

Introduction to Aircraft Product Fundamentals

Welcoming Immigrant Women to
Aerospace



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- Graduate of Masters of Engineering - Aerospace at Toronto Metropolitan University (Ryerson University)
- Professional Engineer
- Over 12 years of experience in manufacturing and operations at a leading Canadian commercial and business aircraft OEM
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LECTURE

Highlights

🕒 0900 - 1000

The primary purpose of this presentation is to introduce the key concepts and primary considerations of aircraft products and their associated systems in the context of the Canadian Aerospace Industry



Agenda

- 1 Aircraft Introduction and Short Theory
- 2 Short History and Major Aviation Highlights in Canada
- 3 Types of Aircraft
- 4 Structures and Major Systems
- 5 Closing Remarks

Aviation is proof that given the will, we have the capacity to achieve the impossible

Edward Vernon Richenbacher





What is an Aircraft?

- an airplane, helicopter, or other machine capable of flight
- Utilizes aerodynamic principles to sustain flight
- Includes everything from large transport airliners to the drones you see in your local electronics store
- Can be categorized as follows:
 - Fixed Wing
 - Rotary Wing or helicopter
 - Un-powered
 - Lighter than air
 - Unmanned





What Drive Aircraft Design and Type?

Mission

What are the performance requirements



Safety

Ensure the preservation of life and property



Regulations and Standards

Local and internationally defined

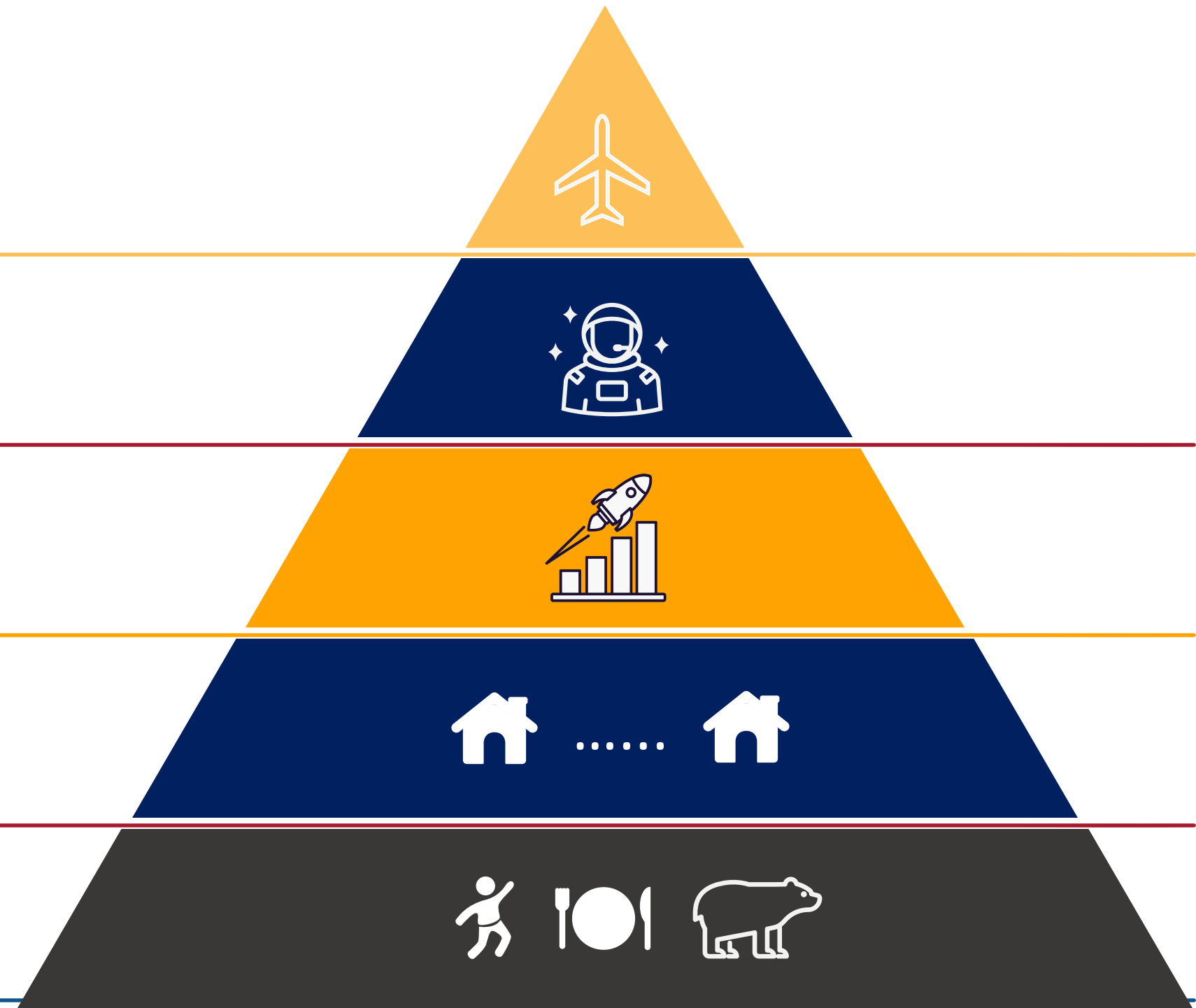




Mission

The mission definition is key to aircraft design and will dictate, type, speed, operating altitude, and distance

- ① Performance
- ② Special Mission Requirements
- ③ Take-off and Landing Requirements
- ④ Range
- ⑤ Payload and Weight





Authorities and Regulatory Bodies

Canada's aviation industry is governed by the Canadian Air Regulations or CARs.

