V_S$, $>V_R$



V-SPEEDS

V_A	Design maneuvering speed, also known as the "Speed for maximum control deflection." This is the speed above which it is unwise to make full application of any single flight control (or "pull to the stops") as it may generate a force greater than the aircraft's structural limitations.
V_1	Maximum speed during takeoff at which a pilot can safely stop the aircraft without leaving the runway. **[min: V_{MCG}; max: V_{MBE}]**
V_R	Rotation speed. The speed at which the aircraft's nose wheel leaves the ground. **[min: V_1 and 1,05 V_{MCA}]**
V_2	Takeoff safety speed. The speed at which the aircraft may safely become airborne with one engine inoperative (achieved by screen height 35ft). **[min: 1,2 V_S and 1,1 V_{MCA}]**
V_3	The aircraft speed on all engines as it passes through the screen height.
V_4	Is the all engine operating take off climb speed the aircraft will achieve by 400ft.
V_{NE}	Never exceed speed.
V_{EF}	The speed at which the critical engine is assumed to fail during takeoff.
V_{MO}	Maximum operating limit speed
V_{NO}	Maximum structural cruising speed or maximum speed for normal operations.
V_{MU}	Minimum unstick speed.
V_{LE}	Maximum landing gear extended speed.
V_{LO}	Maximum landing gear operating speed.
V_{FE}	Maximum flap extended speed.
V_X	Best angle of climb speed – na najkrajši razdalji dosežeš največjo višino
V_Y	Best rate of climb speed – v najkrajšem času dosežeš največjo višino
V_{REF}	Landing reference speed or threshold crossing speed.
V_S	Stall speed or minimum steady flight speed for which the aircraft is still controllable.
V_{SO}	Stall speed or minimum flight speed in landing configuration.
V_{MCA}	Minimum control speed in the air – the minimum airspeed at which the aircraft is directionally controllable in flight with one engine inoperative and takeoff power on the operative engine(s).
V_{MCG}	Minimum control speed on the ground – the minimum airspeed at which the aircraft is directionally controllable during acceleration along the runway with one engine inoperative, takeoff power on the operative engine(s) and with nose wheel steering assumed inoperative.
V_{RA}	Rough air speed (turbulence penetration speed).
V_{MBE}	Maximum brake energy speed. Is the maximum speed on the ground from which a stop can be accomplished within the energy capabilities of the brakes. $V_1 \leq V_{MBE}$
V_{MCL}	Minimum control speed in the landing configuration with one engine inoperative.
V_{IMD}	Minimum drag speed.
V_{LOF}	Speed at point where airplane lifts off.

Flaps down = V_2 decreases   Flaps up = V_2 and V_{LOF} increases

An aircraft's takeoff and landing performance is subject to many variable conditions:

- Aircraft weight
- Flap setting
- Aerodrome pressure altitude
- Air density
- Humidity
- Wind
- Runway length, slope and surface (including wet or icy conditions)

RWY conditions	Turbo-jet
DRY	0,60 [60%]
WET	0,52 [52%]

FACTS

- Balanced field: **TODA=ASDA**, for the aircraft weight, engine thrust, aircraft configuration and runway condition
- Glide angle is not affected by airplane weight (gliding range is not effected by airplane mass)
- A higher pressure altitude at ISA temperature: decreases the field length limited take-off mass
- Specific range (SR) = TAS / total fuel flow
- As altitude increases V_X remains constant and V_Y decreases
- When comparing V_X to V_Y: V_Y will always be greater than or equal to V_X
- The requirement with regards to obstacles in is that the net take-off flight path should clear all obstacles by minimum 35 feet vertically
- To reduce the effects of headwind in climb at cruise climb speed
- To take advantage of tail wind during climb at V_Y

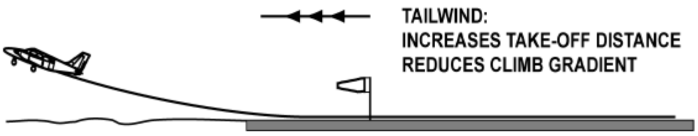
Changes to IAS/Mach No./TAS in climb and descent phases

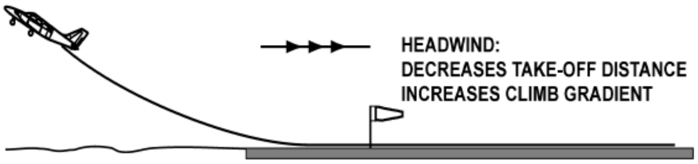
If you climb at a constant IAS then the Mach No increases. Why? Because as you climb, the local speed of sound decreases (decreased temperature) and your TAS increases, therefore if Mach number = TAS/Local Speed of sound then Mach number increases.

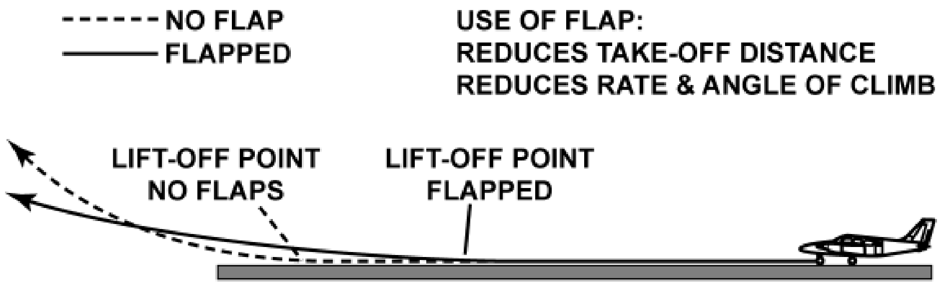
CLIMB (-ECTM+)	DESCEND (+ECTM-)
Speed of Sound is slower in cold air, faster in warm air. The Speed of Sound is constant in the Tropopause. Climbing at a fixed IAS, Mach number and TAS increase. Climbing at a fixed Mach number, IAS and TAS decrease.	Descending at a fixed Mach number causes IAS and TAS increase. Descending at a fixed IAS causes Mach No. and TAS decrease.

Change from IAS to MN

Mach number is used as a speed reference at high altitudes, usually above 26.000ft, because the MN becomes the aircraft's limiting speed in preference to IAS. Up to approximately 26.000ft, an aircraft will climb at a constant IAS against an increasing MN, where the MN speed reaches the aircraft's MN limiting speed. Then above 26.000ft the aircraft is flown at a constant MN with a decreasing IAS for an increase in altitude.

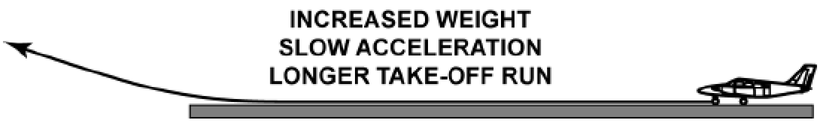

TAILWIND:
INCREASES TAKE-OFF DISTANCE
REDUCES CLIMB GRADIENT

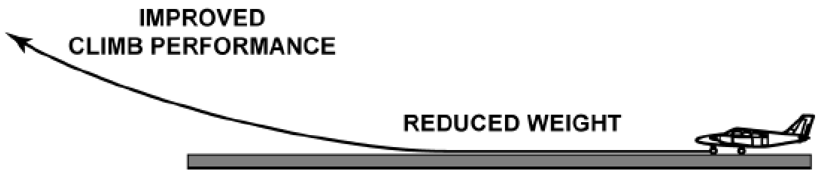

HEADWIND:
DECREASES TAKE-OFF DISTANCE
INCREASES CLIMB GRADIENT


NO FLAP
FLAPPED
USE OF FLAP:
REDUCES TAKE-OFF DISTANCE
REDUCES RATE & ANGLE OF CLIMB
LIFT-OFF POINT
NO FLAPS
LIFT-OFF POINT
FLAPPED


HIGH APPROACH SPEED
SHALLOW APPROACH
NO FLAP

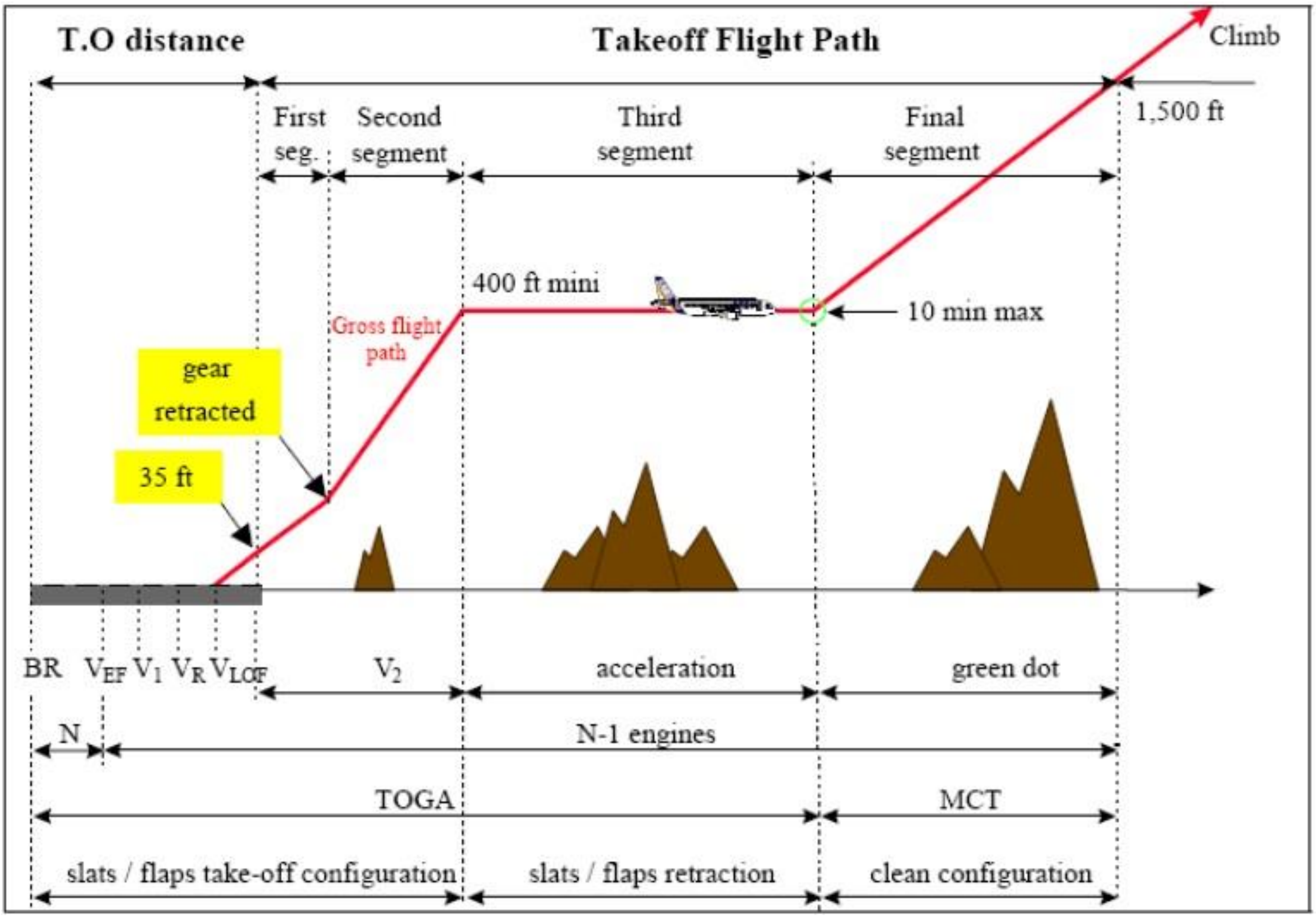

LOW APPROACH SPEED
STEEP APPROACH
FULL FLAP


INCREASED WEIGHT
SLOW ACCELERATION
LONGER TAKE-OFF RUN


IMPROVED
CLIMB PERFORMANCE
REDUCED WEIGHT

TAKEOFF FLIGHT PATH SEGMENTS:

	First Segment:	Second Segment:	Third segment:	Final Segment:
TWIN	**POSITIVE**	**2.4%**	**POSITIVE**	**1.2%**
QUAD	0.5%	3.0%	POSITIVE	1.7%
Start when	Screen height (35ft) is reached	Gear fully retracted	Acceleration height reached (400 ft min)	En route configuration achieved
Speed ref.	$V_{LOF} \rightarrow V_2$	V_2	Acceleration from V_2 to green dot	Green dot



Standard SID climb gradient: **3,3%**

Landing Climb gradient (landing configuration: all engines, gear down, flap land): **3,2%**

Standard missed approach climb gradient: **2,5%**

Approach Climb gradient (one engine out, approach configuration: gear down, flap app): **2,1% (twin engine)**

Missed Approach Climb gradient single engine: **2.1% (twin engine)**

Climb Gradient is the rate, expressed as a percentage, of the change in geometric height divided by the horizontal distance traveled in a given time.

