

Air Transport Management and Technology:

5. The Classification of Aircrafts and Flight Physics Fundamentals

Methodological concept to effectively support technical key competencies using foreign languages ATCZ62 – the CLIL as a university teaching strategy



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Definition of aircraft

- Aircraft is a **flying means of transport**, according to the definition of the Czech standard it refers to: "A device capable of exerting forces carrying it in the atmosphere from air reactions that are not reactions to the Earth's surface."
- Airplanes can be divided according to many aspects, but the basic classification is as follows:
 - **Aircraft lighter than air** – they use aerostatic forces to fly
 - **Aircraft heavier than air** – in order to fly they mostly use aerodynamic force (lift) on lifting surface that can be moving or fixed (wing).

Classification of aircraft

- **Aircraft lighter than air (aerostats)**

- With propulsion - for example airships
- Without propulsion- for example hot air balloons

- **Aircraft heavier than air (aerodynes)**

- Without propulsion with fixed lifting surfaces (wings) – e.g. a parachute or a glider
- With propulsion with moving (rotating) lifting surfaces – e.g. a helicopter
- With propulsion with fixed wing/wings – e.g. a rogallo or a classic **airplane**
- With propulsion without lifting surfaces – a rocket

There are also combinations of the above – e.g. a convertiplane, which changes the method of achieving lift during the flight.

Classification of transport airplanes

- Depending on the length of the flying range we distinguish:
 - **Short-haul** airplanes with a range of up to 1,000 km, sometimes referred to as regional.
 - **Medium-haul** airplanes with a range of 1000 to 3000 km. These aircraft are mainly used on international routes.
 - **Long-haul** aircraft with a range of more than 3000 km are deployed on transcontinental flights.
- Depending on seat capacity:
 - Light aircrafts - aerotaxi: 3 to 10 passengers;
 - Small transport airplanes: 10 to 30 passengers (sometimes called as feederliners);
 - Medium-sized transport airplanes: 30 to 100 passengers;
 - Large transport airplanes: 100 to 200 passengers;
 - High capacity aerobuses : over 200 passengers

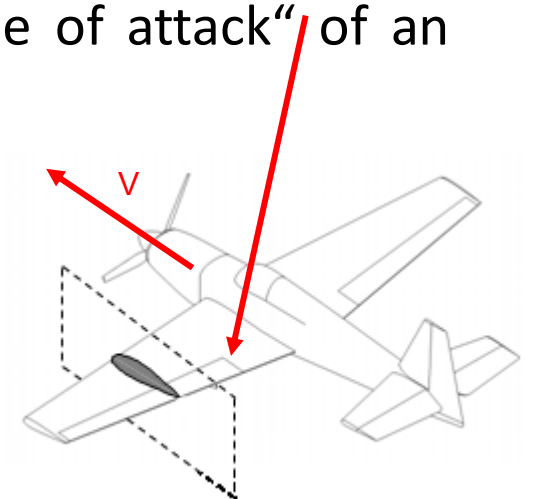
Classification of transport airplanes (continued)

- Depending on the seat arrangement in the airplane:
 - Narrow-body airliners – with single aisle, 2-2 or 3-3 seats abreast;
 - Wide-body airliners – with two aisles and 2-3-2, 3-3-3 or 3-4-3 seats abreast.
- Depending on the type of propulsion system:
 - Propliners (past) or light airplanes with propeller (piston-powered engines);
 - Propjet (Turboprop powered);
 - Jet airliner (Turbofan or turbojet powered).

Transport airplanes can also be distinguished according to the location of lifting surfaces, the number and position of the engines, the type of landing gear or the shape of the wings (and others).

Generation of aerodynamic force

- An airfoil generates lift by exerting a downward force on the air as it flows past. According to Newton's third law, the air must exert an equal and opposite (upward) force on the airfoil, which is the lift. (Simplified physical explanations).
- For aircrafts heavier than air, the aerodynamic force must be equal to or greater than the weight of the flying object.
- To generate the aerodynamic lift it is necessary to ensure the airflow around lifting surfaces (wings) at a certain velocity v , the wing must also have a certain profile (airfoil) and sufficient area S , and it is also necessary to ensure the efficient „angle of attack“ of an airfoil.



Aerodynamic force Y

$$Y = c_y \cdot S \cdot \rho \cdot v^2 / 2$$

S – size of lifting surfaces [m²],

ρ – air density [kg/m³]

v – airplane velocity [km/h]

c_y – „angle of attack α “ function – aerodynamic coefficient