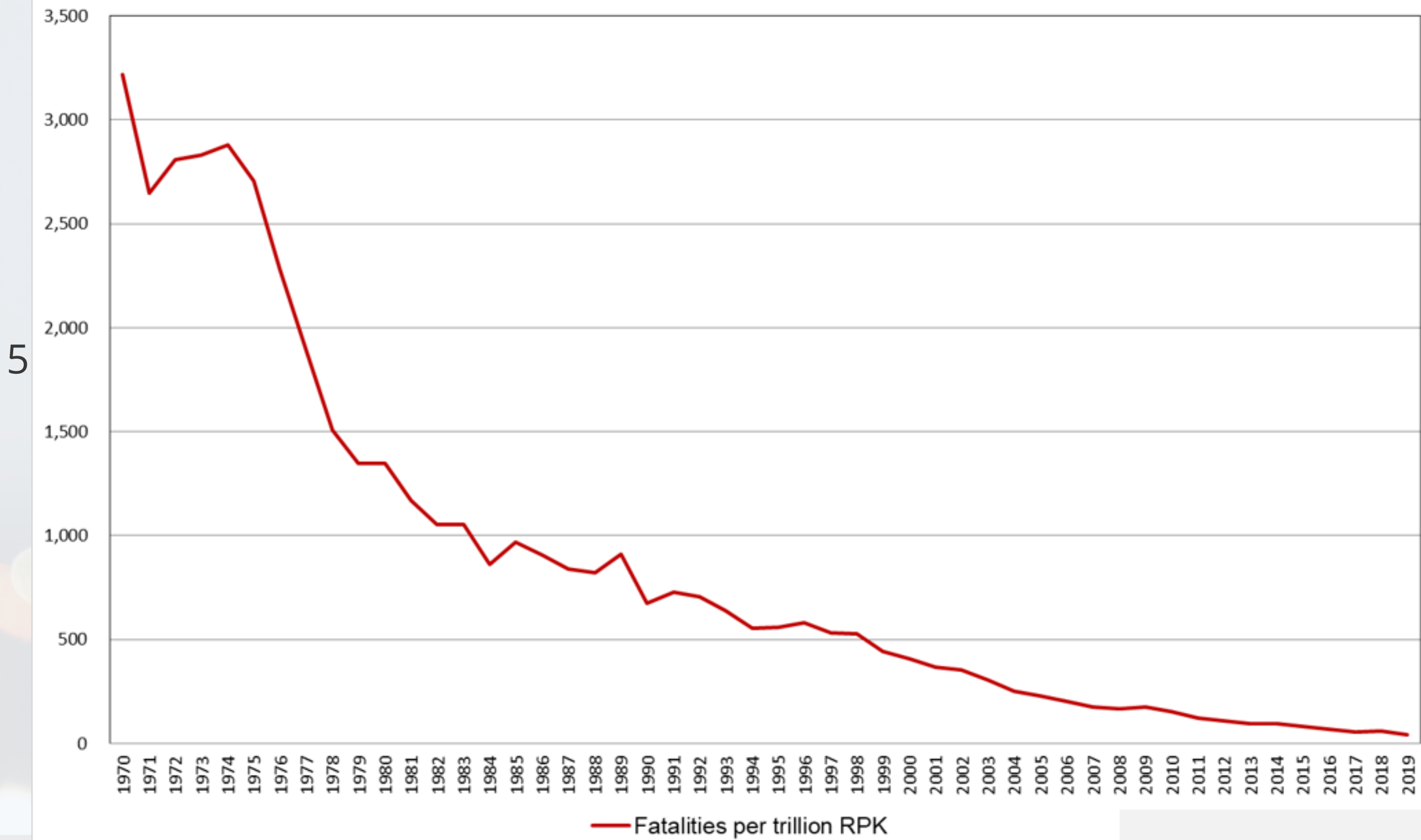
The industry is tied to government and regulatory bodies through Transport Canada, Industry Canada, as well as numerous regional and national bodies



Federal Aviation Administration



Aviation Safety: Fatalities per trillion RPK (Revenue Passenger Kilometers)