Climb rate (fpm) = Gradient (%) * Airspeed (kts)

Gross and net climb gradients

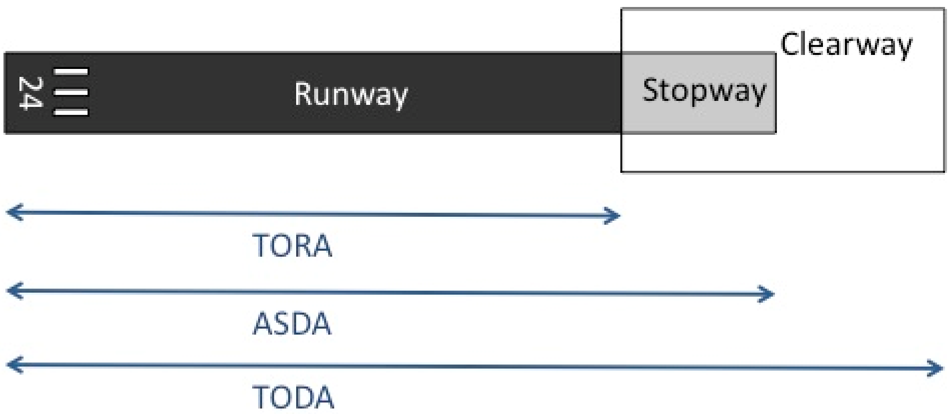
Gross climb gradient is the minimum climb performance that must be satisfied during certification trials when flown with test pilots.

Net climb gradient are the gross climb gradients with a standard deduction for pilot operating technique of line pilots and reduction in engine thrust performance with age.

To get the net performance, Gross performance is reduced by fixed percentages which depends on the number of engines (0.8% for a twin, 3 engines 0.9%, 4 engines 1.0%). In the event of an engine failure at V1 an aircraft is required to meet the gross climb gradients of positive rate, then 2.4%, and finally 1.2% (twin engine).
The net flight path gives you 35ft clearance within 300ft horizontal either side of center.

TOD – takeoff distance (TOD ≤ TODA)
TOR – takeoff run
ASD – accelerate stop distance (ASD ≤ ASDA)
LDA – landing distance available. Is the distance available for landing taking into account any obstacles in the flight path, from 50ft to the end of the landing RWY.
LDR – landing distance required. Is the distance from 50ft to complete stop on the RWY.

TORA – takeoff run available	= RUNWAY
TODA – takeoff distance available	= TORA + clearway
ASDA – accelerate stop distance available	= TORA + stopway



033 – FLIGHT PLANING & MONITORING

FUEL POLICY (EU-OPS)

Taxi fuel

- Taxi fuel shall not be less than the amount, expected to be used prior to take-off. Local conditions at the departure aerodrome and APU consumption shall be taken into account.

Trip fuel

Alternate fuel

Contingency fuel

- 5% of planned trip fuel
- or 3% of planned trip fuel (if EN-ROUTE ALTERNATE aerodrome is available)
- But AT LEAST to fly 5min at holding speed at 1.500ft above destination aerodrome in standard conditions

Final reserve fuel (holding 1.500 feet above aerodrome in standard conditions)

- 30 min for jet and turboprop,
- 45 min for piston engine airplane

Minimum additional fuel

- The minimum additional fuel which shall permit the aircraft to descend as necessary and proceed to an adequate alternate aerodrome in the event of engine failure or loss of pressurization, whichever requires the greater amount of fuel based on the assumption that such a failure occurs at the most critical point along the route.
  a) hold there for 15min at 1.500ft above airport elevation in standard conditions; and make an approach and landing;
     AND
  b) Holding for 15min at 1.500ft above destination airport elevation in standard conditions, where a flight is operated without a destination alternate aerodrome.

  Note: Additional fuel is only required, if the minimum amount of fuel calculated for
  - Trip fuel
  - Contingency fuel
  - Alternate fuel
  - Final reserve fuel → is not sufficient for such an event.

Extra fuel

- Extra fuel is fuel which shall be on the discretion of the commander.

When planning to an **isolated aerodrome** for which an alternate does not exist the fuel required is the sum of:

- Taxi fuel;
- Trip fuel;
- Contingency fuel;
- Additional fuel if required, but not less than fuel to fly for <u>two hours</u>, calculated with the <u>normal cruise consumption</u>, after arriving overhead the destination aerodrome, including final reserve fuel; and
- Additional fuel at the discretion of the Commander

Fuel Emergency

The PIC shall declare a situation of fuel emergency by broadcasting MAYDAY, MAYDAY, MAYDAY FUEL, when the calculated usable fuel predicted to be available upon landing at the nearest aerodrome where a safe landing can be made is <u>less than the planned final reserve fuel</u>.

Performance classes

- **Performance class A** = multi-engine JET and Turboprops (> 5.700kg or > 9 seats)
- Performance class B = propeller driven aeroplanes (≤ 5.700kg and ≤ 9 seats)
- Performance class C = reciprocating engines (> 5.700kg or > 9 seats)

SEMI-CIRCULAR HEIGHT

- Pod FL290 → IFR 000º – 179º = even 180º – 359º = odd
- RVSM airspace from FL290 to FL410
- **RVSM** – Reduced Vertical Separation Minima

MNPS – Minimum Navigation Performance Specification
Extends from: 27° North to 90° North, vertical from FL285 to FL420
Lateral separation applied between MNPS approved aircraft is 60NM. The longitudinal separation minima applied are 15 minutes for crossing tracks and 10 minutes for aircraft that have reported a common point and follow the same track or continuously diverging tracks.

RNP - Required Navigation Performance
An RNP of 10 means that a navigation system must be able to calculate its position to within a circle with a radius of 10 nautical miles. Oceanic airspace has an RNP of 4 or 10.

PBN - Performance-Based Navigation

ETOPS – Extended range Twin-engine Operational Performance Standards
ETOPS flight is a twin engine jet airplane flight conducted over a route, where no suitable airport is within an area of 60 minutes flying time in still air at the approved one engine out cruise speed (A350XWB – 370min ETOPS)

Area navigation (RNAV) - is a method of IFR navigation that allows an aircraft to choose any course within a network of navigation beacons, rather than navigating directly to and from the beacons. This can conserve flight distance, reduce congestion, and allow flights into airports without beacons.
RNAV can be defined as a method of navigation that permits aircraft operation on any desired course within the coverage of station-referenced navigation signals or within the limits of a self-contained system capability, or a combination of these.

Flight rules IFR to VFR: Y / VFR to IFR: Z

ICAO aircraft weight category	
Light (L)	7.000 kg and less
Medium (M)	7.000kg and 136.000kg
Heavy (H)	> 136.000kg
Super (J)	A380-800

Rate 1 turn	**3º/sec**	**180º/min**
Rate 2 turn	6º/sec	360º/min
Rate 3 turn	9º/sec	540º/min

ALTERNATE AERODROMES
Take-off alternate - An alternate aerodrome at which an aircraft can land should this become necessary shortly after take-off and it is not possible to use the aerodrome of departure.
En-route alternate - An aerodrome at which an aircraft would be able to land after experiencing an abnormal or emergency condition whilst en-route.
Destination alternate - An alternate aerodrome to which an aircraft may proceed should it become impossible or inadvisable to land at the aerodrome of intended landing.

Take-off alternate
A Take-Off Alternate Aerodrome shall be selected and specified in the operational flight plan if the weather conditions at the aerodrome of departure are at or below the applicable aerodrome operating minima or it would not be possible to return to the aerodrome of departure for other reasons.
Shall be located within:

- 1 hour flight time at the single engine cruise speed for two engine aircraft. **(Wizz Air = 250nm)**
- 2 hour flight time at the one-engine inoperative cruise speed for three, four engine aircraft.

Weather minimums:
1 hour before and ending 1 hour after the estimated time of arrival to alternate the weather conditions will be at or above the landing minimums

DESTINATION AND DESTINATION ALTERNATE
1 hour before and ending 1 hour after the estimated time of arrival to destination the weather conditions will be at or above the applicable minima as follows:

Planned Type of Approach	Planning Minima
ILS CAT 2 / ILS CAT 3	ILS CAT 1 minima (RVR)
ILS CAT 1 / CAT 1LTS	Non-Precision minima (RVR and Ceiling)
Non-Precision	Increased Non-Precision minima (RVR + 1000 m and Ceiling + 200 ft)
Circling	Circling minima

Flight without alternate
An operator must select <u>at least one destination alternate</u> for each IFR flight **unless**:

- flight is not more than 6 hours and
- two separate runways are available at the destination and it is possible to make an approach to the VMC for 1 hour before and after ETA
- The airport is separated and there is no suitable alternate.

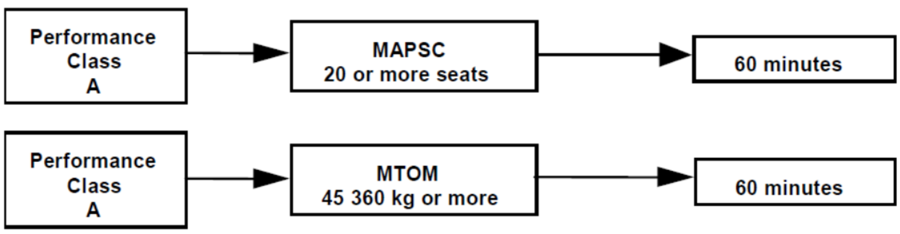
Selection of two Destination Alternates

- the appropriate weather reports or forecasts for the destination or any combination thereof, indicate that during a period commencing 1 hour before and ending 1 hour after the ETA at the destination, the weather conditions will be below the applicable planning minima, or
- no weather forecasts are available for destination

EN-ROUTE ALTERNATE non ETOPS
En-route alternate (ERA) aerodrome: An adequate aerodrome along the route, which may be required at the planning stage.
3 % ERA: An en-route alternate aerodrome selected for the purposes of reducing contingency fuel to 3 %.

EU OPS 1.245 - Maximum distance from an adequate aerodrome for two-engined aeroplanes (non ETOPS)
Unless specifically approved by the Authority in accordance with OPS 1.246 (ETOPS approval), an operator shall not operate a two-engined aeroplane over a route which contains a point further from an adequate aerodrome than (see table below).

Maximum distance from an adequate aerodrome for two-engined aeroplanes without ETOPS Approval



Adequate Aerodrome: An aerodrome which the operator considers to be satisfactory, taking account of the applicable performance requirements and runway characteristics; at the expected time of use, the aerodrome will be available and equipped with necessary ancillary services such as ATS, sufficient lighting, communications, weather reporting, navaids and emergency services.

040 – HUMAN PREFORMANCE

ATMOSPHERE

- 78% nitrogen, 21% oxygen and 1% other gasses.

HYPERVENTILATION

Occurs when the rate and quantity of alveolar ventilation of carbon dioxide exceeds body's production of carbon dioxide. Hyperventilation can be voluntary or involuntary.

Increase in breathing → reduction in CO2 → change of acid balance (blood more alkaline) → reduction of artery diameter → lack of oxygen

- If someone hyperventilates due to stress his blood will get: more alkaline
- Hyperventilation can cause unconsciousness, because blood circulation to the brain is slowed down

HYPOXIA

- is a condition in which the body or a region of the body is deprived of adequate oxygen supply
- pain in the joints = not a symptom of hypoxia

Cyanosis

Is the appearance of a blue or purple coloration of the skin or mucous membranes due to the tissues near the skin surface having low oxygen saturation. Exists only in hypoxia.

