



SNS COLLEGE OF TECHNOLOGY



(An Autonomous Institution)
Coimbatore - 641 035, Tamil Nadu

DEPARTMENT OF AEROSPACE ENGINEERING

23AST101 - Fundamental of Aerospace Engineering

Topic: *Wing Structure*

By

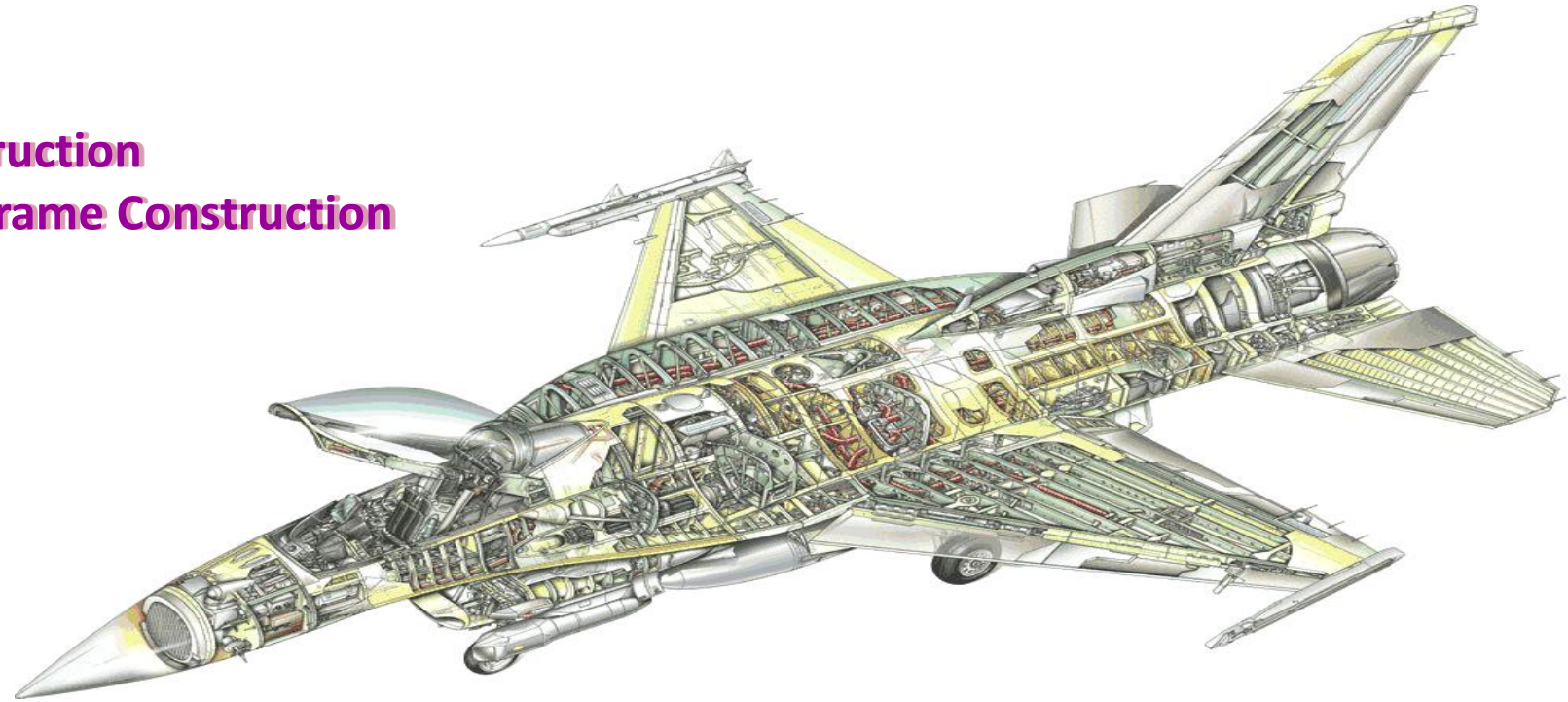
NEHRU.K

Assistant Professor
Aerospace Engineering



Recall

- Aircraft Components
- Material use in Airframe Construction
- Example of Material use in Airframe Construction
- Function of Aircraft Structure
- Fuselage Structure
 - Truss Type
 - Pratt Truss
 - Warren Truss
 - Monocoque
 - Semi-Monocoque
- Basic Structure Member Terms
- Wing Structure
- Empennage Structure
- Power Plant
 - Wing Pod Mount
 - Fuselage Mount
- Landing Gear Structure