5

— Fatalities per trillion RPK



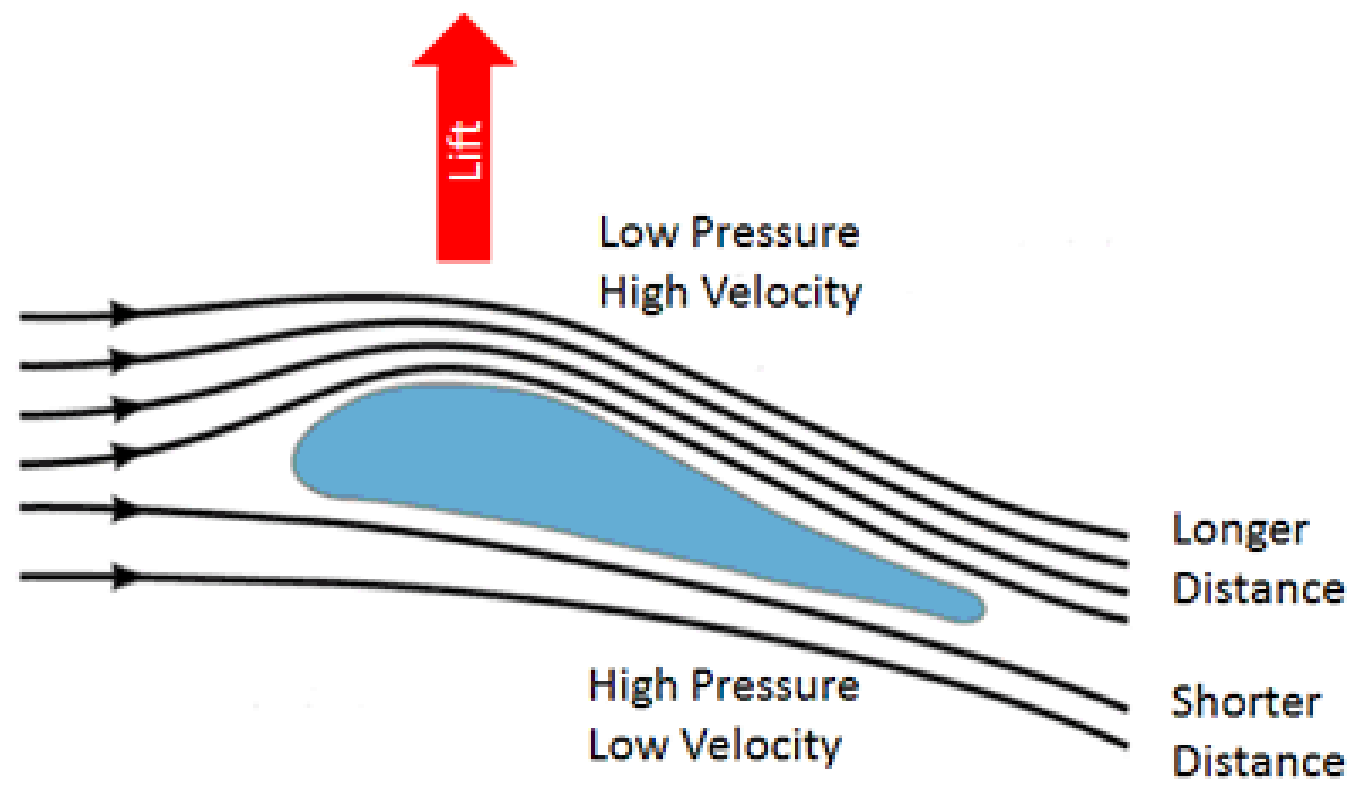
Theory of Flight





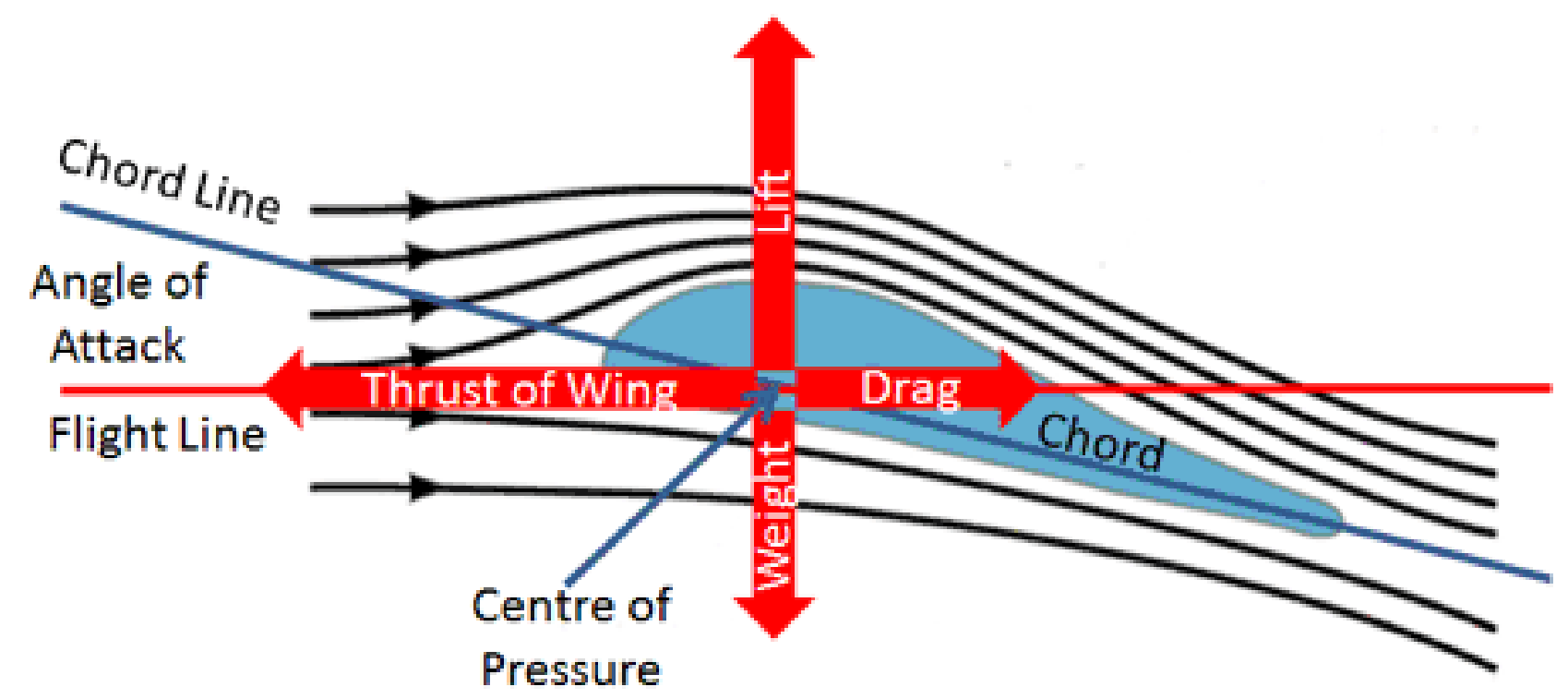
Theory of Flight

Aerodynamic Lift – Explained by Bernoulli's Conservation of Energy Law



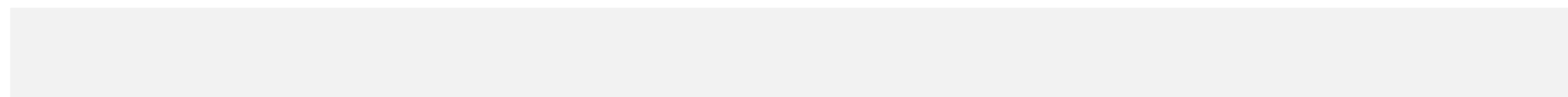
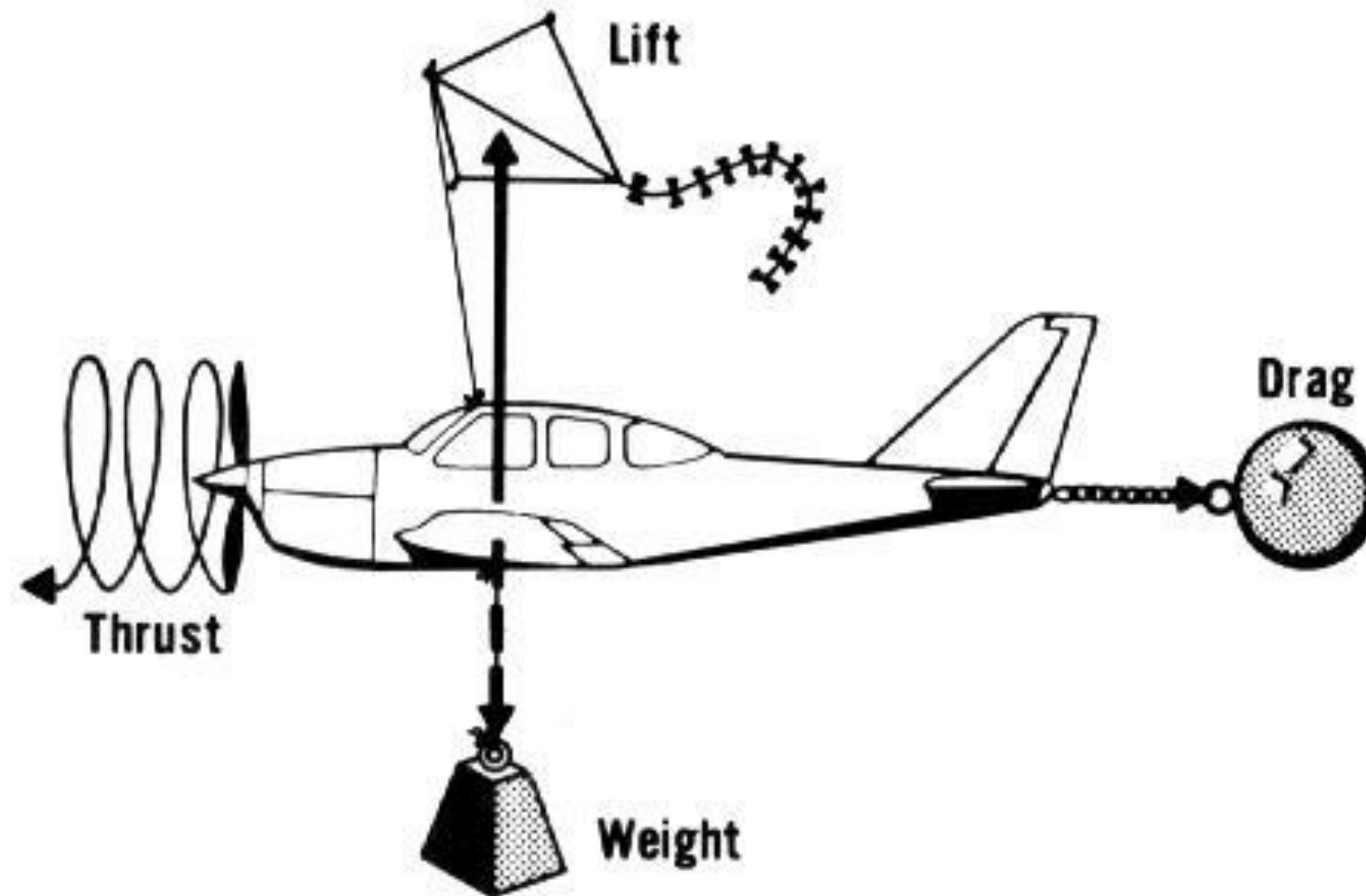
Also known as the "Longer Path" or "Equal Transit" Theory