TIME OF USEFUL CONSCIOUNESS

18.000ft	30 min
25.000ft	2-3 min
30.000ft	45-75 sec
40.000ft	20 sec
45.000ft	12 sec

OTHER

- westbound trans-oceanic flights are easier to cope with than eastbound (red eye) flights
- the brain can only deal with one decision at a time
- situational awareness = maintaining an accurate mental model

LANDING ILLUSIONS

Condition	Perception	Unintended Action	Result
Narrow / long runway	Being too high	Push	Land short / Land hard
Wide or short runway	Being too low	Pull	Land long / overrun
Runway or terrain uphill slope	Being too high	Push	Land short / Land hard
Runway or terrain downhill slope	Being too low	Pull	Land long / overrun
Bright runway lighting	Being too close (too steep)	Push	Land short / Land hard
Low intensity lighting	Being farther away (too shallow)	Pull	Land long / Overrun
Light rain, fog, haze, mist smoke, dust	Being too high	Push over	Land short / Land hard
Heavy rain	Being too close	Push over	Land short / Land hard
Entering fog (shallow layer)	Increasing pitch	Push over	Steep glide path / CFIT
Flying in haze	Being farther away (too shallow)	Pull up	Land long / Overrun
Drifting rain, snow or sand	Aircraft drifting sideways	Undue drift correction	Off-runway landing
Wet Runway	Being farther away (too high)	Late flare	Hard landing
Crosswind	Being angled with runway	Cancel drift correction	Drifting off track / off runway centerline

050 – METEOROLOGY

STANDARD ATMOSPHERE (ISA)

- pressure: 1013,25 hPa
- temperature: 15°C (see level)
- air density: 1,225 kg/m3
- temperature gradient: 1,98°C/1.000ft
- troposphere height: 11.000 m (-56,5°C)

TEMPERATURE

- OAT – is the ambient outside air temperature
- SAT – ambient static air temperature (the same as OAT). Actual temperature of the air outside, the same your thermometer will pick up if you were not moving.
- TAT – total air temperature indicated on the air temperature instrument. It is a product of SAT and the adiabatic compression rise in temperature experienced on the temperature probe.

CAVOK (Ceiling And Visibility Okay)

- Visibility > 10km
- No cloud occur below 5.000ft (or the lowest sector height)
- No Cb in the vicinity (>15 km)
- No precipitation (except ice crystals), thunderstorm, low snow drift, shallow fog, low drift dust or sand and sand- or dust- storms.

ALTIMETRY

- QNH ↑ = true altitude is HIGHER than indicated altitude
- QNH ↓ = true altitude is LOWER than indicated altitude
- Temperature is higher than ISA = altimeter shows lower altitude
- Temperature is lower than ISA = altimeter shows higher altitude ("temperature is low look below")
- **MEMO:** GOING FROM HIGH TO LOW…LOOK BELOW
- **Altimeter error** = 4 ft per 1°C deviation from ISA for every 1.000 ft
- Altimeter settings: QNH ↑ = altitude ↑
- **1hPa = 27,29ft = 8,32m**
- QNE = Altimeter setting 29,92 inches of mercury or 1013,2 millibars
- QNH = Altitude above mean sea level based on local station pressure (airfield pressure)

FACTS

- **Dry adiabatic lapse rate (DALR)** = 3,0°C /1.000 FT (unsaturated air)
- **Saturated adiabatic laps rate (SALR)** = 1,5°C /1.000 FT
- What type of front / occlusion usually moves the fastest: Cold front
- T↓ = relative humidity ↑ (increases with increasing altitude)
- 1KT = 0,52 m/s = 1,85 km/h
- **Cloud base formula** = (TEMP-DP)/3 * 1.000 [ft]
- To be considered a **Jet Stream**, the accepted minimum speed limit is **60 knots**

CLOUDS

- Curriform
- Cumuliform
- Stratiform
- Nimbus

These are than further subdivided according to height

- Cirro – high level cloud (base > 16.500 – 20.000 ft)
- Alto – medium level cloud (base > 6.500 ft)
- No prefix, low level cloud (base < 6.500 ft)

WIND

Geostrophic: It blows parallel to straight isobars, when no friction is present. Forces in balance: Gradient force and Coriolis force. The geostrophic wind velocity depends upon latitude (Increase with decreasing latitude).
Anabatic: is a local valley wind that flows UP the side of a hill
Katabatic: is a local valley wind that flows DOWN the side of a hill
Land/sea breezes: flows from sea to land during the day, and from land to sea during the night

FOG TYPES

Radiation fog: This type of fog forms at night under clear skies with calm winds when heat absorbed by the earth's surface during the day is radiated into space. Radiation fog varies in depth from 3 feet to about 1,000 feet and is always found at ground level and usually remains stationary.
Advection fog: Advection fog often looks like radiation fog and is also the result of condensation. However, the condensation in this case is caused not by a reduction in surface temperature, but rather by the horizontal movement of warm moist air over a cold surface.
Upslope fog: Forms when light winds push moist air up a hillside or mountainside to a level where the air becomes saturated and condensation occurs.

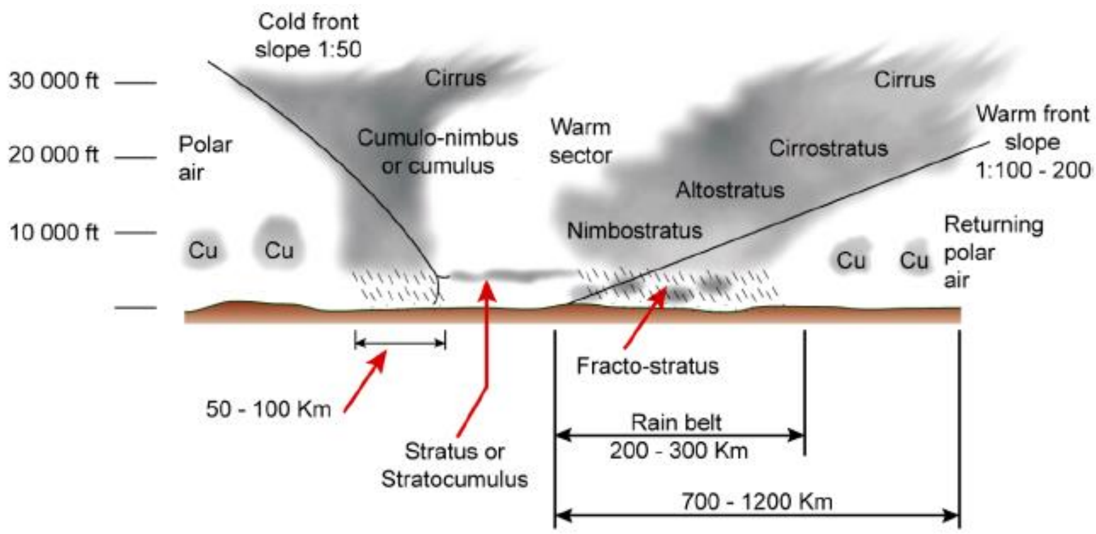
AIR MASSES/PRESSURE SYSTEMS and FRONTS

A pressure system is a circulating air mass that is classified as either a low or high.

Low pressure system: the wind circulates counterclockwise around a low pressure system in the northern hemisphere and clockwise in the southern. Flying toward a low in the northern hemisphere, an aircraft will experience RIGHT drift. (PORT drift in the southern hemisphere).
Moves faster over the earth and has a shorter life span than high pressure system. Air is RISING in the depression.
Weather: visibility may be good, moderate to strong winds, cloud formation and related weather are present and frontal weather is present.

MEMO: From HIGH to LOW, beware below! (your altimeter will over read)

High pressure system: anticyclone. Air is subsiding (descending) in the center.
The wind circulates clockwise around a high pressure system in the northern hemisphere and counterclockwise in the southern. Flying toward a high in the northern hemisphere, an aircraft will experience LEFT drift.
Weather: clear upper skies with little or no low-level clouds and precipitation, light winds and possible poor visibility at low levels.



Geostrophic Force (Coriolis Effect) and Geostrophic Wind
Under normal circumstances air would just move from high to low pressure, across the isobars (due to the Pressure Gradient Force, or PGF). The PGF acts at right angles to the isobars, from high to low pressure. Its size depends on the spacing of the isobars and air density.
However, this is only true around the Equator. In the Northern Hemisphere, air actually moves clockwise round a high pressure area and anticlockwise round a low, because the Earth is spinning, and deflects normal air movement (over the ground), until eventually the wind blows along the isobars (instead of across) at around 2,000 feet.

ITCZ: Intertropical Convergence Zone, is the area encircling the earth near the equator where the northeast and southeast trade winds come together (between 30 NM and 300 NM wide)

VOLMET (French origin VOL (flight) and METEO (weather)), or meteorological information for aircraft in flight, is a worldwide network of radio stations that broadcast TAF, SIGMET and METAR reports on shortwave frequencies, and in some countries on VHF too.

SIGMET General
SIGMETs are warnings of actual and/or forecasted weather phenomena, hazardous to aircraft in-flight. The validity shall be not more than 4 HR (for TC, VA 6 HR) and should be cancelled when the phenomena are no longer occurring or expected to occur.
The area affected is always specified by making reference to a CTA or FIR, even if the hazard is occurring in the UIR.
Information of severe weather phenomena like: TS, TC, TURB, ICG, MTW, HVY DS/SS, RDOACT CLD

EXAMPLE: YUDD SHANLON FIR/UIR OBSC TS FCST S OF N54 TOP FL390 MOV E WKN

ASHTAM
Provides information on the status/changes of activity of a volcano using a level of alert. The maximum validity is 24 hours.

TURBULENCE

LIGHT	Condition less than moderate turbulence. Changes in accelerometer readings less than 0.5g at the Center of Gravity (CG). Reported as “Turbulence light”.
MODERATE	Moderate changes in ACFT attitude and/or altitude may occur but ACFT remains in positive control at all times. Accelerometer readings 0.5g to 1.0g. Difficulties in walking. Loose objects move about. Strain felt against belt. Reported as “Turbulence moderate”.
SEVERE	Abrupt changes in ACFT attitude and/or altitude. ACFT may be out of control for short periods. Large variation in airspeed. Accelerometers readings > 1.0g. Occupants forced violently against seatbelts. Loose objects tossed about. Reported as “Turbulence severe”.

Clear Air Turbulence (CAT)
Associated with jet streams is a phenomenon known as CAT, caused by vertical and horizontal wind shear connected to the jet streams. The CAT is strongest on the cold air side of the jet, next to and just underneath the axis of the jet.
When turbulence becomes excessive, an **altitude change is more efficient than a track change**.

Downdraft and Microburst (MB)
A downdraft is a relative small scale downward current of air; often observed on the lee side of large objects restricting the smooth flow of the air or in precipitation areas in or near cumuliform clouds.
Microbursts are small-scale intense cold air downdrafts out of cumulus clouds or thunderstorm cells which, on reaching the surface, spread outward in all directions from the downdraft center.
This causes the presence of vertical and horizontal wind shear, especially at low altitude within some 1.000ft of the ground.

Microbursts either occur as wet microburst carrying precipitation to the ground or as dry microburst descending from cumulonimbi or towering cumuli with a high cloud base (around 10.000ft), typically in desert regions.

Size

The strong downdraft is typically less than 1NM in diameter; the horizontal outflow can extend to approximately 4NM in diameter.

Intensity

The downdrafts can be as strong as 8.000ft/MIN. Horizontal winds speeds near the surface can reach up to 100KT. It normally lasts for 1 to 5 minutes

THUNDERSTORM

Many thunderstorms undergo a three-stage life cycle: Cumulus stage, Mature stage and Decaying stage.
Cb should be cleared by a minimum of **5.000 ft vertically and 20 NM laterally**, to minimize the risk of encountering severe turbulence.

WINDSHEAR

Is a difference in wind speed and direction over a relatively short distance in the atmosphere. Wind shear can be broken down into vertical and horizontal components, with horizontal wind shear seen across fronts and near the coast, and vertical shear typically near the surface, though also at higher levels in the atmosphere near upper level jets and frontal zones aloft.

ICING

Any cloud containing liquid water can present a significant icing environment if the temperature is 0 °C or less.

- no icing above 0°C or below -45°C, clear ice near 0°C, rime near -25°C
- 0°C highest proportion of dangerous clear ice in cloud

Types

Rime Ice

Rime ice is formed when small supercooled water droplets freeze rapidly on contact with a sub-zero surface. The rapidity of the transition to a frozen state is because the droplets are small and the almost instant transition leads to the creation of a mixture of tiny ice particles and trapped air. The resultant ice deposit formed is rough and crystalline and opaque and because of its crystalline structure, is brittle. It appears white in color when viewed from a distance - for example from the flight deck when on a wing leading edge.

Clear Ice

Clear or Glaze ice is formed by larger supercooled water droplets, of which only a small portion freezes immediately. This results in runback and progressive freezing of the remaining liquid and since the resultant frozen deposit contains relatively few air bubbles as a result, the accreted ice accretion is transparent or translucent. If the freezing process is sufficiently slow to allow the water to spread more evenly before freezing, the resultant transparent sheet of ice may be difficult to detect. The larger the droplets and the slower the freezing process, the more transparent the ice.