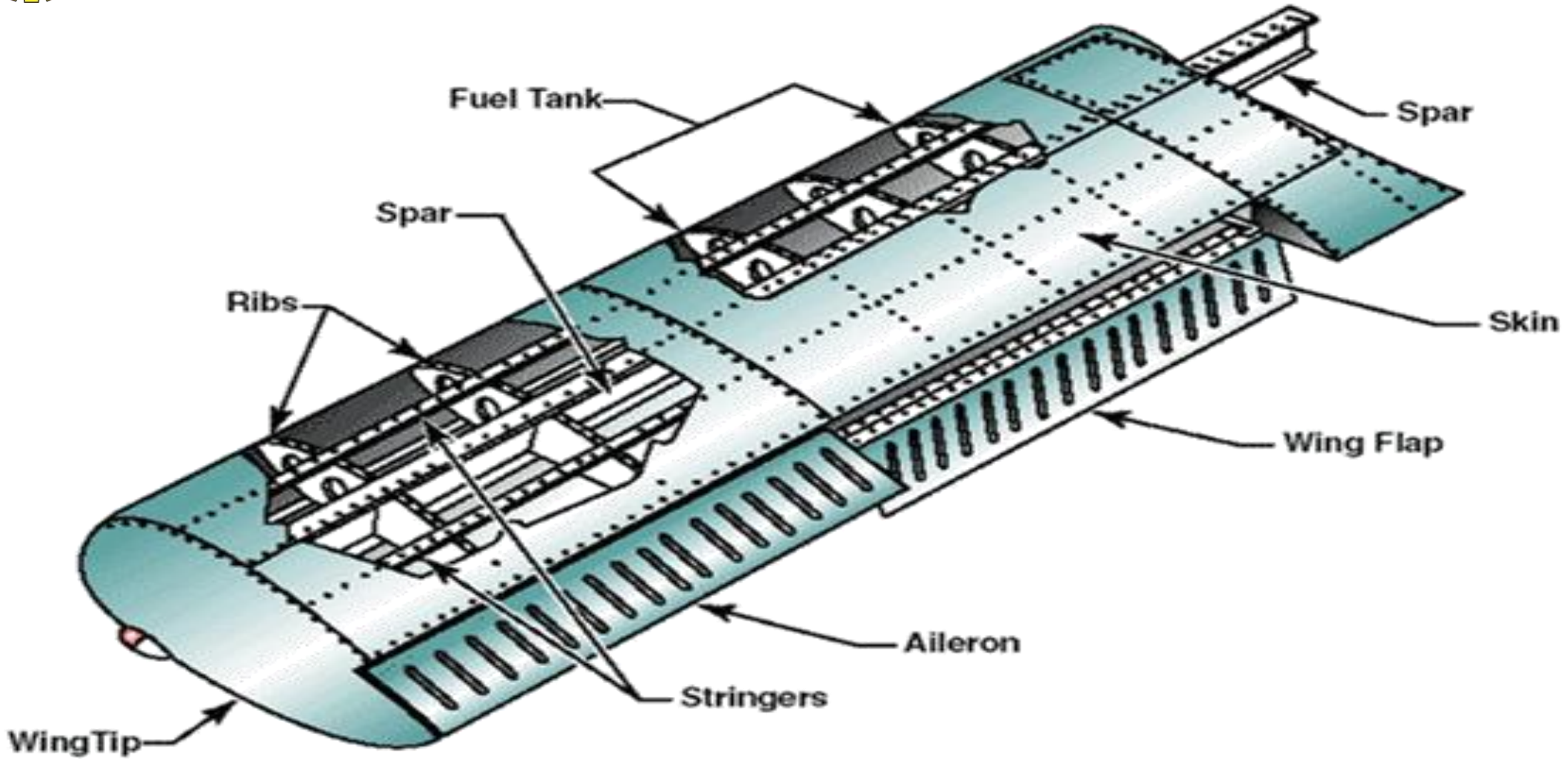
Wing Structure



- ❖ Many high-wing airplanes have external braces, or wing struts, which transmit the flight and landing loads through the struts to the main fuselage structure.
- ❖ Since the wing struts are usually attached approximately halfway out on the wing, this type of wing structure is called *semi-cantilever*.
- ❖ A few high-wing and most low-wing airplanes have a *full cantilever* wing designed to carry the loads without external struts.
- ❖ The principal structural parts of the wing are spars, ribs, and stringers.
- ❖ These are reinforced by trusses, I-beams, tubing, or other devices, including the skin.
- ❖ The wing ribs determine the shape and thickness of the wing (airfoil).



