
HOW TO:
Aeronautical Therapy

How to use this guide

Review this guide to see what you'll be teaching your customers in the Aeronautical Therapy. This will help you plan and conduct your flight simulations effectively.

The sections in purple are internal notes for you and are not meant for the customer's final presentation.

Lesson Plan

- Objectives
- Safety Information
- Aerodynamics
- Aviation Regulations
- Weather Theory
- Emergency procedures

Objectives

Give the self-assurance that will allow you to apprehend your upcoming travel.

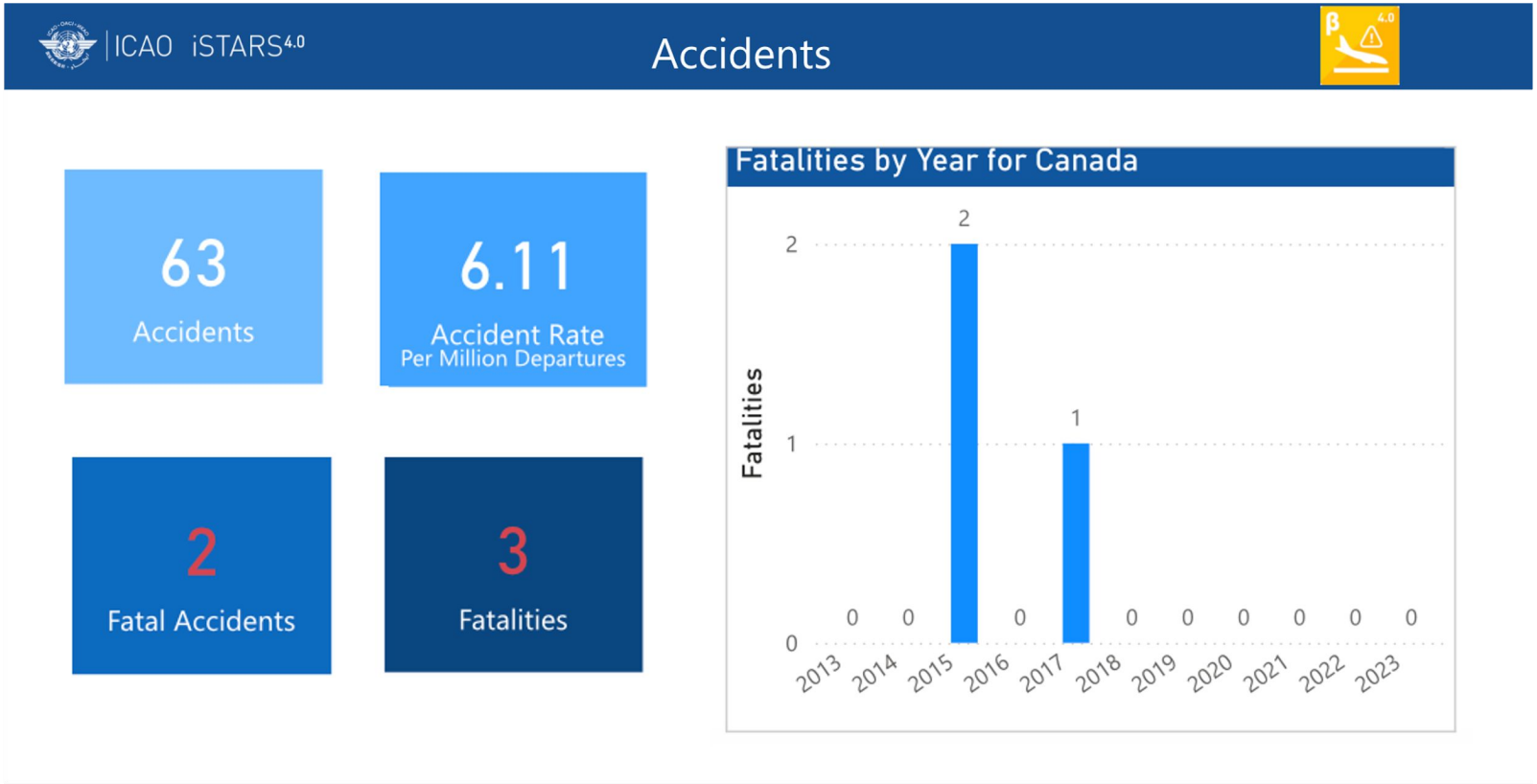
The goal is to provide participants with the knowledge and confidence to tackle their next flight.

Bring rational explanations about flight, risks and mitigations.

By providing rational explanations of how a flight unfolds, potential risks and existing mitigation measures, we aim to demystify aviation.

Safety Information

Present the ICAO graph showing the low number of accidents and fatalities.



Safety Information

With data from 2024 (Until June 16th):

- There is going to be approximately between 35.9 and 40.1 million commercial flights in 2024.