Cloudy or Mixed Ice, Supercooled Large Droplets (SLD), Runback Ice and Intercycle Ice

FLIGHT DOCUMENTATION

Documentation is required for each flight. The documentation must cover the flight in respect of time, altitude and geographical extent including the route between destination and destination alternate.
Presentation may vary according to regional agreements and standards. Flight documentation must be supplied (or updated in case of delay) as close to departure as practicable.

Standard Flight Documentation

- Significant Weather Chart (SIGWX)
- Upper winds and temperature charts
    - Wind direction is in degrees true

- Information of specified en-route weather phenomena (SIGMET)
- Low Level en-route weather (AIRMET)

TAF & METAR

- FC LJLJ 130600Z [date/time of origin] 130716 [validity time]
- R04/1500N = RVR along runway 04 is 1.500 m and not changing significantly
- R22/1500U = RVR along runway 22 is 1.500 m and rising
- P2000 = RVR is more than 2000, but general visibility is poor
- **TREND** = short forecast given in METAR, and is used to advise expected changes within the two hours following the observation (NOSIG, TEMPO and BECMG)

Aerodrome Forecast - TAF
FT = TAF less than 12hours; **FC** = TAF up to 30 hours
The period of validity should not be less than 6 hours, no more than 30 hours.
TAFs valid for less than 12 hours should be issued every 3 hours and those valid for 12 to 30 hours every 6 hours.

Aerodrome Report - METAR / SPECI (SA)
METARs are issued half hourly or hourly, e.g. 0920 / 0950, 1400 / 1430, or 1600 / 1700.

METAR WX codes

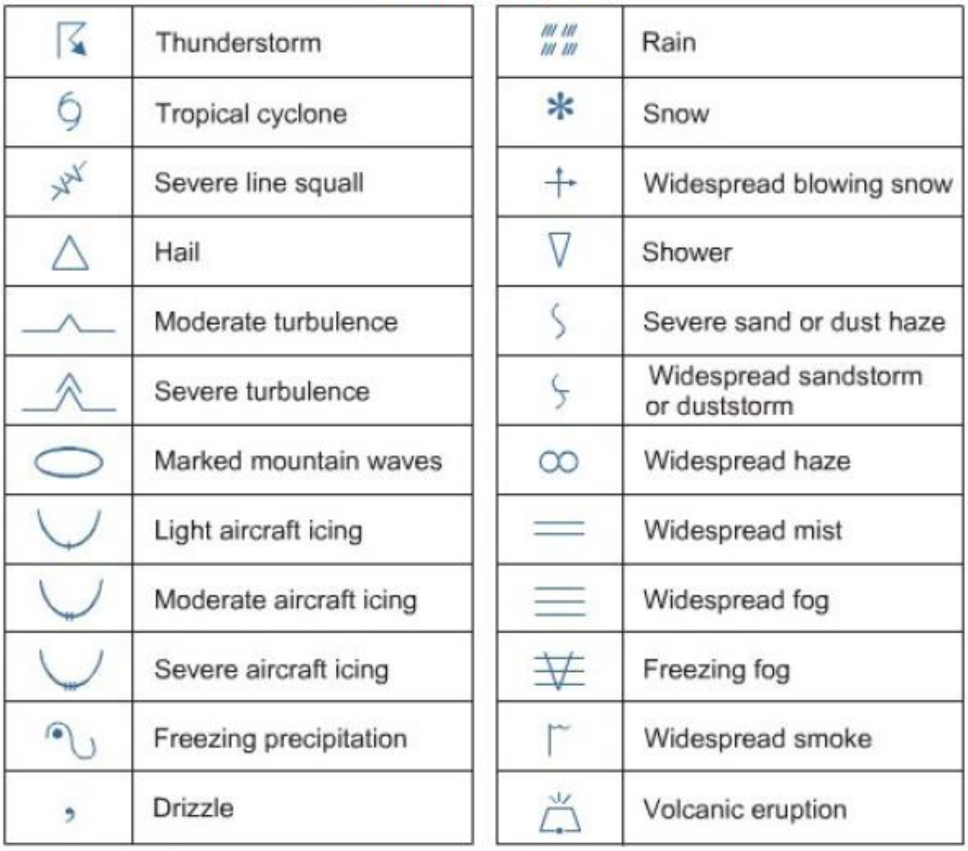
Type	Abbreviation	Meaning	Abbreviation	Meaning
Intensity	**-**	Light intensity	**blank**	Moderate intensity
Intensity	**+**	Heavy intensity	**VC**	In the vicinity
Descriptor	**MI**	Shallow	**PR**	Partial
Descriptor	**BC**	Patches	**DR**	Low drifting
Descriptor	**BL**	Blowing	**SH**	Showers
Descriptor	**TS**	Thunderstorm	**FZ**	Freezing
Precipitation	**RA**	Rain	**DZ**	Drizzle
Precipitation	**SN**	Snow	**SG**	Snow Grains
Precipitation	**IC**	Ice Crystals	**PL**	Ice Pellets
Precipitation	**GR**	Hail	**GS**	Small Hail and/or Snow Pellets
Precipitation	**UP**	Unknown Precipitation		
Obscuration	**FG**	Fog < 1.000m	**VA**	Volcanic Ash
Obscuration	**BR**	> 1.000m Mist < 5.000m	**HZ**	Haze
Obscuration	**DU**	Widespread Dust	**FU**	Smoke
Obscuration	**SA**	Sand	**PY**	Spray
Other	**SQ**	Squall	**PO**	Dust or Sand Whirls
Other	**DS**	Duststorm	**SS**	Sandstorm
Other	**FC**	Funnel Cloud		
Time	**B**	Began At Time	**E**	Ended At Time
Time	**2 digits**	Minutes of current hour	**4 digits**	Hour/Minutes Zulu Time

QNH is defined as, "barometric pressure adjusted to sea level." It is a pressure setting used by pilots, air traffic control to refer to the barometric setting which, when set on an aircraft's altimeter, will cause the altimeter to read altitude above mean sea level within a certain defined region.

QFE is a reading of station pressure taken on an accurate barometer and adjusted for any difference in height between the barometer and the field elevation. If QFE is set, altimeters should read zero on the ground at the airfield.

MEMO:
QNH = Altitude (AMSL)
QFE = Height (AGL)
QNE = Flight Level (FL)

Weather chart symbols



	Thunderstorm		Rain
	Tropical cyclone		Snow
	Severe line squall		Widespread blowing snow
	Hail		Shower
	Moderate turbulence		Severe sand or dust haze
	Severe turbulence		Widespread sandstorm or duststorm
	Marked mountain waves		Widespread haze
	Light aircraft icing		Widespread mist
	Moderate aircraft icing		Widespread fog
	Severe aircraft icing		Freezing fog
	Freezing precipitation		Widespread smoke
	Drizzle		Volcanic eruption

SPECI
Special weather report issued when the when there is a significant deterioration or improvement in airport weather conditions. The format is similar to METAR. Issued between METAR intervals.

061 – GENERAL NAVIGATION

Variation and deviation
MEMO: Can Dead Man Vote Twice?

C	D	⇨	M	V	⇨	T

- Deviation east = compass least — Deviation west = compass best
- Variation east = magnetic least — Variation west = magnetic best
- (+) = east — (-) = west
- Longitude east = UT least — longitude west = UT best

QUJ	True bearing TO the station	**QDM**	Magnetic bearing TO the station
QTE	True bearing FROM the station	**QFU**	Magnetic bearing of the runway in use
QDR	Magnetic bearing FROM the station	**QGE**	Distance

FACT: 1° (N/S) = 60nm   1° (E/W) = 30nm

$$LSS = 661 * \sqrt{\frac{T(kelvin)}{288}} \qquad LSS = 39 * \sqrt{T(kelvin)} \qquad Mach = \frac{TAS}{LSS}$$

LSS (ISA conditions, sea level) = 662kt
Temperature in K = °C + 273,15
Local Speed of Sound (LSS) depends on the OAT (Outside Air Temperature) → **T↑= LSS ↑**

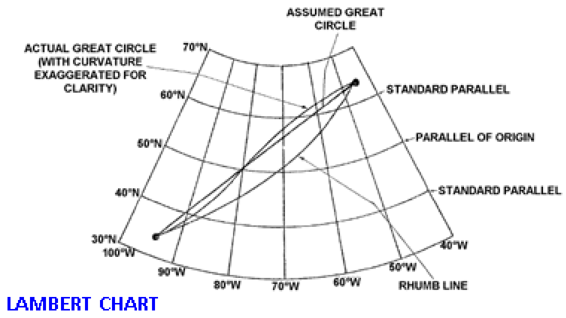
FACTS:

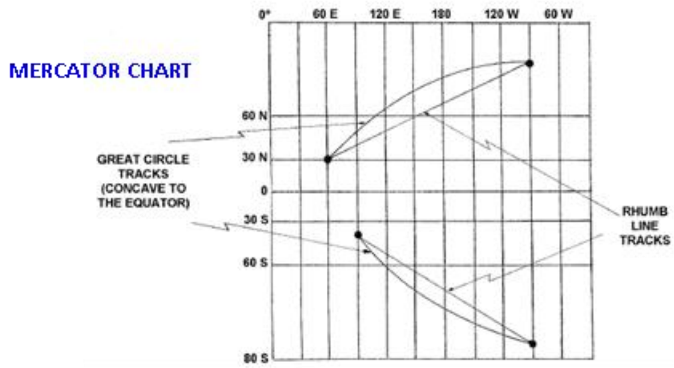
- **“PUSH THE HEAD AND PULL THE TAIL”** intercepting NDB QDR/QDM
- VOR’s variation at station / NDB’s variation at aircraft
- Sun travels: 15°/h = 1°/4 min
- Earth is furthest from the sun (aphelion): beginning of July
- Earth is closest to the sun (perihelion): beginning of January

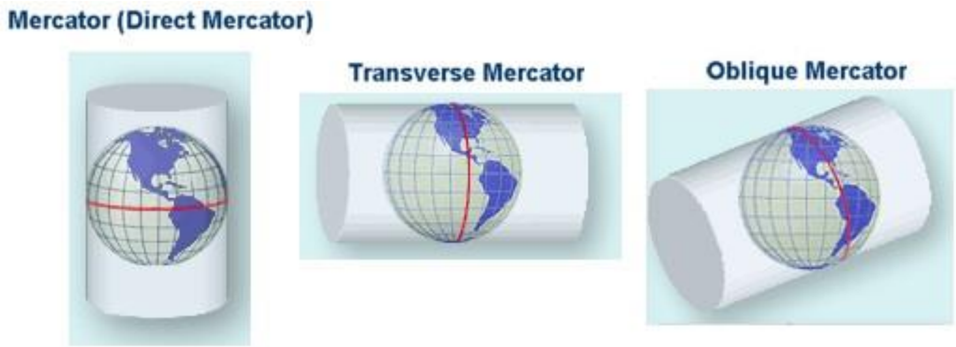
Maps and lines:

- Isogrives are lines that connect positions that have the same grivation.
- An Agonic line is a line that connects, positions that have 0(degrees) variation.
- Contour lines on aeronautical maps and charts connect points with the some elevation.

Great circle track: is a line of shortest distance between two points on a sphere with constantly changing track direction as a result of convergence.
Rumb line (or loxodrome): is an arc crossing all meridians of longitude at the same angle.







Direct Mercator: A cylindrical projection based on the Equator.
Transverse Mercator: A cylindrical projection based on a meridian and anti-meridian (for maps of large north-south extend).
Oblique Mercator: A cylindrical projection based on any other great circle of tangency.

062 – RADIO NAVIGATION

Frequency band		Frequency coverage	Uses
Very low frequency	VLF	<30 KHz	
Low frequency	LF	30 – 300 KHz	Loran, NDB
Medium frequency	MF	300 KHz – 3 MHz	NDB
High frequency	HF	3 MHz – 30 MHz	Comm
Very high frequency	**VHF**	**30 MHz – 300 MHz**	**Comm**
Ultra high frequency	UHF	300 MHz – 3 GHz	Glideslope, GPS, SSR, DME
Super high frequency	SHF	3 – 30 GHz	Radio Alt, MLS, Radar
Extremely high frequency	EHF	30 – 300 GHz	

HF is used for long range communication, aviation frequencies: 2,85MHz – 22 MHz
VHF is used for short range communications, aviation frequencies **118MHz – 137MHZ**

MEMO: Aviation VHF frequencies from **108,00MHz to 137,00MHz**

DME (Distance measuring equipment):

- is a transponder-based radio navigation technology that measures distance by timing the propagation delay of VHF or UHF radio signals.
- frequencies: **962 to 1213 MHz (UHF) = 252 channels**
- 'Beacon Saturation' will occur whenever the number of simultaneous interrogations exceeds 100
- DME channels utilize frequencies of approximately 1000 MHz
- If a DME beacon becomes saturated by interrogations it adjusts the gain to reply to the 100 strongest signals.