Aerofoil Lift and Drag – Aircraft Wings



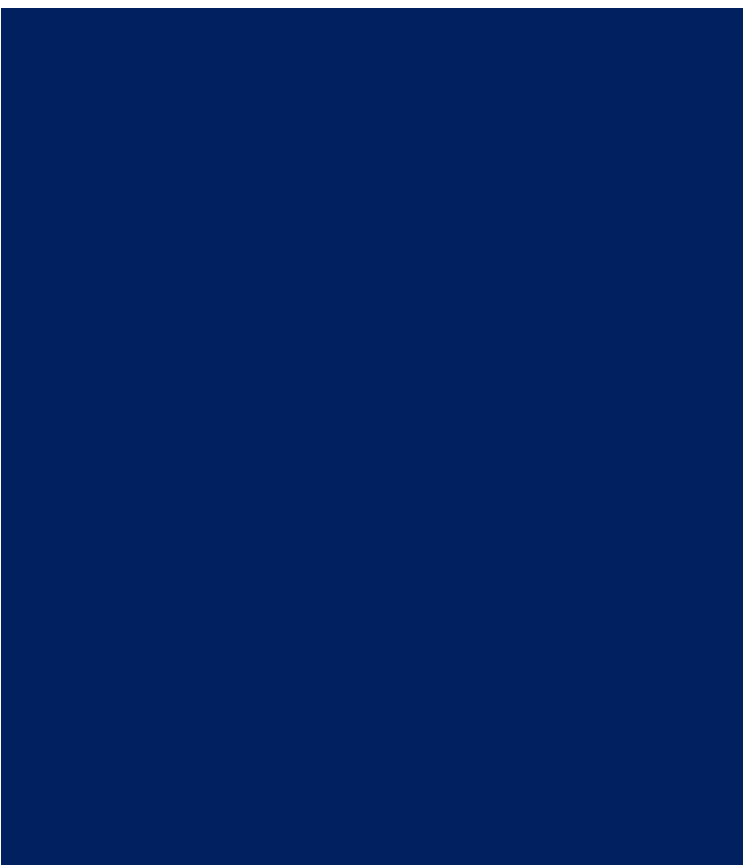
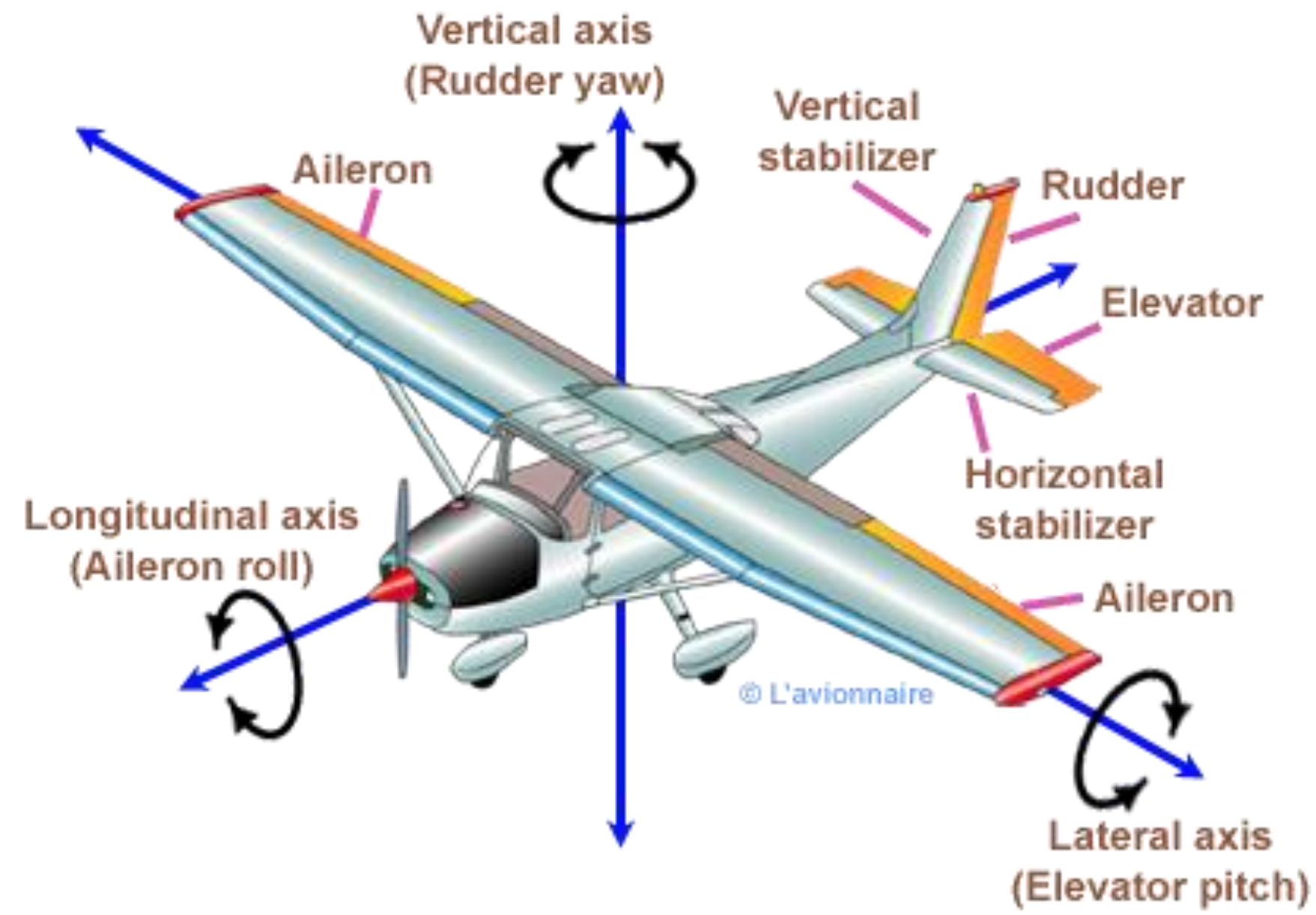