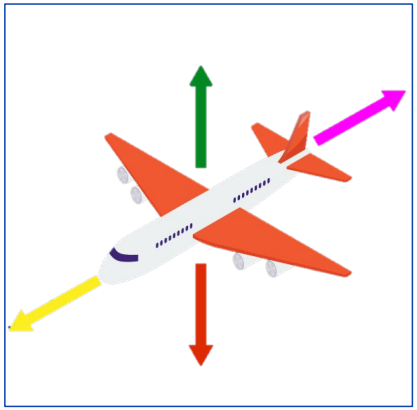
- It is expected to reach 9.4 billion pax transported by the end of the year.

- On August 11th of 2023, airlines operated 18.6 million seats, making it the busiest day of the 2023 period.

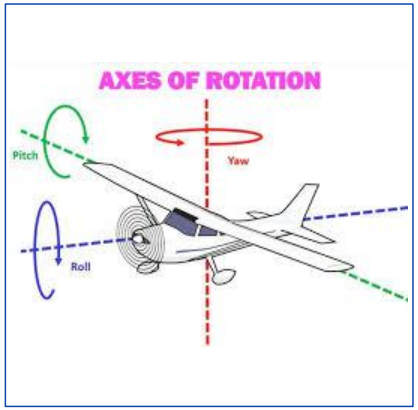
Explain that each dot represents an airplane in flight,
demonstrating the routine and normality of this activity.

Aerodynamics

Forces of Flight

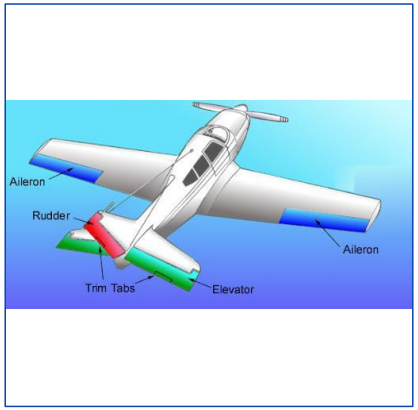


Axes of Movement



Engines

Flight Controls

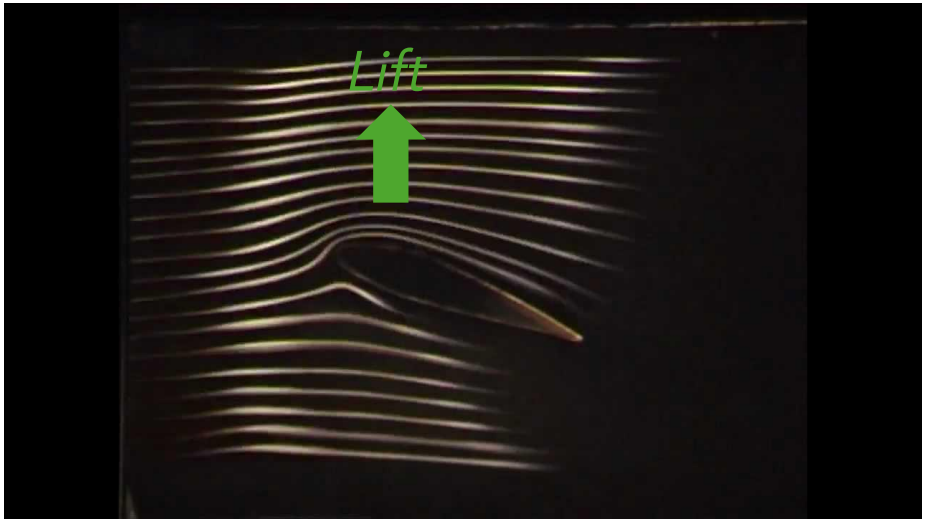


How does the airplane fly?

- **How does the airplane fly?**
- **Which are the forces acting during flight?**

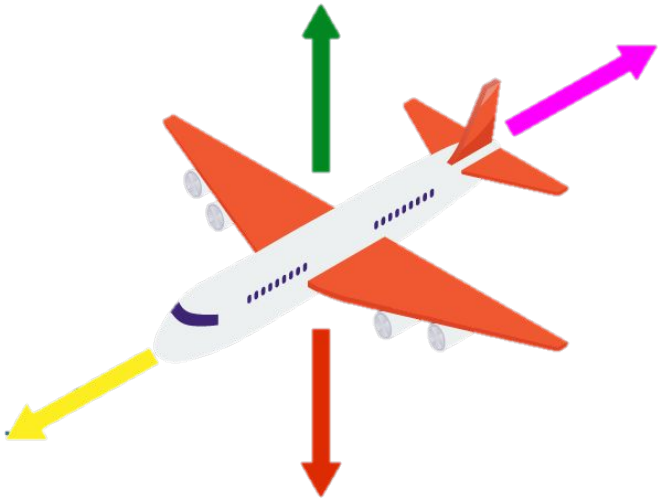
Daniel Bernoulli

It is generated by the shape of the wings and the speed of the air flowing over and under them. The air passing over the wing is faster, which creates lower pressure, sucking the wing upwards (Bernoulli's Principle). In addition, the wing deflects the air downwards, which, by reaction (Newton's third law), pushes the aircraft upwards.