MLS (Microwave Landing System):
Frequency: 5,03 – 5,09 GHz (SHF) = 200 channels
is an all-weather, precision landing system originally intended to replace or supplement instrument landing systems (ILS). MLS has a number of operational advantages, including a wide selection of channels to avoid interference with other nearby airports, excellent performance in all weather, a small "footprint" at the airports, and wide vertical and horizontal "capture" angles that allowed approaches from wider areas around the airport.

GPS (Global Positioning System):

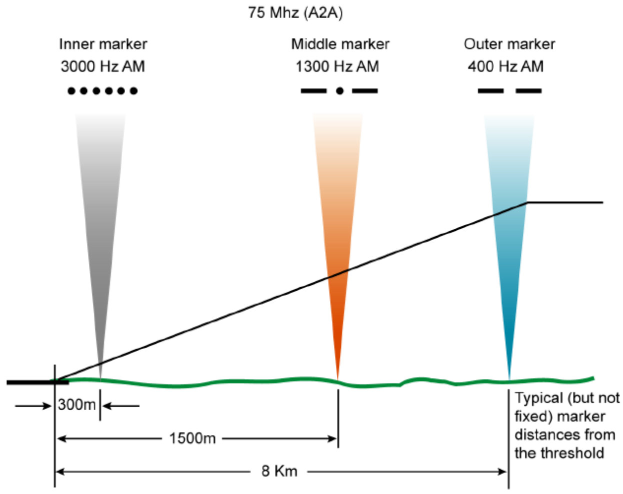
- 24 satellites (21 operational, 3 standby)
- height above the earth: 20.200km
- Current minimum operational standards for the GPS system calls for: 5 satellites "visible" at least 7,5° above the horizon
- In civil aviation, the height value computed by the receiver of the satellite navigation system NAVSTAR/GPS is the: height above the WGS-84 ellipsoid

An RMI indicates aircraft heading. To convert the RMI bearings of NDBs and VORs to true bearings the correct combination for the application of magnetic variation:

- NDB: aircraft position
- VOR: beacon position

ILS (Instrument Landing System):

- frequency of localizer: **108 – 111.975MHz (VHF)**
- glide path: **UHF**
- markers: VHF – 75MHz
- 150 Hz right and bellow



NDB (Non-Directional Radio Beacon):

NDB navigation consists of two parts — the automatic direction finder (or ADF) equipment on the aircraft that detects an NDB's signal, and the NDB transmitter.

- Frequency: **190 – 1750 kHz (LF & MF)**
- Accuracy: ± 5° (day only)
- Range: 3 * √P (W) over water
  2 * √P (W) over land

Errors:

Night effect, Terrain effect, Electrical effect, Shoreline effect and Bank effect.

VOR (VHF Omnidirectional Range):

Is a type of radio navigation system for aircraft. A VOR ground station broadcasts a VHF radio composite signal including the station's identifier, voice and navigation signal. The navigation signal allows the airborne receiving equipment to determine a magnetic bearing from the station to the aircraft.

- Frequency: **108 to 117.95 MHz = 160 channels**
- Principle of operation: phase comparison of two 30 Hz signals
- Range: line of sight

Errors: Equipment, Site and Propagation error.

FMS (Flight Management System):

- The database of an FMS is organized in such a way that the pilot can insert navigation data between two updates
- The FMS database can be: only read by the pilots.

Inertial navigation system (INS):

is a navigation aid that uses a computer, motion sensors (accelerometers) and rotation sensors (gyroscopes) to continuously calculate via dead reckoning the position, orientation, and velocity (direction and speed of movement) of a moving object without the need for external references.

070 – OPERATIONAL PROCEDURES / EU-OPS

Circle to land minimums:

	horizontal visibility	MDA	V at = 1,3 Vs
Category A	1.500 m	400 ft	Less than 91 kt
Category B	1.600 m	500 ft	from 91 kt to 120 kt
Category C (A320)	**2.400 m**	**600 ft**	**from 121 kt to 140 kt**
Category D	3.600 m	700 ft	from 141 kt to 165 kt
Category E			from 166 kt to 210 kt

Minima for NON-precision approach:

NDB	**350 ft**	VOR/DME	**250 ft**
NDB/DME	**300 ft**	ILS LOC (GS U/S)	**250 ft**
VOR	**300 ft**	RNAV/LNAV	**300 ft**

LOW VISIBILITY OPERATIONS

Low Visibility Operations (LVO): Means operating a Company airplane in low visibility conditions (LVC). LVO include Low Visibility Taxi, Low Visibility Take-off and ILS CAT 1, CAT 1LTS, CAT 2, CAT 2OTS and CAT 3 Landings in LVC.

Low Visibility Procedures (LVP): Procedures applied at the aerodrome for the purpose of ensuring safe operation during CAT 2/3 approaches and Low Visibility Take-offs.

Low Visibility Take-off (LVTO): A take-off where runway visual range (RVR) is less than 400 m.

Low Visibility Conditions (LVC): LVC for take-off and landing are defined in table below

Low Visibility Conditions	RVR / CMV	Cloud Base / Vertical Visibility
Take-off	Less than 400 m	Not applicable
Landing	Less than 1000 m	Less than 300 ft

CAT I	RVR = 550 m	DH = 200 ft
CAT II	RVR = 300 m	DH = 100 ft
CAT IIIA	RVR = 200 m	DH < 100 ft but ≥ 50 ft
CAT IIIB	RVR = 75 m	DH < 50 ft
CAT IIIC	No RVR	No DH

Category II Operations A pilot may not continue an approach below the Category II decision height unless visual reference containing a segment of at least 3 consecutive lights being the center line of the approach lights, or touchdown zone lights, or runway center line lights, or runway edge lights, or a combination of these is attained and can be maintained. This visual reference must include a lateral element of the ground pattern, i.e. an approach lighting crossbar or the landing threshold or a barrette of the touchdown zone lighting.

Visual approach: is not permitted when RVR is less than 800m.

- On landing on an isolated field, the captain of a turbojet engined aircraft must mandatory have a minimum quantity of fuel and lubricant sufficient for flying 2 hours with normal cruising consumption

- For the flight crew members, quickly-fitted oxygen masks are compulsory on board any pressurized aircraft flying at a pressure altitude greater than: 25.000 ft

- Jets must be able to land in 60% and turboprops in 70% of the LDA.

- A public transport aircraft is intended to be operated at FL 390. The total number of oxygen masks (dispensing units and outlets) in the cabin must be at least the same as the total number of seats exceeded by 10%.

- Recency is 3 take off's and landings in the last 90 days. // Flight preparation documents must be kept for 3 months.

Contaminated Runway - A runway is considered contaminated when more than 25% of the runway area within the required length and width being used is covered by the following:

a) Surface water more than 3mm deep, or by slush or loose snow, equivalent to more than 3mm water;
b) Snow which has been compressed into a solid mass which resists further compression and will hold together or break into lumps if picked up (compacted snow); or
c) Ice, including wet ice.

Wet Runway - A runway is considered wet when the runway surface is covered with water or equivalent, less than specified under "Contaminated Runway" above or when there is sufficient moisture on the runway surface to cause it to appear reflective, but without significant areas of standing water.

During a landing approach, the aircraft is subjected to windshear with an increasing head wind. In the absence of a pilot action, the aircraft:

- flies above the glide path
- has an increasing true airspeed

Positive windshear (headwind) – IAS increases, LIFT increases
Negative windshear (tailwind) – IAS decreases, LIFT decreases

The maximum validity of a **SNOWTAM** is: 24 hours (Rum TE Dobr Butne)

Format:

04	5	9	05	92
RR	T	E	DD	BB

RR – runway designator
T – type of deposit (0-9, /)
E – extent of contamination

DD – depth of deposit
BB – braking conditions (01-90, friction coefficient)

MDA – measured from QNH

DA – measured from radio altimeter or QFE

1 NM = 1,85 km	1 kg = 2,205 lb
1 SM = 1,609 km	1 lb = 0,45 kg
1 ft = 0,305 m	1 USgal = 3,785 l
1 m = 3,28 ft	

Height (ft) = height (m) * 3 + 10%

Height (m) = height (ft) / 3 – 10%

3,5° = 6,1 % = 372 ft/NM
3° = 5,2% = 319 ft/NM
2,5° = 4,4% = 265 ft/NM

Time to descent: (Δ Altitude / ROD) = Time to descent
Miles to descent: (Δ Flight level / 3) = NM
3° Glide slope: Ground Speed/2 * 10 = ROD

EU OPS 1.085 - Crew responsibilities

A crew member shall be subject to appropriate requirements on the consumption of alcohol which shall be established by the operator and acceptable by the Authority, and which shall not be less restrictive than the following:

- no alcohol shall be consumed less than eight hours prior to the specified reporting time for flight duty or the commencement of standby;
- the blood alcohol level shall not exceed 0,2 promille at the start of a flight duty period;
- no alcohol shall be consumed during the flight duty period or whilst on standby.

EU OPS 1.125 - Documents to be carried

1. The Certificate of Registration;
2. The Certificate of Airworthiness;
3. The original copy of Noise Certificate;
4. The original copy of Air Operator Certificate (AOC);
5. The aircraft Radio License and
6. The original or a copy of the Third party Insurance Certificate.

Documents for flight:

1. Flight plan;
2. Dispatch release;
3. Meteo for take off, landing and alternate;
4. NOTAMs;
5. Loadsheet;
6. Airplane Technical Log;
7. Details of the filed ATS flight plan;
8. Mass and balance documentation;
9. Notification of special loads including dangerous;
10. Current maps and charts and associated.

EU OPS 1.1045 Operations Manual — structure and contents

PART A = General/basic

- Quality system, crew composition, qualification requirements, crew health precautions, flight time limitations, operating procedures, dangerous goods and weapons, security, rules of the air, …

PART B = Aeroplane operating matters

- Limitations, normal procedures, abnormal and emergency procedures, performance, flight planning, mass and balance, loading, MEL, CDL, airplane systems, …

PART C = Route and aerodrome instructions and information

PART D = Training

COST INDEX (CI)
Definition: The ratio of fuel costs to all other costs.
The lower the CI, the more "importance" the machinery places on saving fuel. Low cost indexes will result in lower climb speed, (both indicated and Mach), lower cruise speed, a generally higher cruise altitude, a later descent and a slower descent Mach/speed. The higher CI's will result in the opposite.

Minimum Equipment List (MEL):): A list which provides for the operation of aircraft, under specified conditions, with particular instruments, items of equipment or functions inoperative at the commencement of flight.
This list is prepared by the operator for his own particular aircraft taking account of their aircraft definitions and the relevant operational and maintenance conditions in accordance with a procedure approved by the Authority.

Master Minimum Equipment List (MMEL): is drawn up by the manufacturer and approved by the certification authority

Configuration Deviation List (CDL): is a list, established by the organization responsible for the type design with the approval of the State of Design, which identifies any external parts of an aircraft type which may be missing at the commencement of a flight, and which contains, where necessary, any information on associated operating limitations and performance correction.

Emergency and Survival Equipment
Minimum Number of Hand Fire Extinguishers (61 to 200 pax) = 3 AND crash axe or a crow-bar on the flight deck
Minimum Number of Megaphones Required (100 and more pax) = 2
The battery in a search and rescue beacon (SARB) / (ELT) should last for 48 hours
Smoke hoods are available to "Aircraft Crew" and they must give oxygen for "15 minute
A life jacket is mandatory for any passenger on board an aircraft flying away from the shore by more than 50nm

RUNWAY LIGHTNING

CENTERLINE	900m to the end begins with white and red alternate (in turns), 300m to the end only red. The distance between the lights at least 15m.
EDGE	600m from the end of yellow begins. The distance between the lights 60m
APPROACH	approach end of the runway, series of light bars, strobe lights
TDZ lights	rows of white light bars (with three in each row) at 30 m intervals over the first 900 m of the runway

Minima for take-off

Lightning	**RVR or visibility**	
	CAT A,B,C	CAT D
None (day only)	**500 m**	
Runway edge lights OR centerline	**250 m**	300 m
Runway edge lights AND centerline	**200 m**	250 m
Runway edge lights AND centerline AND multiple RVR	**150 m**	200 m

LVP, LVTO when RVR less than 400m
150 m – reduced to 125 m LVP when:

- LVP in force
- High intensity center lights spaced 15 m or less AND High intensity edge lights spaced 60 m or less
- Flight crew after completed training
- 90 m visual segment available from the cockpit = 6 lamps x 15 m.
- RVR for all reporting points

VIS to RVR conversion
Can be used when VIS is more than 800 m.