Aeroplane Theory of Flight





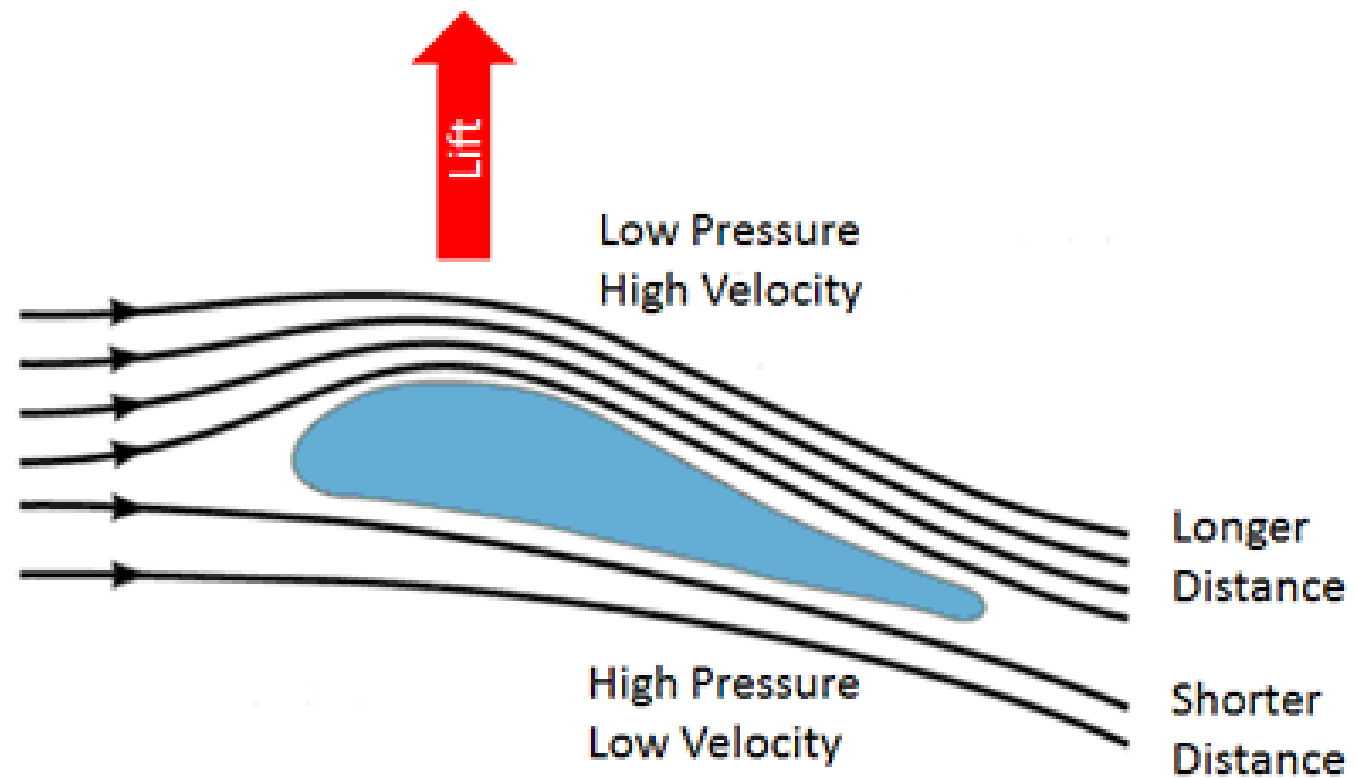
Aeroplane Theory of Flight



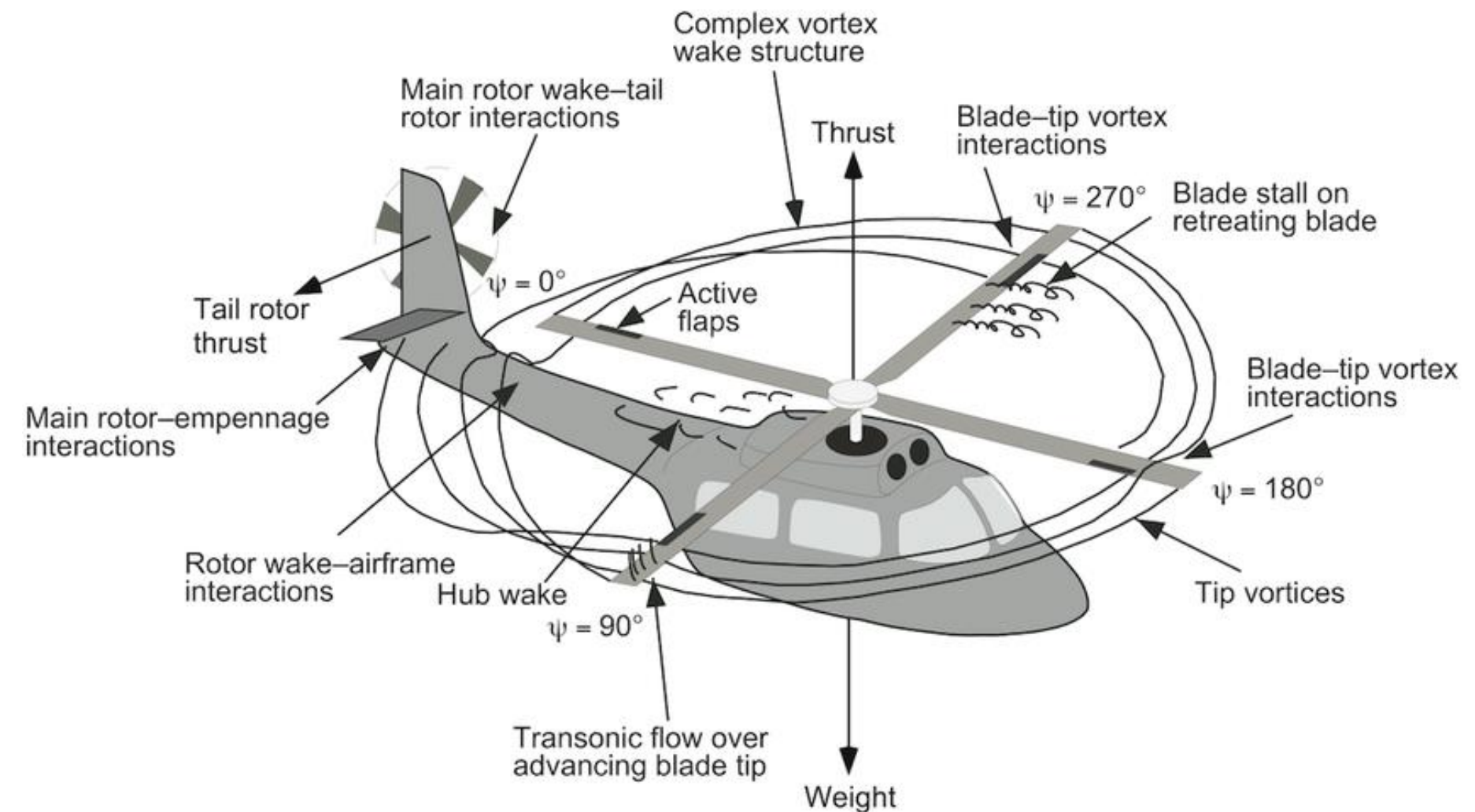
Helicopter Theory of Flight



Aerodynamic Lift – Explained by Bernoulli's Conservation of Energy Law



Also known as the "Longer Path" or "Equal Transit" Theory





Aviation in Canada

Short look at aviation history

- 8 SEPTEMBER 1856 First Balloon flight in Canada at Wesleyan Methodist Church in Griffintown, Montreal
- February 23, 1909 First Powered Flight by the Silver Dart with a top speed of 65km/hr and 9 meters in height above ground
- July 1913, Alys Mckey Bryant is the first female pilot takes to the Canadian skies
- Trans-Canada Airlines was created 10 April 1937 by Act of Parliament as a subsidiary of Canadian National Railways and eventually, would become Air Canada
- During the second world war, aerospace manufacturing in Canada boomed with over a dozen OEM or licensed manufacturers active
- Today, Viking Air (de Havilland), Bombardier, Pratt & Whitney, Boeing and Magellen all continue this tradition





Types of Aircraft

Small to large, different types of aircraft for the specified mission

General Types

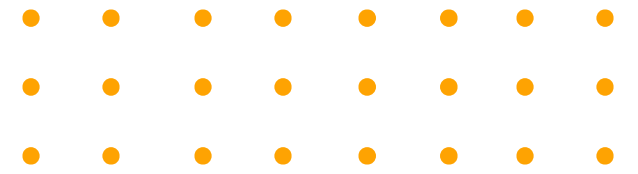
- Small Aircraft used for training, agriculture and commuter operations
- Mid-size aircraft used for regional and private operations
- Large transport category aircraft used for passenger and cargo transport
- Helicopters used for training and commercial operations
- Unmanned Aerial Vehicles (UAV) used for consumers, agriculture and commercial operations



Types of Aircraft







Aircraft Systems and Major Assemblies

Primary structures and avionics are key to successful aircraft design, performance and safety.