Forces of Flight

- **Lift**
- **Weight**
- **Thrust**
- **Drag**



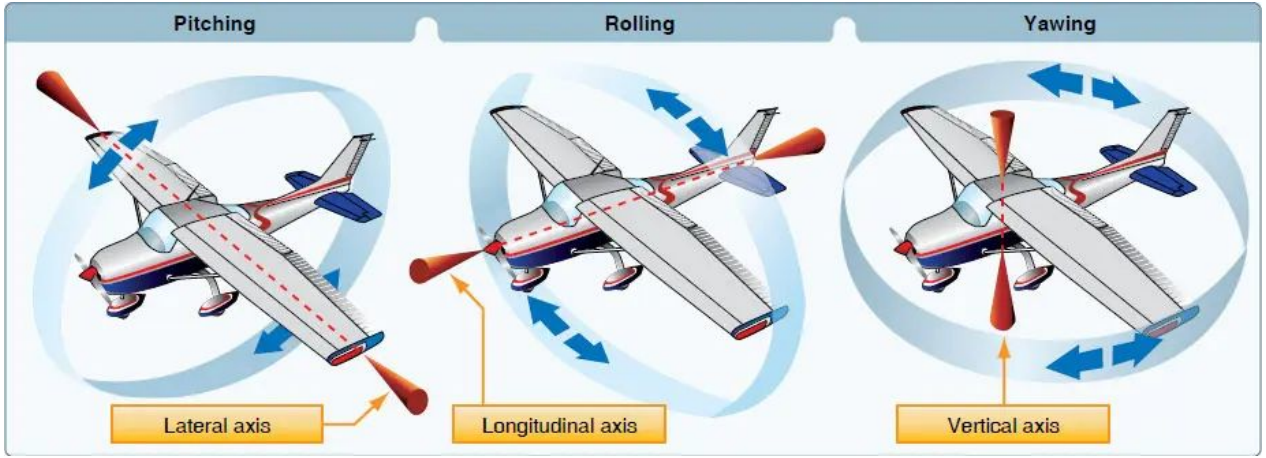
"In steady, unaccelerated flight, these forces are in a state of balance. The goal is to make Lift equal to Weight, and Thrust equal to Drag.

To climb, we increase thrust. This makes thrust greater than drag, which increases our speed. As our speed increases, our wings generate more lift, which makes lift greater than weight, and the airplane begins to climb.

To descend, we do the opposite. We reduce thrust. This makes drag greater than thrust, and our speed decreases. As a result, lift becomes less than weight, and the airplane starts to descend."

Axes of movement

Briefly explain the purpose of ailerons, elevator and rudder, relating them to the axes of movement.

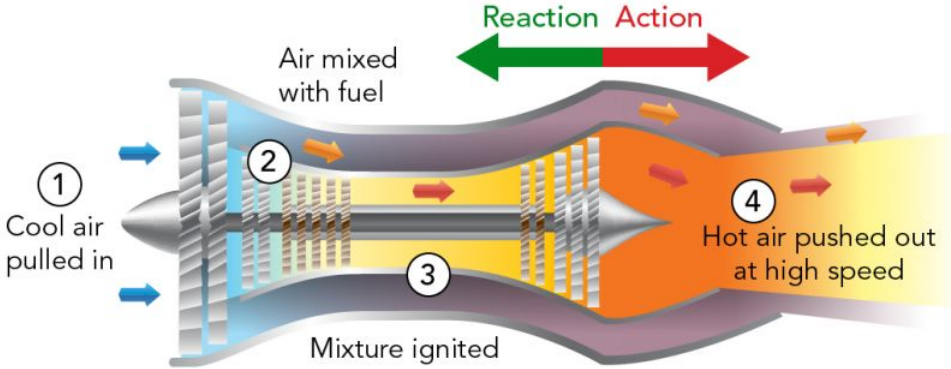


Engines

Engines help us generate thrust. And thrust is generated by:

- **Expansion of hot gases**
- **Air pushed back by the fan**

Thus, engines also go through different safety inspections to ensure proper operation



The engines generate the thrust needed to overcome drag and allow lift to develop.

Engines (Safety Inspections)

The Trent 1000 engine

has more than:

12,000 flight time in testing

4,800 in flight testing

1,800 flights before certification.

Engines (Maintenance)

A Check:

Every 300 cycles or 125 flight hours, whichever comes first.

B Check:

Every three months.