High Intensity approach & runway lighting:	RVR = met VIS x 1.5 (daytime), met VIS x 2.0 (night time)
Any other lighting facilities:	RVR = met VIS x 1.0 (daytime), met VIS x 1.5 (night time)
No lighting:	RVR = met VIS x 1.0 (daytime), cannot be converted at night

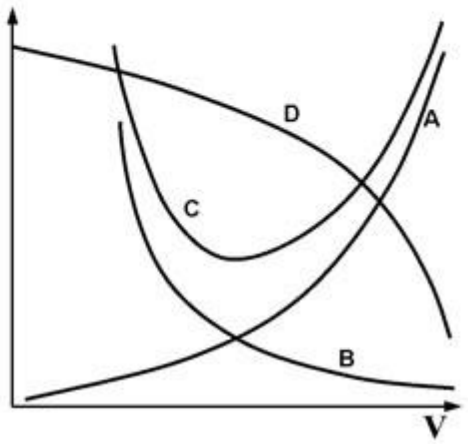
DE-ICING
An aircraft having undergone an anti-icing procedure must be anti-icing fluid free at the latest when during rotation (before takeoff).

Under icing conditions, if you exceeded the holdover time, the correct procedure is to de-ice again then apply anti-icing fluid.

During a de-icing/anti-icing procedure carried out in two stages, the waiting time starts at the beginning of the second stage (anti-icing stage).

Landing Distances
Actual Landing Distance (ALD) dry: 50 ft, VREF, dry RWY, Max manual braking, spoilers, no reverse
Required Landing Distance [dry] = ALD dry * 1,64
RLD [wet] = RLD dry * 1,15
RLD contaminated = ALD contaminated * 1,15 or RLD wet (whichever is higher)

080 – PRINCIPLES OF FLIGHT



A = parasite drag (zero lift drag)

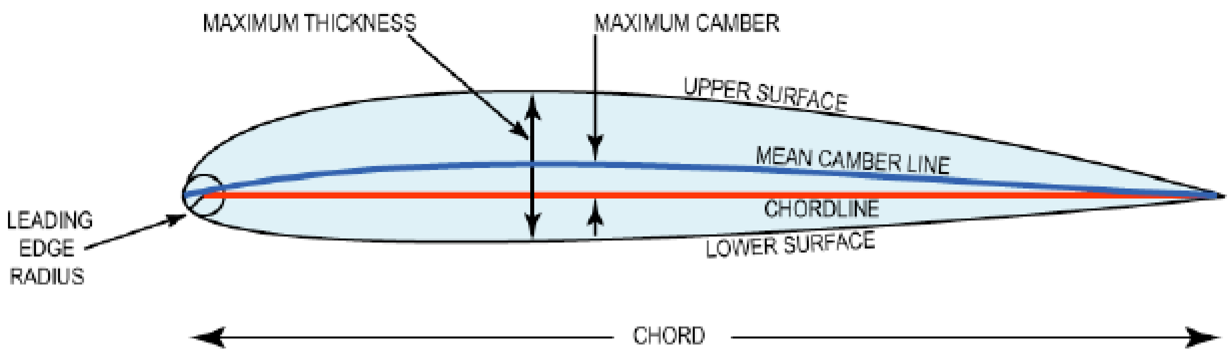
B = induced drag (lift depending drag), highest at LOW speeds (wake turbulence)

C = total drag

D = piston engine thrust

FACTS

- The total aerodynamic force act at CP (center of pressure).
- Location of CP varies with AOA, but general it is located within the forward half of the chord (approximately 25% of the chord).



$$\boldsymbol{lift\ (L) = CL * \frac{\rho\, V^2}{2} * S}$$

L	Lift, which must equal the airplane's weight in pounds
ρ	density of the air. This will change due to altitude.
v	velocity of an aircraft expressed in feet per second
s	the wing area of an aircraft in square feet
CL	Coefficient of lift , which is determined by the type of airfoil and angle of attack.

The lift coefficient (CL):
is a number associated with a particular shape of an airfoil, and is incorporated in the lift equation to predict the lift force generated by a wing using this particular cross section.

A yaw damper:
Is a device used on many aircraft (usually jets and turboprops) to damp (reduce) the rolling and yawing oscillations due to Dutch roll. It involves yaw rate sensors and a processor that provides a signal to an actuator connected to the rudder. The use of the yaw damper helps to provide a better ride for passengers and on some aircraft is a required piece of equipment to ensure that the aircraft stability remains within certification values.

A yaw damper is a system which increases directional stability.

Dutch roll:
Is a battle between the lateral and directional stability of the aircraft. Lateral stability is the tendency of an aircraft to roll wings level if it gets into a bank. Directional stability is the tendency of an aircraft to weathervane into the relative wind.
Both of these types of stability depend on a side slip to function. Lateral stability, for instance, is classically provided by wing dihedral. When the aircraft side slips in one direction, the dihedral tends to raise the low wing. Directional stability, which depends on the vertical stabilizer, wants to weathervane into the wind. Both effects want to eliminate side slip, but do it in different ways.
Recovery technique: apply opposite aileron to the direction of the roll (yaw dampers U/S)

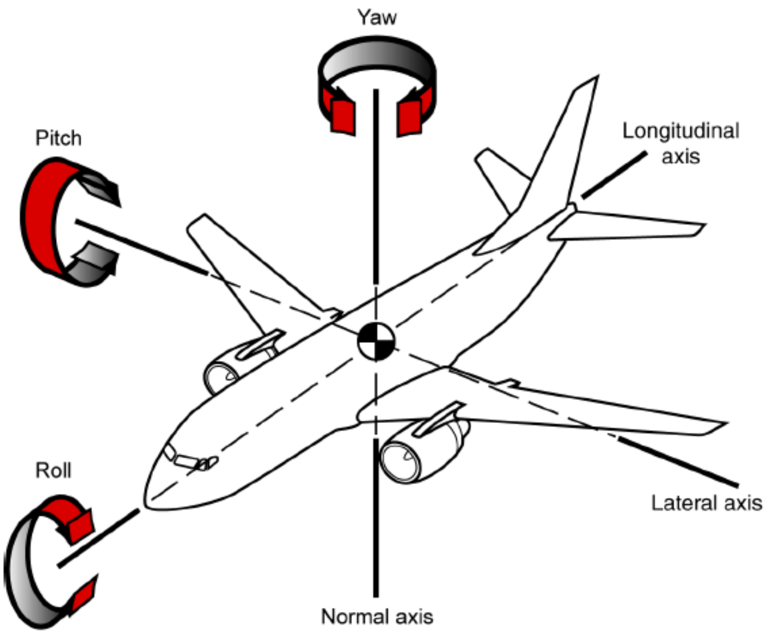
The coffin corner:
Is the altitude at or near which a fast fixed-wing aircraft's stall speed is equal to the critical Mach number, at a given gross weight and G-force loading. At this altitude the airplane becomes nearly impossible to keep in stable flight. Since the stall speed is the minimum speed required to maintain level flight, any reduction in speed will cause the airplane to stall and lose altitude. Since the critical Mach number is the maximum speed at which air can travel over the wings without losing lift due to flow separation and shock waves, any increase in speed will cause the airplane to lose lift, or to pitch heavily nose-down, and lose altitude. The "corner" refers to the triangular shape at the top right of a flight envelope chart where the stall speed and critical Mach number lines come together.

The critical Mach number (Mcr):
Is the aircraft Mach speed at which the airflow over a wing becomes sonic.
At the critical Mach number, local airflow in some areas near the airframe reaches the speed of sound, even though the aircraft itself has an airspeed lower than Mach 1.0. This creates a weak shock wave. At speeds faster than the Critical Mach number the drag coefficient increases suddenly, causing dramatically increased drag and, if an aircraft not designed for transonic or supersonic speeds, changes to the airflow over the flight control surfaces lead to deterioration in control of the aircraft.

"Flutter" may be caused by: distortion by bending and torsion of the structure causing increasing vibration in the resonance frequency.

An aircraft in flight is affected by loads.
These may be classified as: compressive, tensile, shear and torsional.

AXIS AIRCRAFT CONTROL



STABILITY

Static stability: is the initial tendency of an airplane, when disturbed, to return to the original position.
Dynamic stability: is the overall tendency of an airplane to return to its original position following a series damped out oscillations.

Longitudinal stability

Longitudinal stability is pitch stability, or stability around the lateral axis of the airplane.
Two principal factors influence longitudinal stability: size and position of the horizontal stabilizer, and position of the center of gravity.
Longitudinal static stability is created by the fact that the: center of gravity is located in front of the neutral point of the airplane.

Lateral stability

Lateral stability is stability around the longitudinal axis, or roll stability.
Lateral stability is achieved through wing dihedral, sweepback, keel effect, and proper distribution of weight.

Directional stability

Directional stability is stability around the vertical or normal axis.
The most important feature that affects directional stability is the vertical tail surface, that is, the fin and rudder. Keel effect and sweepback also contribute to directional stability to some degree.

- Lateral static stability is determined by aircraft response to sideslip.
- Directional static stability is determined by fin volume.
- A statically unstable airplane is never dynamically stable.
- Dutch roll occurs when lateral stability is too great compared to directional stability.

STALL

Stall is a reduction in the lift coefficient generated by a foil as angle of attack increases. This occurs when the critical angle of attack of the foil is exceeded.

- The heavier the aircraft, the higher is the indicated speed at which the aircraft will stall.
- Superstall is a condition, which is a stable stall with almost a constant pitch attitude. It is a stall from which the aircraft is unable to recover.
- The stall speed in a 60° banked turn increases by the factor **1.41**
- Approaching a stall, CP moves FORWARD

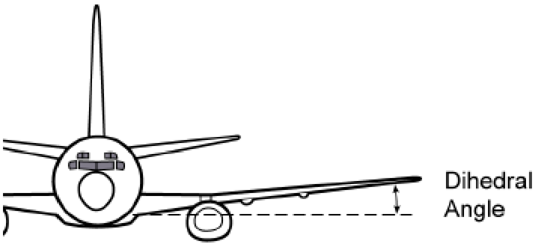
For a jet aircraft the best rate of climb is achieved: when excess power available is at a maximum
For a jet aircraft the best angle of climb is achieved: when excess thrust available is at a maximum

Vortex Generators transfer energy from the free airflow into the boundary layer

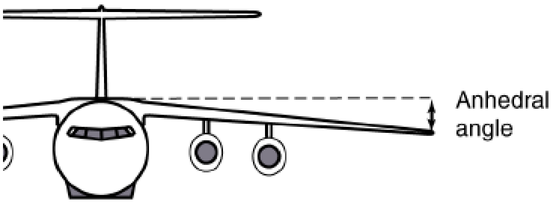
Mach Buffet

is the separation of airflow from the flight surfaces because they exceed the speed of sound. This occurs because a shockwave is formed. After the formation of the shockwave, the airflow begins to separate behind the shockwave. Because of this buffeting can occur and loss of control. It’s because of this factor that M_{MO} (Max Operating Mach) is used.

DIHEDRAL
Is the upward inclination of a wing from the root to the tip.



ANHEDRAL
Is the downward inclination of a wing from the root to the tip.



ASPECT RATIO
Is the ratio of the wing span to its chord.

- Aspect ratio = wing span2/wing area
- High = high lift (gliders)
- Low = lower lift but capable of higher speeds

SWEPT WING
The sweepback wing is the wing of choice for most high-speed airplanes made today. Sweep wings create less drag, but are somewhat more unstable at low speeds. The amount of sweep of the wing depends on the purpose of the airplane. A commercial airliner has a moderate sweep. This results in less drag while maintaining stability at lower speeds.