While each design is unique and catered to its specific target use, the major assemblies, systems, and subsystems can be commonly observed and are broken down into Structure and Systems.

More Information >>>>

Major Structures

Aircraft basic design has vastly changed in terms of material, application, and manufacturing over the last 100 years, but the main overall components remain the same

Fuselage

Primary vessel for cargo, crew and passengers

Wings

Generate the lift and commonly hold fuel

Empennage

Counter the rotational force generated by lift (at the wing) and keep the aircraft level longitudinally and in yaw

Flight Controls

Manipulates the direction of flight by deflecting a surface or propulsive force

Landing Gear

Used to support the aircraft when on the ground

Major Systems

Advancements in systems and avionics has seen the greatest impact to the industry in ease of use, efficiency and safety

Avionics

Communications and navigation computers

Hydraulics

Used to drive manipulation of flight controls and landing gear or other systems

Fuel

Whether battery or fossil fuel driven, a source of energy must be present to support generation of thrust

Fly-By-Wire

Modern flight controls utilize computers to interpret input and manipulate the direction of flight

Power Plant

Propulsive power may be derived from piston, turbojet, turboprop, turbofan and electric motors

Major Aircraft Structures and Systems Aeroplane



Major Systems Small Aeroplane



Powerplant

- 2-6 cylinder piston driven engines
- Utilize low lead aviation fuels
- Can be super or turbocharged
- Next generation utilizing electric motors



Systems

- Generally unpressurized
- Oxygen systems are supplemental
- Fixed or retractable landing gear

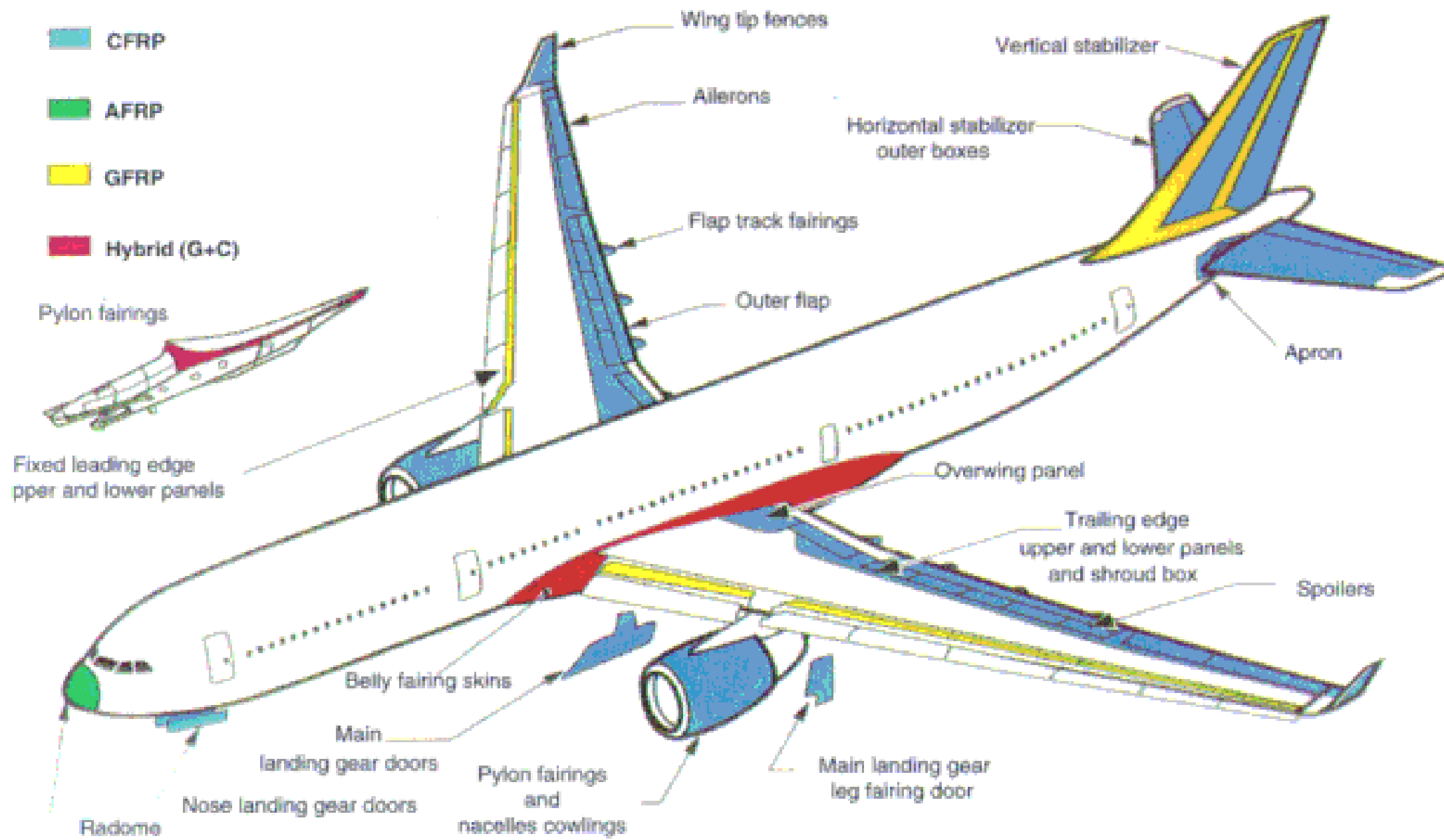


Avionics and Communications

- Typically analogue and vacuum driven instruments
- Communication and navigation use LF and VHF radio spectrum
- Modern small piston aircraft have more advanced systems including “Glass Cockpit” and GPS navigation

Major Aircraft Structures and Systems

Large Aeroplane



Major Systems

Large Aeroplane



Avionics and Communications

- Glass cockpit design and ergonomics
- Communication and navigation use LF, VHF and HF radio spectrum, though also now incorporate satellite communication systems
- Primarily navigation via GPS