C Check:

Every 12 - 18 months

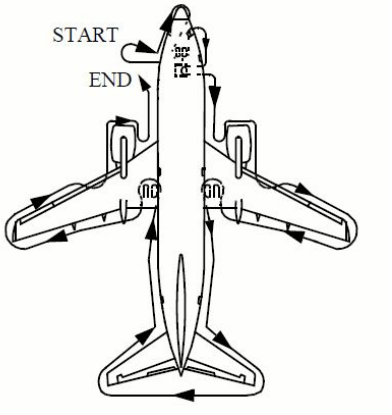
D Check: (high maintenance visit)

Every 4-5 years (Lasts 2-3 months)

Flight Controls (Safety Inspections)

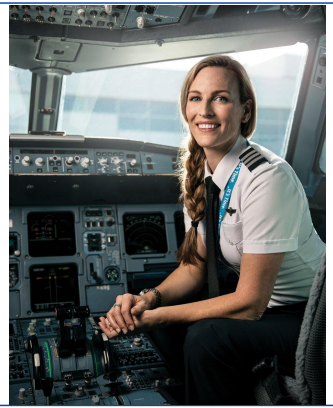
Walk arounds are performed to verify exterior components.

If there are anomalies, the flight won't take place until the aircraft is re-inspected thoroughly and repaired if needed.



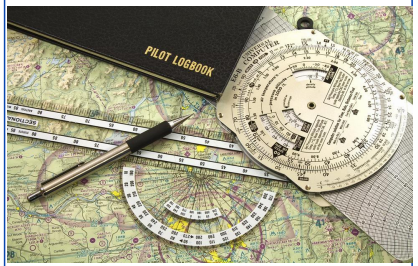
Regulations

Pilots

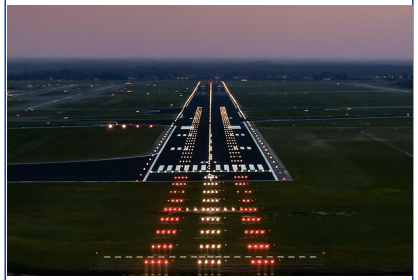


Flight Attendants

Flight Planning



Approach Categories



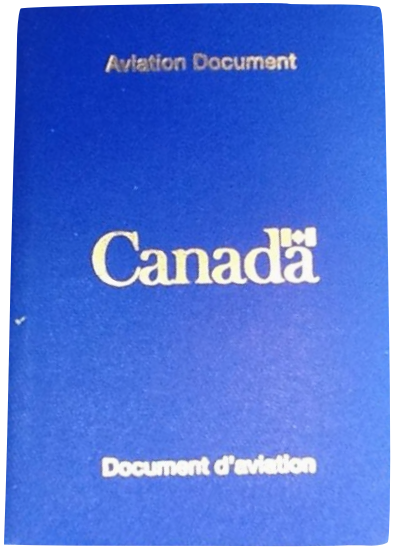
Pilots

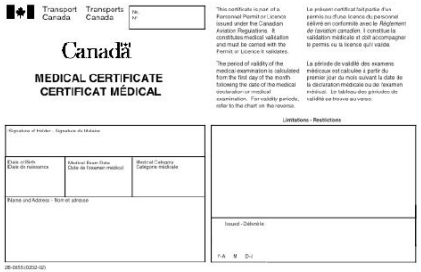
Both pilots need:

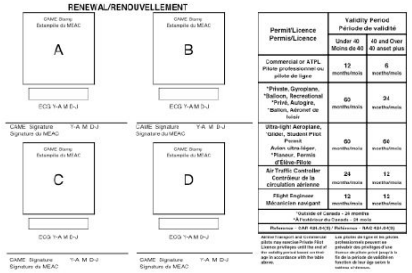
- Aviation document issued by Transport Canada.

- A class 1 medical certificate performed by a certified doctor once a year (twice if +40 years old)

- Specific training for the type of aircraft







Flight Attendants

Flight attendants receive an extensive initial training. Additionally, they must pass their medical certification and undergo recurrent training (once a year).

Flight Planning

A Pilot must gather all available information concerning their flight prior to takeoff.

This includes, but is not limited to:

Fuel consumption
- Available Alternates
- Current and Forecasted Weather
- Performance Data
- Weight and Balance

Dangerous Goods

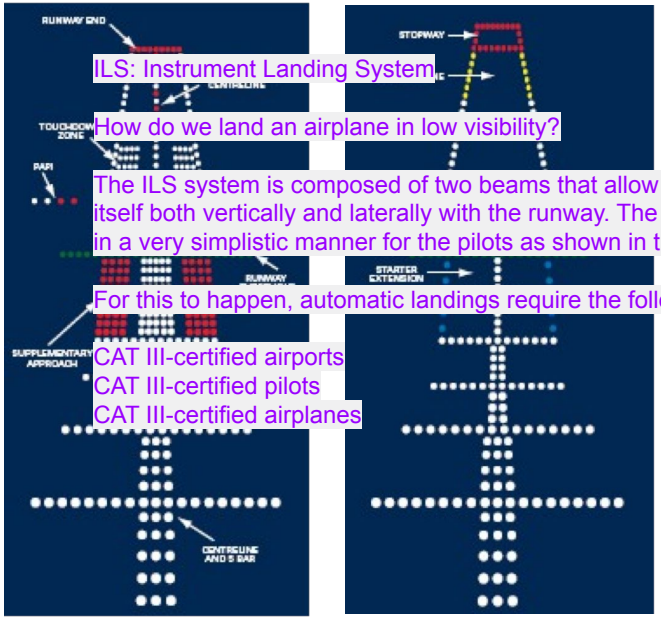
Fuel considerations:

- Taxi consumption
- Leg consumption (trip fuel)
- En route reserve
- Alternate fuel - which allows an app, a missed app, and then fly to and land at the alternate airport.
- Legal reserve (30/45 minutes of flight)
- Weather reserve (holding)
- Extra fuel - decided by the captain based on his/her experience.

Approach Categories

ILS Approaches

When visibility falls under certain values and becomes zero visibility, some pilots are train to do automatic landings.



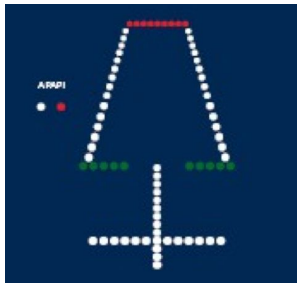
ILS: Instrument Landing System

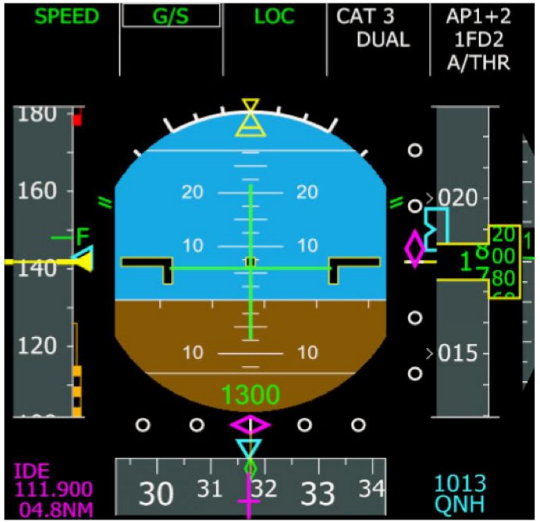
How do we land an airplane in low visibility?

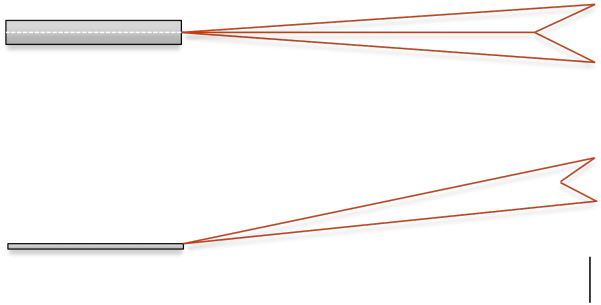
The ILS system is composed of two beams that allow the aircraft to align itself both vertically and laterally with the runway. The ILS system is shown in a very simplistic manner for the pilots as shown in the image above.

For this to happen, automatic landings require the following:

CAT III-certified airports
CAT III-certified pilots
CAT III-certified airplanes







Weather

Turbulence

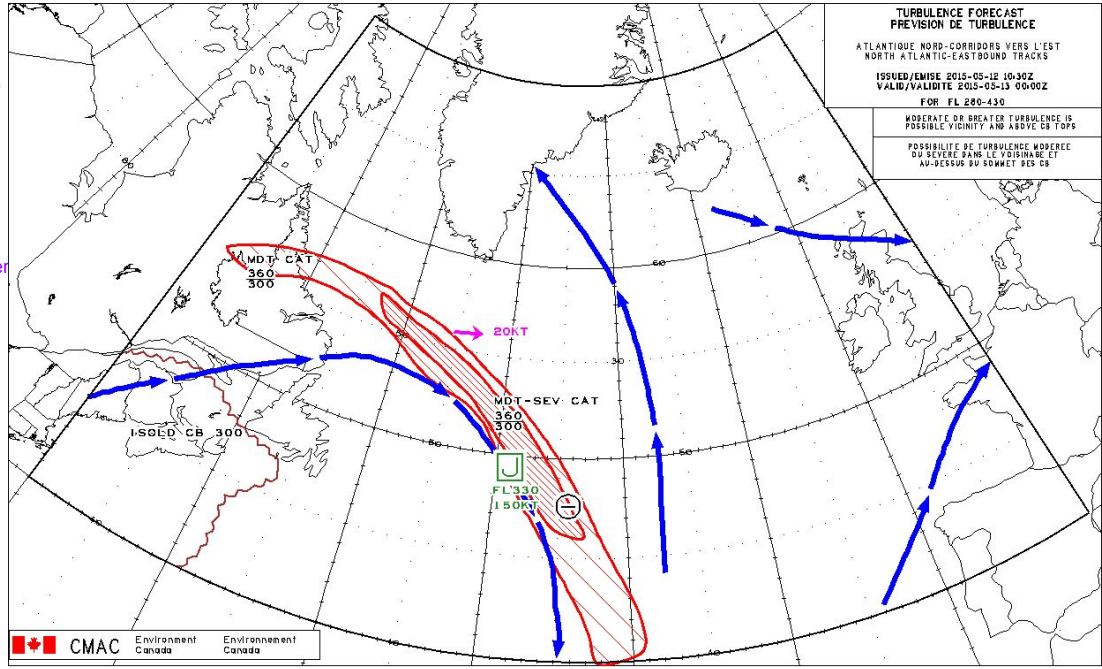
Storms and Lightning

Icing

Turbulence

Where does turbulence come from? We will see two types, and how they originate.

- **Clear Air Turbulence**
  Caused by jet streams, invisible to the naked eye but predictable thanks to weather maps.
- **Associated with clouds**
  Generally linked to ascending and descending air currents in convective clouds (cumulus, cumulonimbus).



Turbulence

turbulence occurs in clouds is due to the unstable mixing of air due to the temperature, pressure, and velocity changes within clouds compared to the outside air.

In cumulonimbus clouds (Left picture), are commonly associated with storms and you can also expect:

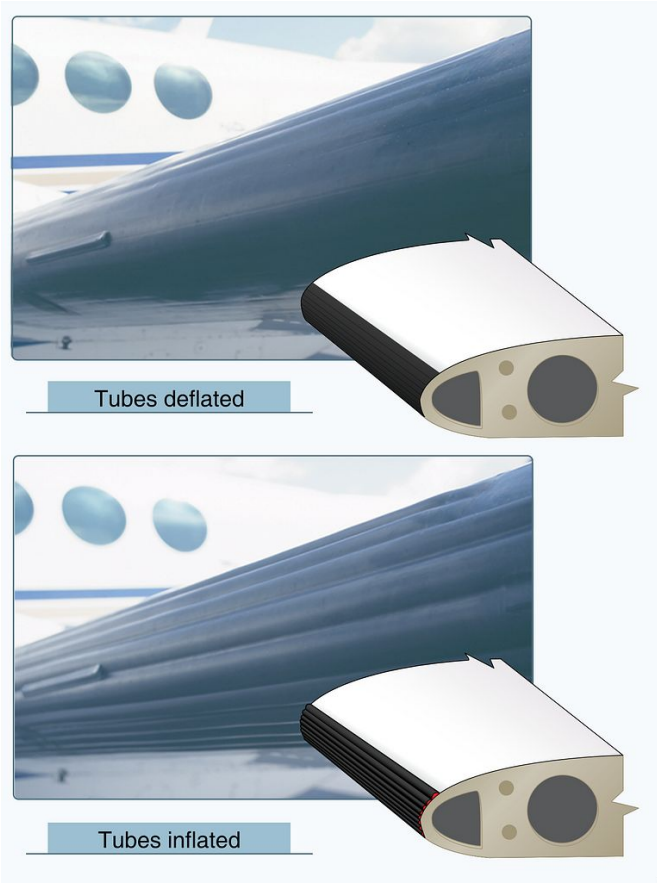
Windshear
Icing conditions
Hail
Rain
Lightning

Lightning

Airplanes are conceived to resist lightning strikes. It is said that airplanes are struck by lightning more than once a year. In fact, aircrafts often triggers lightning because of the particularities of the aircraft. The equipment onboard is able to sustain the electric charge.
The last crash that occurred following a lightning strike dates back from 1967, almost half a century ago

Icing

Wings are de-iced before each flight when conditions are such that de-icing is required - i.e. wings and other lift-induced surfaces are contaminated by snow or ice.

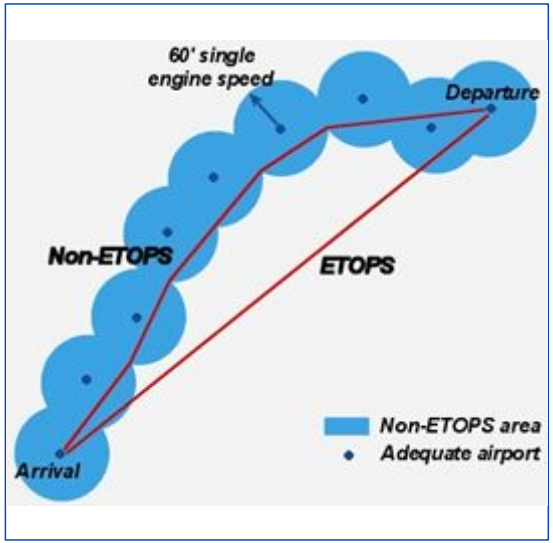


In flight, anti-icing systems and de-icing systems exist as to eliminate the ice build up on critical surfaces.