Advantages:

- high Mach cruise speed
- stability in turbulence (result of lower lift)
- less air friction, as wings are designed thin and fine
- more lateral stability

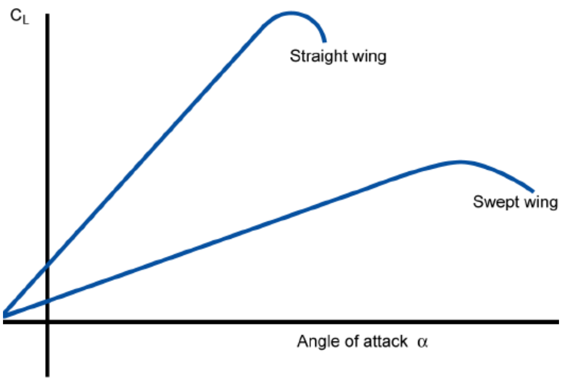
Disadvantages:

- produces less lift compared to straight wing
- higher stall speed (result of lower lift)
- speed instability
- wing tip stalling tendency, mainly because of high local Cl loading (harder to recover from stall)

  Design functions to reduce tip stall:
  - wing fences to re-direct sideways moving air back towards the rear of the wing
  - use some degree of washout

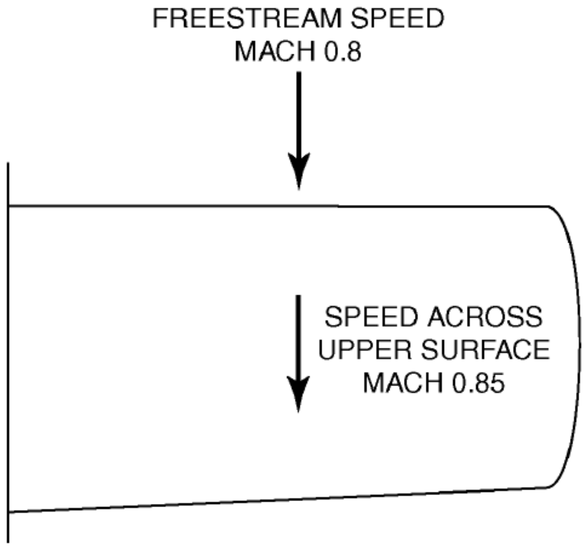
Facts

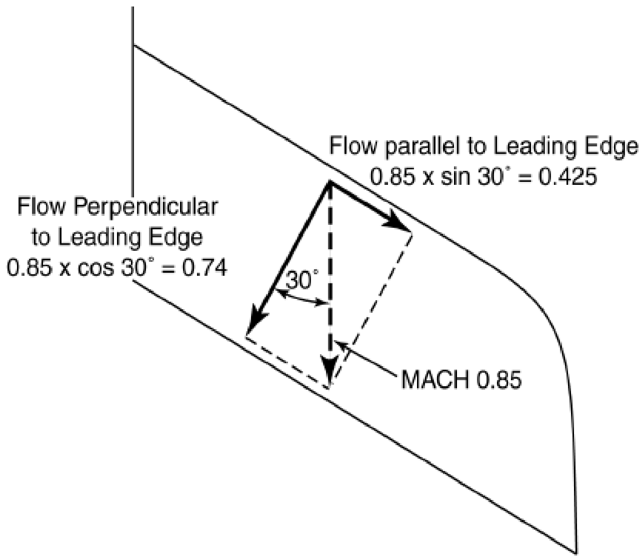
- A swept wing will for a given angle of attack and wing area be more laterally stable and produce less lift
- Compared to straight wings, swept back wings have better directional stability
- The effect of a swept wing is to give a positive dihedral effect
- A boundary layer fence on a swept wing will improve the low speed characteristics
- Swept wing give less lift at high angle of attack



Considering the lateral stability of a swept wing aircraft, at high level the static lateral stability will be the same and the dynamic lateral stability will be less.

The primary purpose of sweptback is to increase the value of critical Mach number for a given aircraft.

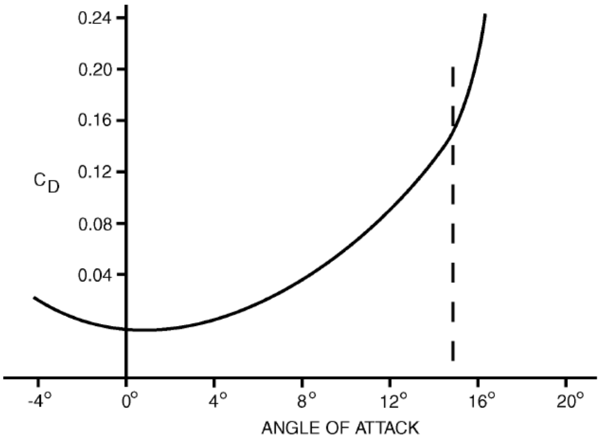




DRAG

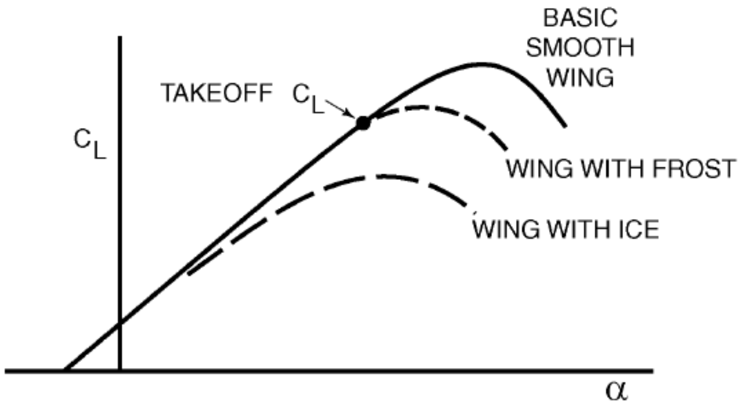
Coefficient of drag (CD) = $\dfrac{Fd}{\frac{1}{2} * \rho * v^2 * S}$

Fd = is the drag force, which is by definition the force component in the direction of the flow velocity
P = is the mass density of the fluid
v = the speed of the object relative to the fluid
S = is the reference area



Induced drag may be reduced by an increase in aspect ratio.

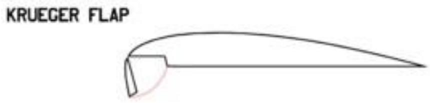
ICE EFFECT



If ice is present on the leading edge of the wings, it may increase the landing distance due to higher Vth with: **30 – 40%**

HIGH LIFT DEVICES

- Trailing edge flaps (Fowler flaps) – increase lift at lower angels of deflection
- Leading edge flaps (Krueger flaps) and slats – increase lift by creating a longer wing chord line, chamber and area



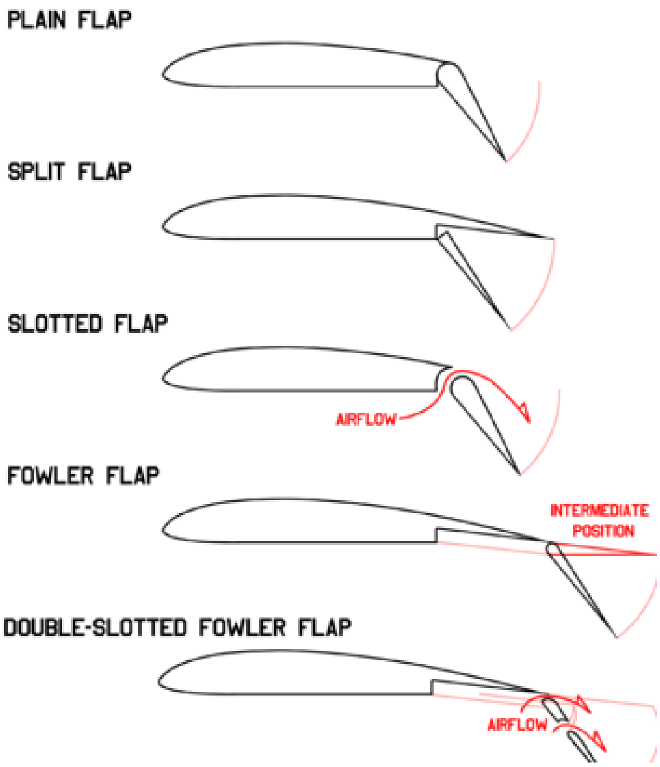
- Slots – prevent/delay the separation of the airflow boundary layer and therefore produce an increase in the coefficient of lift maximum

A **leading edge slot** is a fixed aerodynamic feature of the wing of some aircraft to reduce the stall speed and promote good low-speed handling qualities. A leading edge slot is a spanwise gap in each wing, allowing air to flow from below the wing to its upper surface. In this manner they allow flight at higher angles of attack and thus reduce the stall speed.

HIGH DRAG DEVICES in flight

- Trailing edge flaps
- Spoilers are intended to create drag and reduce lift by "spoiling" the airflow over the wing. Spoilers are usually installed mid chord on the upper surface of the wing, but may also be installed on the lower surface of the wing as well.
- Landing gear

Flaps



Winglets
Wingtip devices increase the lift generated at the wingtip (by smoothing the airflow across the upper wing near the tip) and reduce the induced drag caused by wingtip vortices, improving lift-to-drag ratio. This increases fuel efficiency and increases optimum flight level.

Service ceiling is where the rate of climb drops below a prescribed value (100 feet per minute climb).
Absolute ceiling is the height at which rate of climb drops to zero (also known as coffin corner).

WIZZ AIR data

The airline was established in September 2003. The lead investor is **Indigo Partners**, an American private equity firm specializing in transportation investments. The first flight was made from Katowice on 19 May 2004.

Wizz Air has its Headquarters at Budapest International Airport in Budapest. Financial: Geneva

It currently serves 37 countries (106 destinations, over 360 routes, 15.8 million pax).

Key people: József Váradi (CEO) and Diederik Pen (COO)

Company slogan: **Now we can all fly.**

Callsign: WizzAir / IATA code: W6 / ICAO code: WZZ

Fleet:

Aircraft	In fleet	Orders	Notes
Airbus A320-232	54	34	
Airbus A321-231	0	26	First in 2015
Total	**54**	**60**	

International Aero Engine's V-2500 engines and equipped with 180 comfortable leather seats. All new deliveries are fitted with "Sharklets" wingtip devices.

Bases for pilots:
Poland: Gdansk, Poznan, Katowice, Warsaw and Wroclaw (5 bases)
Czech Republic: Prague
Hungary: Budapest
Bulgaria: Sofia
Romania: Bucharest, Cluj-Napoca, Tirgu Mures, Craiova and Timisoara (5 bases)
Lithuania: Vilnius
Latvia: Riga
Ukraine: Kyiv
Macedonia: Skopje
Serbia: Belgrade
Slovakia: Kosice
Bosnia and Hercegovina: Tuzla (june 2015)

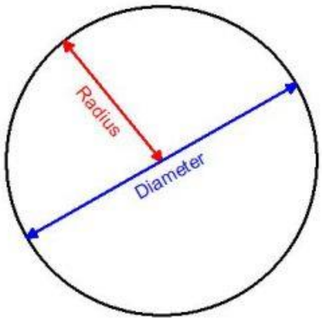
TOTAL: 12 countries and 20 bases

Routes from London Luton: 30 destinations (jan 2015)

Most NORTH aerodrome: **Trondheim**
Most SOUTH aerodrome: **Dubai**
Most EAST aerodrome: **Baku (Dubai)**
Most WEST aerodrome: **Lisbon**

Mathematics

If the radius of the wheel is 25cm, what is the distance covered by 2 wheel rotations?

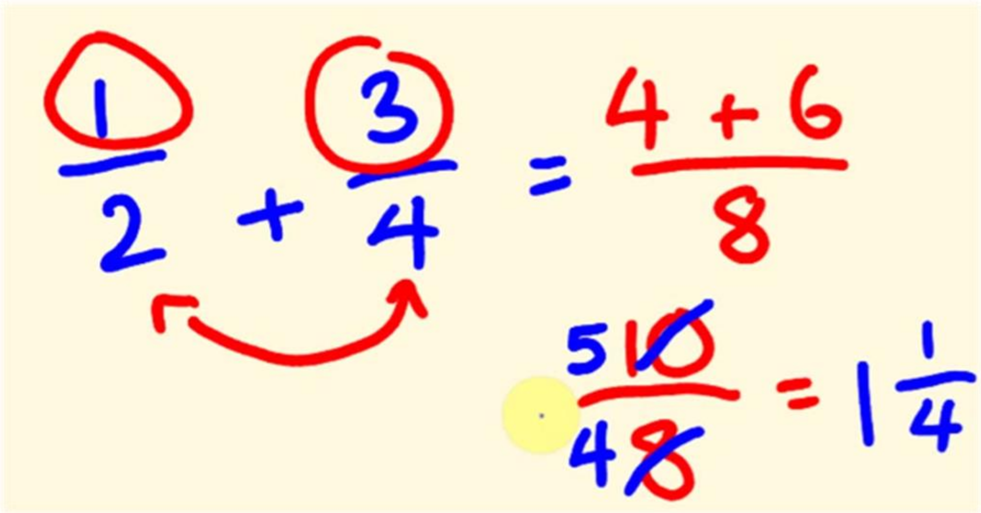


$o = 2\pi r$

Result: 314cm = 3,14m

fractions ADDITION AND

COUNTDOWN



Process:

- Multiply the numbers below (2 * 4 = 8)
- Multiply the upper left by the lower right (1 * 4 = 4)
- Multiply the lower left by the upper right (2 * 3 = 6)
- You shorten

Countdown:

- Same procedure as multiplication, only at the end you subtract the above numbers
- Always start “top left with bottom right”

IMPORTANT

example: 2 1/3 = change to incomplete → 2 multiply by 3 and add 1 → 7/3

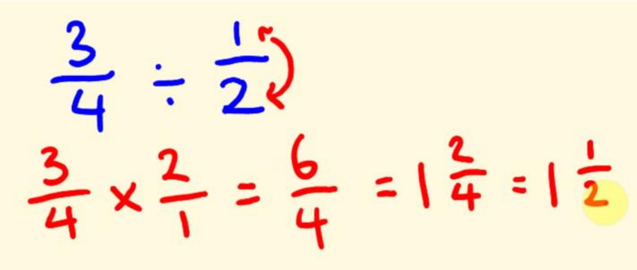
MULTIPLICATION OF FRAGMENTS

You multiply the upper and lower numbers

Example:

$$\frac{3}{8} * \frac{2}{3} = \frac{6}{24} = \frac{1}{4}$$

SHARING fractions



IMPORTANT: The main thing is to turn the second fragment.