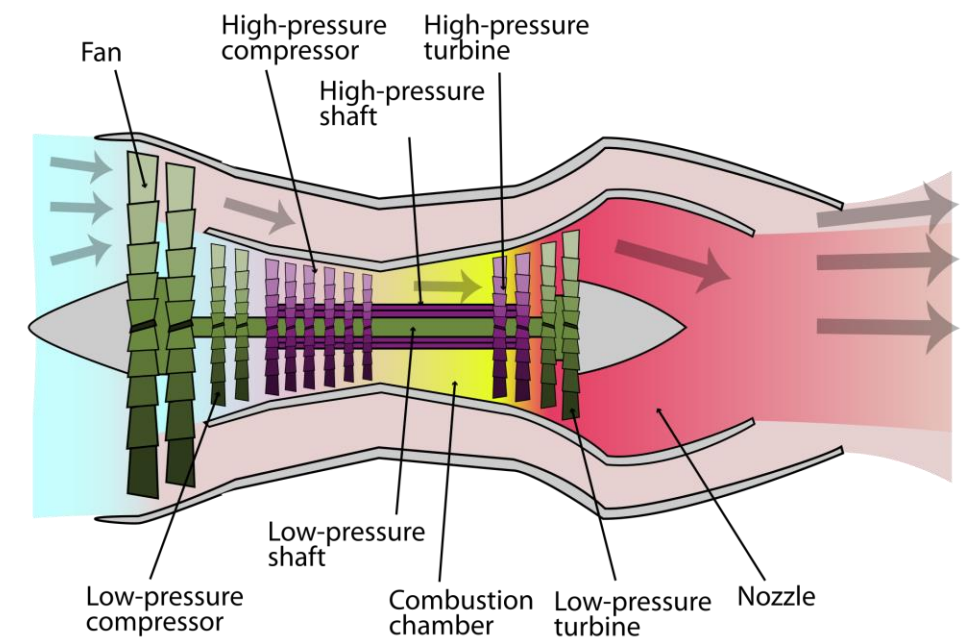


Systems

- Pressurized Cabin
- Complex primary and secondary flight controls
- Fly-by-wire
- Redundancy built into various systems by design
- Retractable landing gear
- Weather Radar

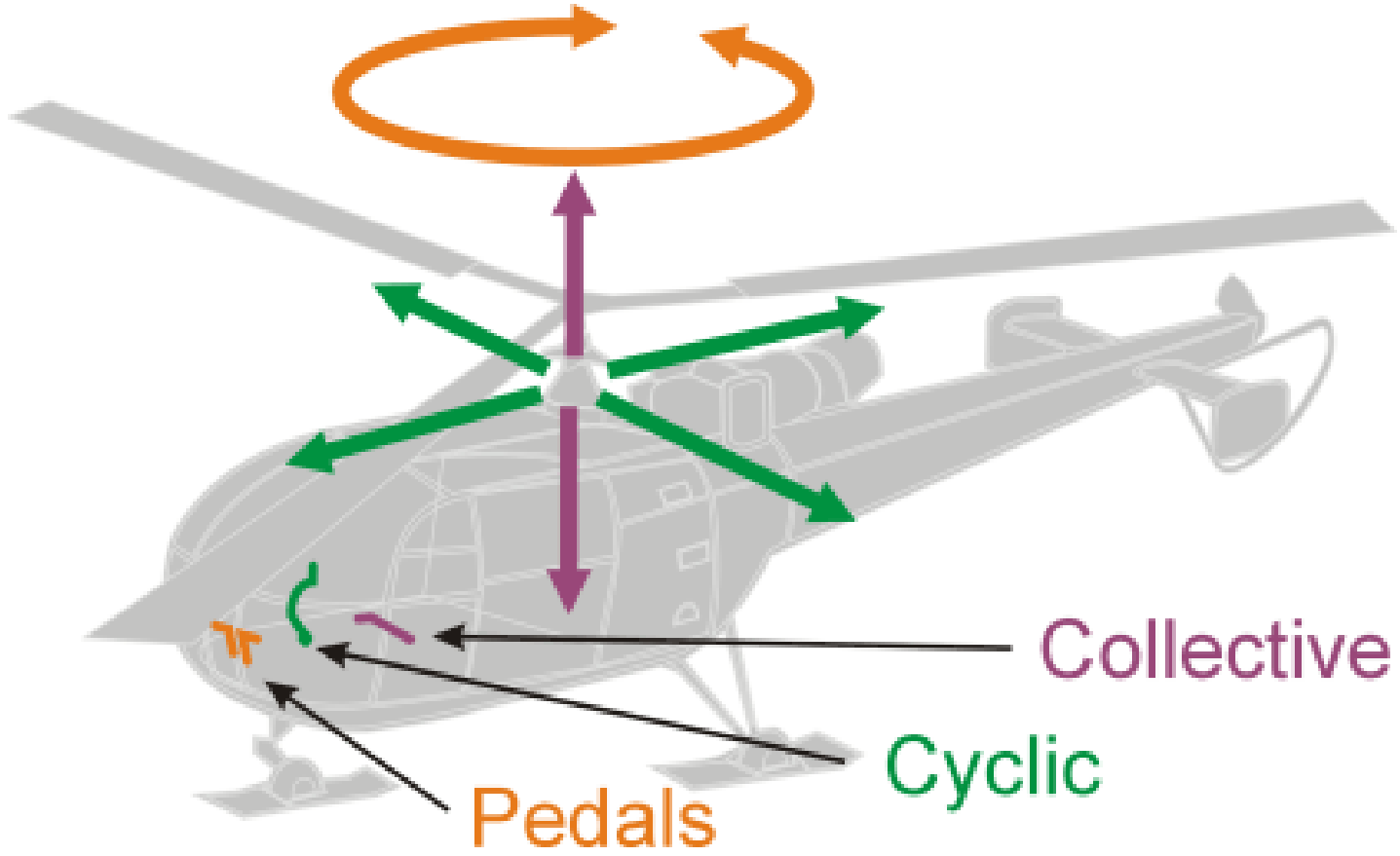
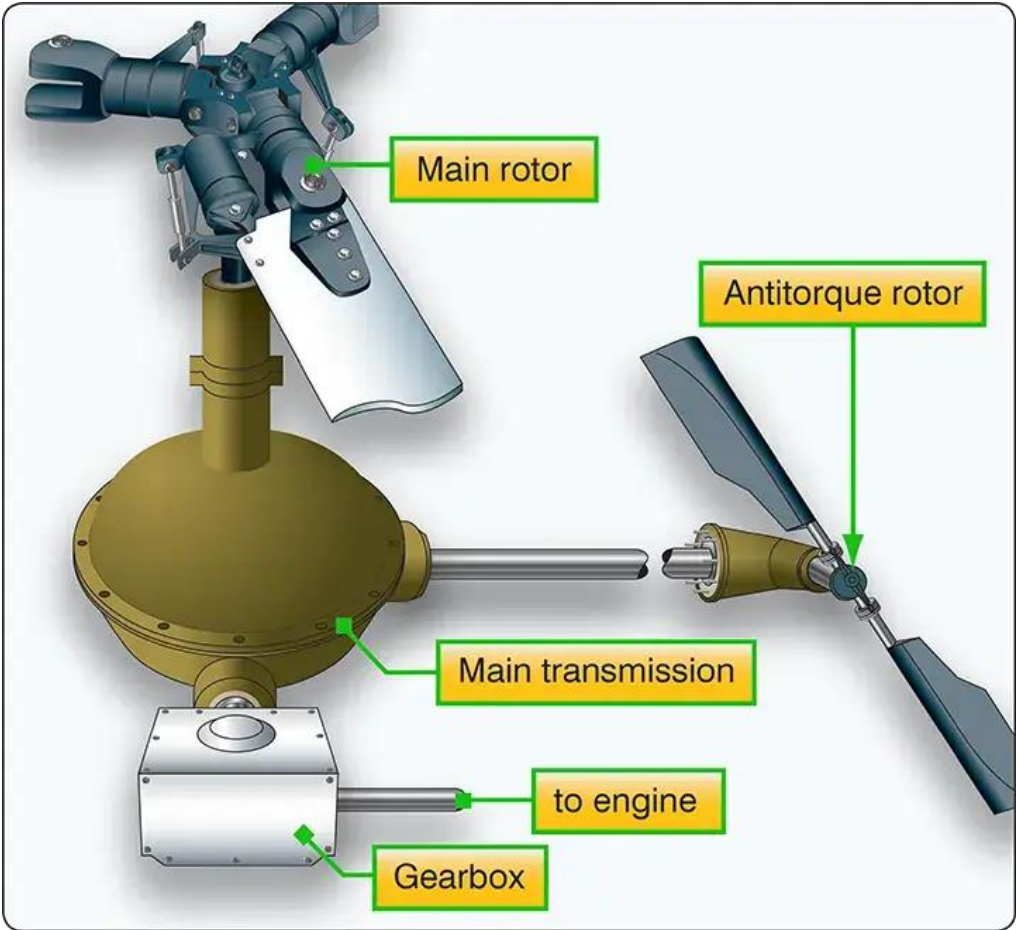
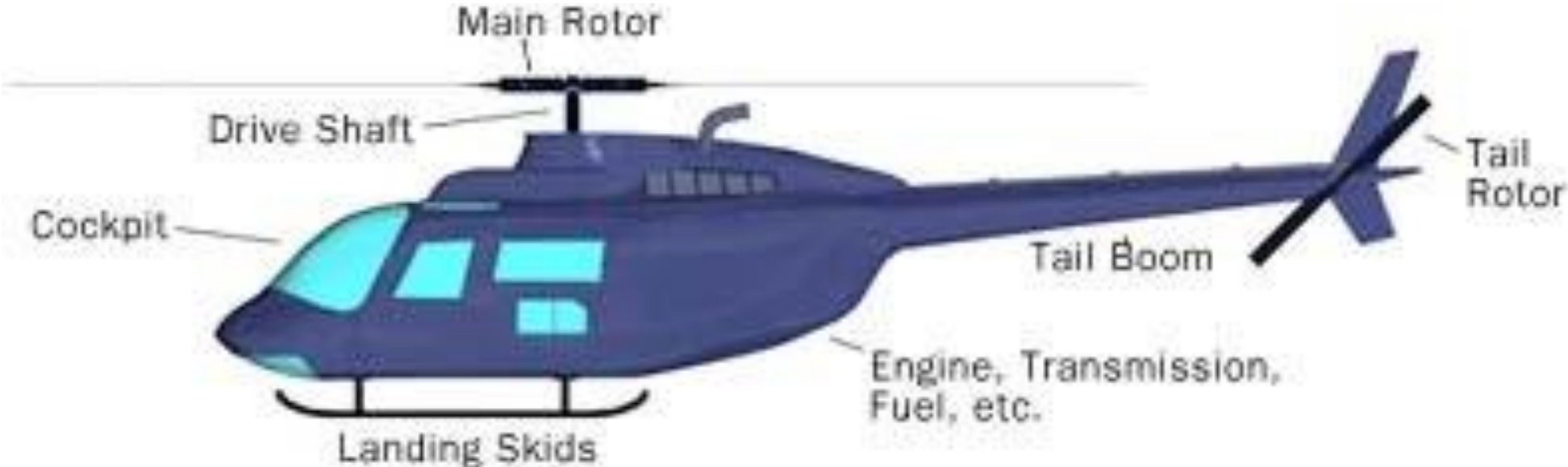
Powerplant