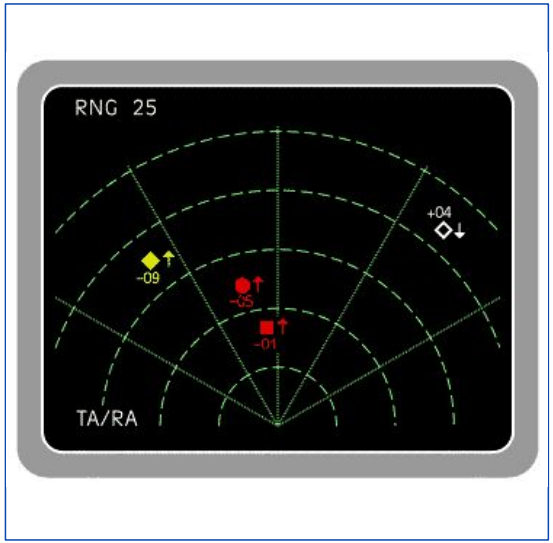
The anti-icing system found on most airliners is provided by hot bleed air whereas on smaller aircrafts, de-icing systems are often inflatable boots.

Failures

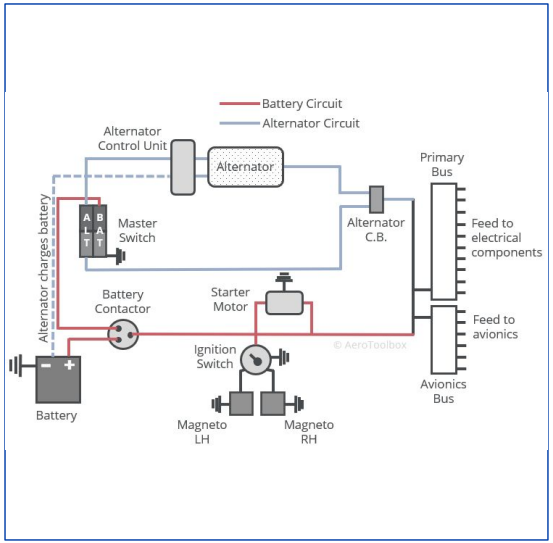
ETOPS



Mid-air collision



Electrical failure



ETOPS

Pilots are quick to react in the eventuality of an engine failure thanks to the memory items.

Twin engine airplanes have more than often more power than necessary (overpowered). Hence, in case of an engine failure, one engine is more than enough to assure a safe flight to an alternate airport.

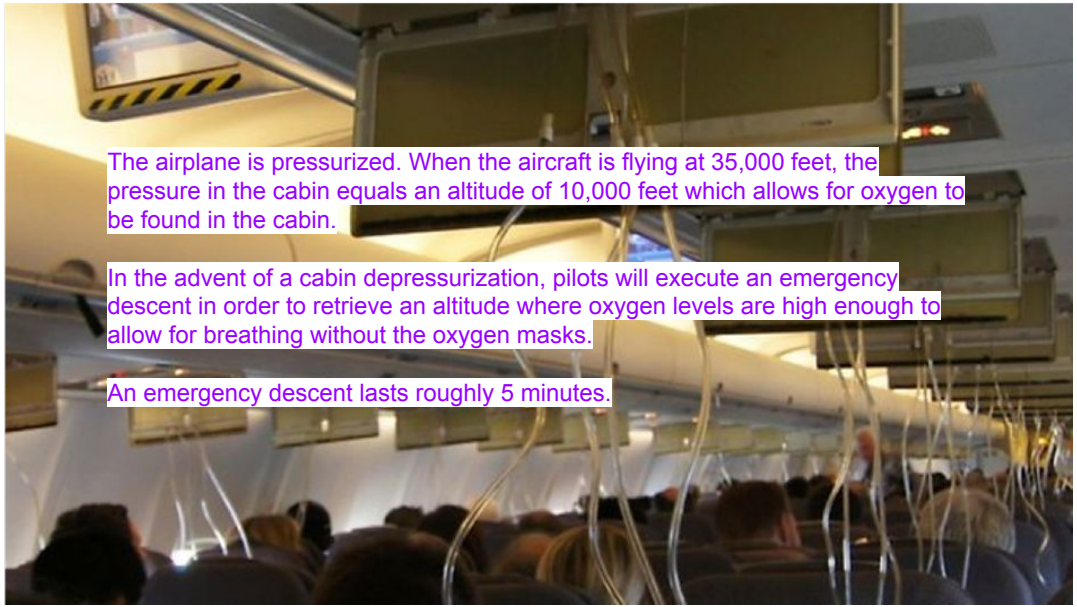
"Extended-range Twin-engine Operational Performance Standards." It is a set of regulations and guidelines established by aviation authorities that allow twin-engine aircraft to fly routes that are farther from diversion airports than would normally be allowed.