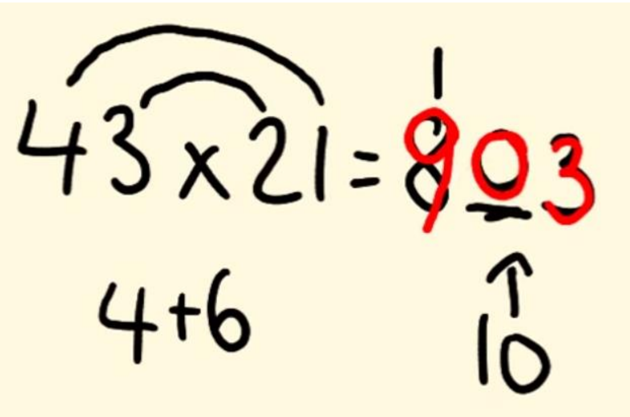
Solving more complex accounts

7+(6*5^2+8)=165

Process:

- you solve first 5^2
- Divide before multiplying
- 🕐 Add up before you subtract

MULTIPLICATION



TIPS:

a) 0,1 * 0,1 = 0,01
b) 0,5 * 0,1 = 0,05

PROCESS:

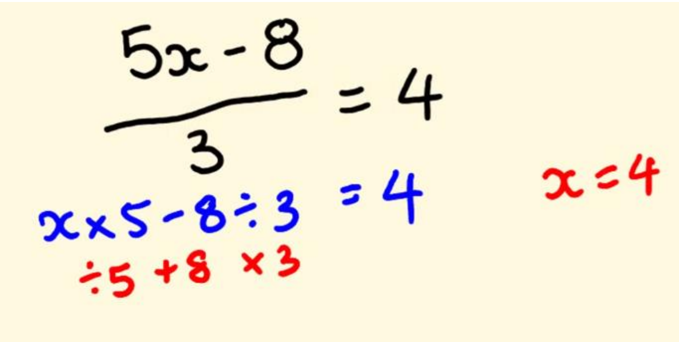
🕐 Multiply 4 * 2 = 8
🕐 Multiply 3 * 1 = 3
🕐 Multiply 4 * 1 and 3 * 2 by the mean → add together → 10
🕐 Enter in the middle field, because it is more than 9, 1 is added to the first number → result = 903

SHARING
Division by numbers 5, 25 and 125:
Example (division by 5): 74/5 =? → 74 * 2 = 148/10 = 14.8
Example (division by 25): 63/25 =? → 63 * 4 = 252/100 = 2.52
Example (division by 125): 9/125 =? → 9 * 8 = 72/1000 = 0.072
PERCENTAGE
Example_1: 60% of 42 = 25.2
What is 50% of 42 = 21
What is 10% of 42 = 4.2 → add together = 25.2

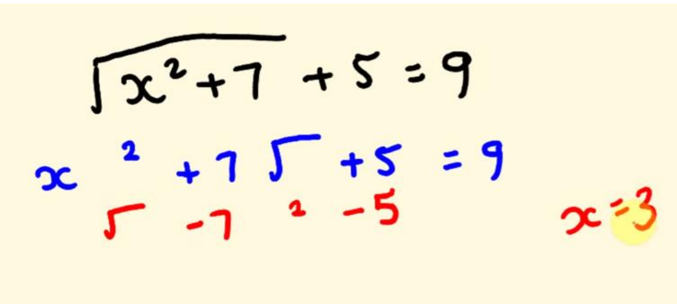
first_2: 95% od 720 = 684
100% od 720 = 720
10% = 72 → 5% od 720 = 36
Subrtract: 720-36 = 684

first_3: 12% od 80 = 9,6
10% od 80 = 8
1% od 80 = 0,8

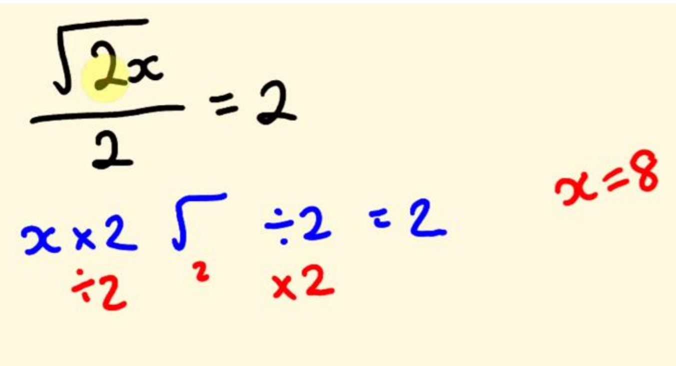
ALGEBRA



solution: 4*3 = 12 + 8 = 20 / 5 = 4



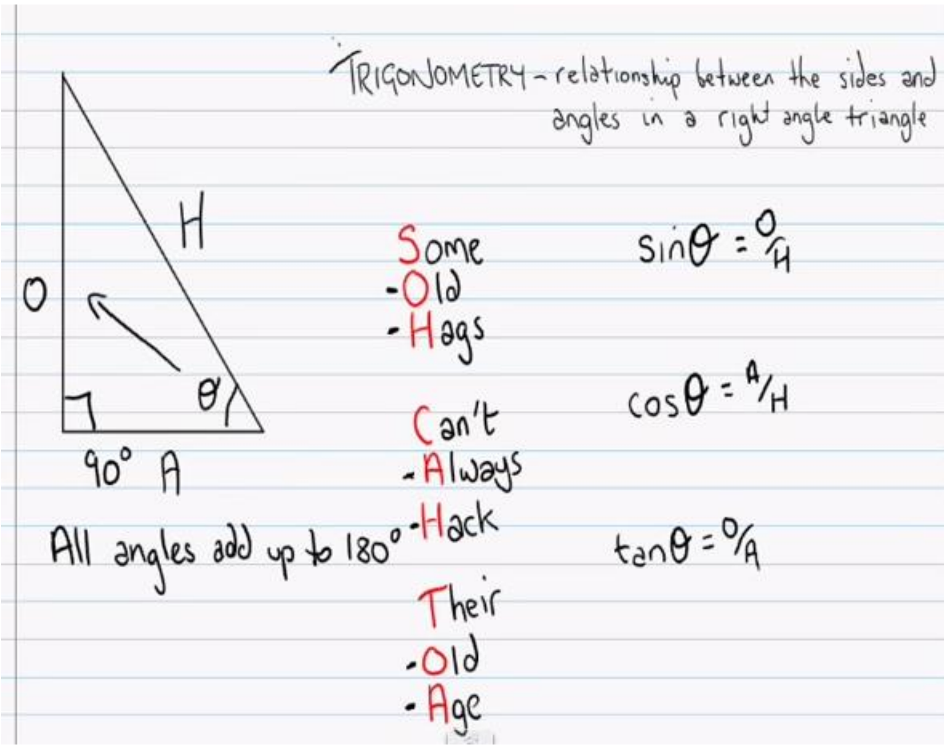
solution: 9 - 5 = 4 squared = 16 - 7 = 9 squared = 3



Solution: 2 * 2 = 4 squared = 16/2 = 8

TRIGONOMETRY
The sum of all the angles in the triangle is 180!
Trick with your hand!

	0^o	30^o	45^o	60^o	90^o
SIN (α)	**0**	**1/2**	$\sqrt{2}/_2$	$\sqrt{3}/_2$	**1**
COS (α)	**1**	$\sqrt{3}/_2$	$\sqrt{2}/_2$	**1/2**	**0**
TAN (α)	**0**	$\sqrt{3}/_3$	**1**	$\sqrt{3}$	**undefined**



DIRECT PROPORTIONS
Sample: Earnings = Constant * hours → more you work, more you earn!

Sample_2: If you work 50 hours, you will earn 250€. How much will you earn if you work for 80 hours?
Answer: (80*250) / 50 = 400€

INVERSE PROPORTIONS
Sample: Speed α Time → as speed goes up, time decreases

Sample_2: 4 workers can paint a fence in 3 hours. How long will it take 6 workers?
Answer: 4*3 = 12 → 12/6 = 2 hours

RE-ARANGING EQUATIONS
Samples:

$$ax + b = c$$
$$ax = c - b$$
$$x = \frac{c - b}{a}$$

$$b(cx + 5) = f$$
$$bcx + 5b = f$$
$$bcx = f - 5b$$
$$x = \frac{f - 5b}{bc}$$

$$\frac{ax}{b} - f = c$$
$$\frac{ax}{b} = c + f$$
$$ax = b(c + f)$$
$$x = \frac{b(c + f)}{a}$$

$$ax^2 + b = c$$
$$x^2 = \frac{c - b}{a} \rightarrow x = \sqrt{\frac{c - b}{a}}$$

$$(x - t)^2 + b = c$$
$$(x - t)^2 = c - b$$
$$x - t = \sqrt{c - b}$$
$$x = \sqrt{c - b} + t$$

$$\sqrt{x - a} = b$$
$$x - a = b^2$$
$$x = b^2 + a$$

PRIME NUMBERS to 100:
2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47, 53, 59, 61, 67, 71, 73, 79, 83, 89, 97

HR QUESTIONS

What four words best describe you?
Honest, responsible, dedicated and organized.

What are your weakness?
I expect others to be as committed as I am, sensitive, too much thinking about something.

What kind of salary do you expect?
That is a tough question. Can you tell me the range for this position?

Tell me about yourself:

- Name
- Place information
- Education (short)
- Job experience
- Aviation experience
- Family details

My name is Agapito. I come from Italy. I studied at the Faculty for Business and Managment in Bari. For the last 10 years I have been working as Cabin crew at Ryanair. I started my flying career 11 years ago. Since then I flow around 600 hours, mostly on business turboprops across the Europe.

What can you do for us that other candidates can't?
I have a unique combination of pilot and Cabin Crew skills. This gives me the big picture and a lot of extra knowledge.

Where do you see yourself in 5 years?
Captain on A320 in your company.

What are your biggest strengths?
Problem solver, performing good under pressure, loyal, positive attitude, eager to learn, attention to detail, …

Why do you want to work for Wizzair?
I think it is a great privilege for any pilot to work in a reputed company like Wizzair. …

Group exercise

5 aircraft, color of the tail, destination, cargo, time and place.

First: list ALL the options!
Second: deduction (draw a table)

	1	2	3	4	5
Color					
Destination					
Cargo					
Time					
Place					

CRM - Crew Resource Management
is the effective use of all available resources for flight crew personnel to assure a safe and efficient operation, reducing error, avoiding stress and increasing efficiency.

SIMULATOR

1. Check cockpit before DEPARTURE (PFD – ND), anti ice, TO-CONFIG, …
2. Raw data take off
3. Radial intercept (set COURSE on RAD/NAV)
4. ECAM warning (simple)
5. Downwind, raw data ILS
6. GA + engine failure (till clean up)
7. Reposition
8. Single engine ILS – full stop

RAW DATA TAKEOFF

Procedure:

- select V2 in the FCU
- establish initial climb of 15 °
- when reaching the thrust reduction altitude (THR RED ALT):
  - pitch 10°
  - SELECT a climb speed (250 kts)
  - SET the thrust levers to CL detent
- F/S speeds - appropriate actions
- TURN ON the FDs (basic modes engage)
- SELECT appropriate modes
  - Manage NAV
  - Manage SPEED
- AP - ON
- ACTIVATE the autothrust NOTE: never engage A/THR without first selecting a speed higher than actual