- 2-4 turbofan engines with high bypass ratio



Major Aircraft Structures

Helicopter





Major Systems Helicopter



Avionics and Communications

- Common to have classic or glass cockpit
- Communication and navigation use VHF as well as satellite communication systems
- Primarily navigation via GPS and classic radio navigation



Powerplant

- Piston or turbine powered

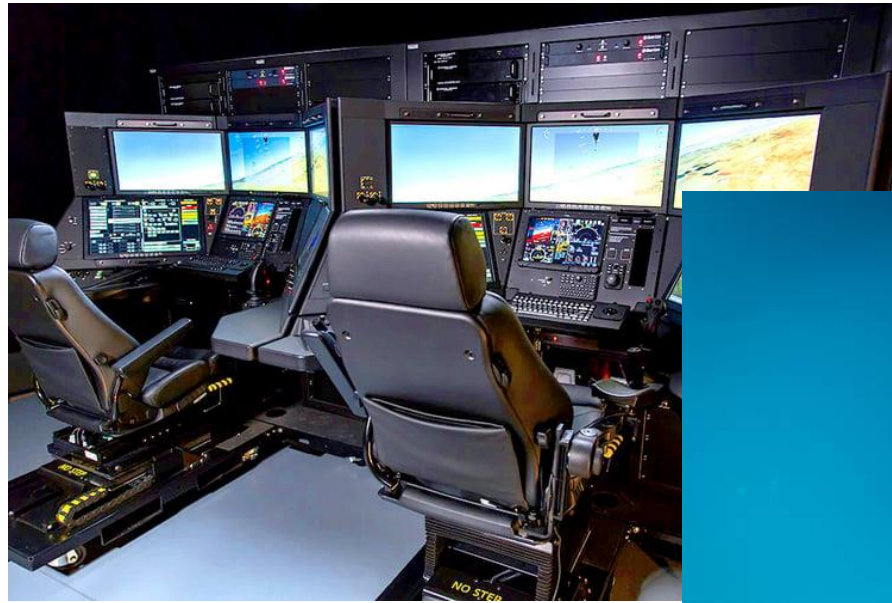
Systems

- Complex flight control system is tied to the propulsion system
- Can be fly-by-wire or direct control system
- Can be pressurized





Unmanned Aerial Vehicles (UAV)



Command and Control

- Utilize ground station or controller for flight control
- Can utilize radio frequencies (2.4GHz or 5GHz or others)
- GPS and satellite communication

Powerplant

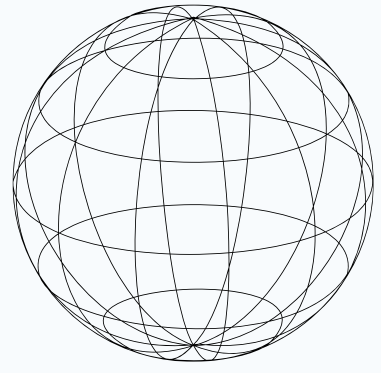
- Piston, turbine or electric motor



Systems

- No need for life support systems
- Mission specific systems such as cameras, FLIR, aerial applicators





Closing Remarks





THANK YOU

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