The ETOPS certification allows airlines to operate twin-engine aircraft on long-haul routes, such as transatlantic or transpacific flights, by ensuring that the aircraft can safely divert to an alternate airport in the event of an engine failure or other emergency. The certification specifies the maximum diversion time, typically in increments like 60, 90, 120, 180 minutes, etc., which indicates how long the aircraft can be from a suitable airport at any point during the flight.

Engine Fire

The engine will be shut down by the crew and they will follow a checklist to verify all systems potentially affected by the associated failure and make sure that the reminder systems work.

Depressurization



The airplane is pressurized. When the aircraft is flying at 35,000 feet, the pressure in the cabin equals an altitude of 10,000 feet which allows for oxygen to be found in the cabin.

In the advent of a cabin depressurization, pilots will execute an emergency descent in order to retrieve an altitude where oxygen levels are high enough to allow for breathing without the oxygen masks.

An emergency descent lasts roughly 5 minutes.

Oxygen masks have a capacity of 15 to 20 minutes per passenger. Pilots have a separate system of oxygen for redundancy.

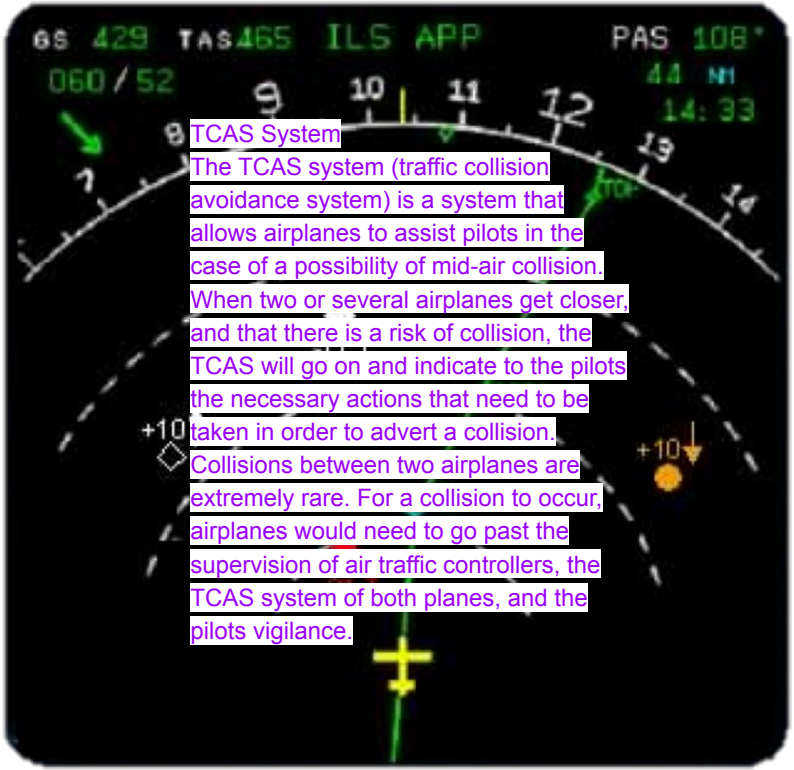
Mid-air collision

Traffic nearby
No altitude information

Traffic nearby
1100ft higher and descending

Traffic Advisory (TA)
900ft lower cruising

Resolution Advisory (RA)
500ft lower and climbing
Requires immediate action



TCAS System

The TCAS system (traffic collision avoidance system) is a system that allows airplanes to assist pilots in the case of a possibility of mid-air collision. When two or several airplanes get closer, and that there is a risk of collision, the TCAS will go on and indicate to the pilots the necessary actions that need to be taken in order to advert a collision. Collisions between two airplanes are extremely rare. For a collision to occur, airplanes would need to go past the supervision of air traffic controllers, the TCAS system of both planes, and the pilots vigilance.

Electrical failures

In the advent of an electrical failure, several solutions are possible.

The n°2 generator provides electricity to the n°1 generator.

In case of an electrical failure, the auxiliary power unit (APU) can also provide electricity.

In case of a total electrical failure (which has seldom been seen) the ram air turbine (RAT) allows for a minimum amount of electricity to be provided to systems which will in turn allow for a safe emergency landing.

Hijacking Attempts

What actions are taken by the flight crew to avoid hijackings?

- Emergency descent to avoid an explosive depressurization
- Control the unruly passenger
- Emergency landing in order for the competent authority to arrest the passenger and search the aircraft

Hijackings and bombs onboard are very rare occurrences since 9/11. Most of the time, bomb threats result in emergency landings without ever finding actual bombs onboard. However, threats are still taken very seriously.

Congratulations!

Congratulations!

Now you have the knowledge required for a demonstration flight!

Have a Great Flight!