Wing Structure of an airplane





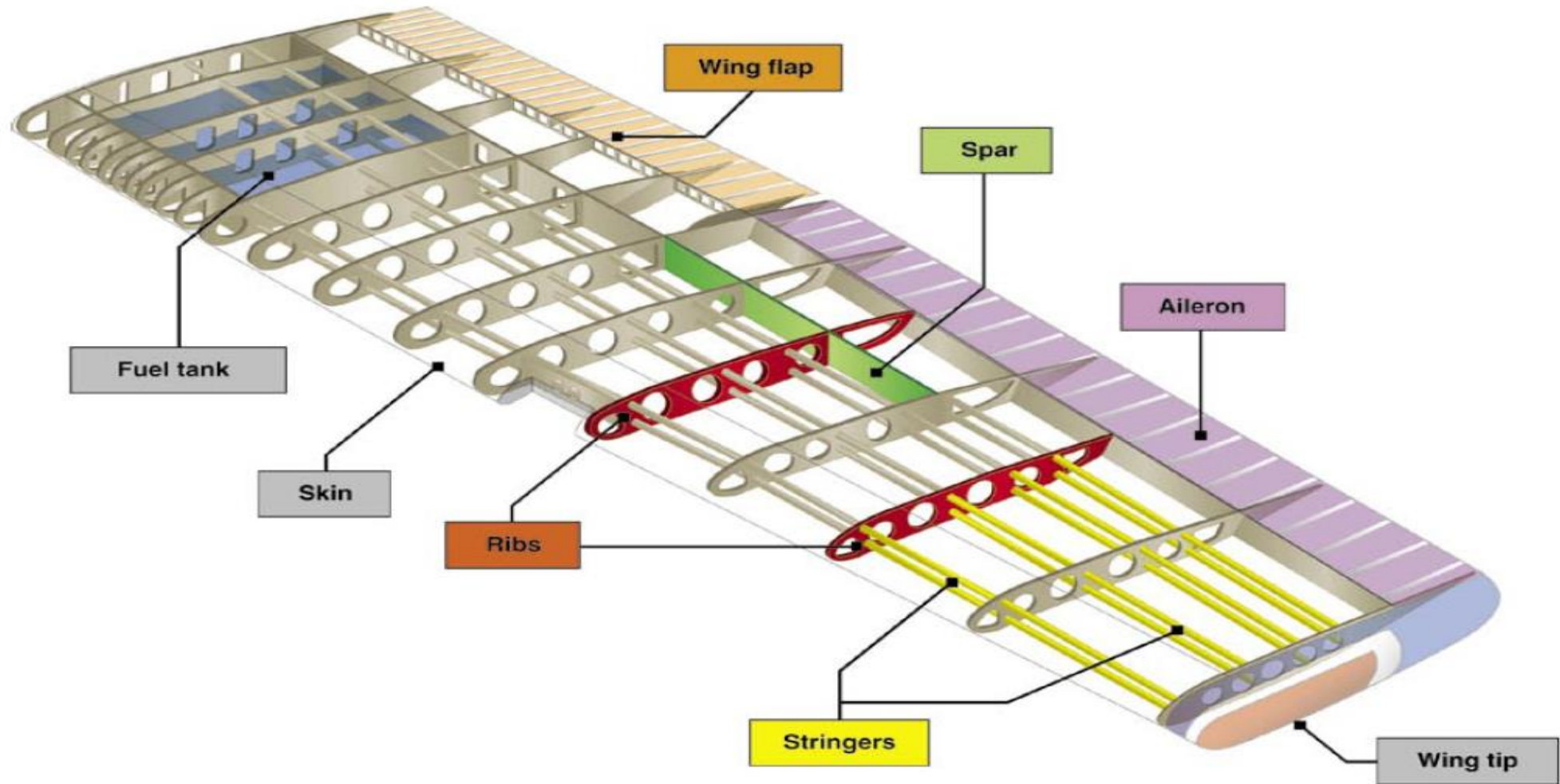
Wing Structure



- In most modern airplanes, the fuel tanks either are an integral part of the wing structure, or consist of flexible containers mounted inside of the wing.
- Attached to the rear, or trailing, edges of the wings are two types of control surfaces referred to as *ailerons* and *flaps*.
- Ailerons extend from about the midpoint of each wing outward toward the tip and move in opposite directions to create aerodynamic forces that cause the airplane to roll.
- Flaps extend outward from the fuselage to near the midpoint of each wing.
- The flaps are normally flush with the wing's surface during cruising flight.
- When extended, the flaps move simultaneously downward to increase the lifting force of the wing for takeoffs and landings.



Wing Structure of an airplane

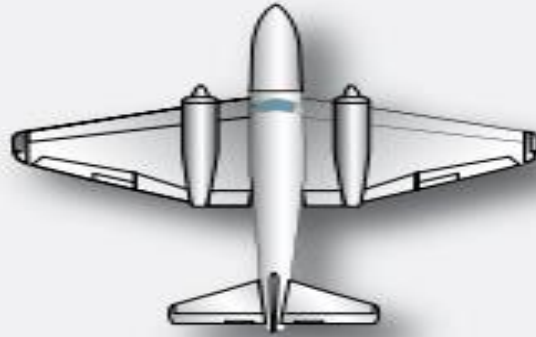




Wing Types



Tapered leading edge,
straight trailing edge



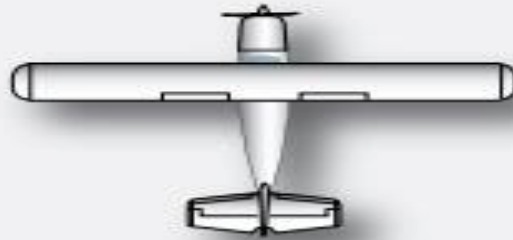
Tapered leading and
trailing edges



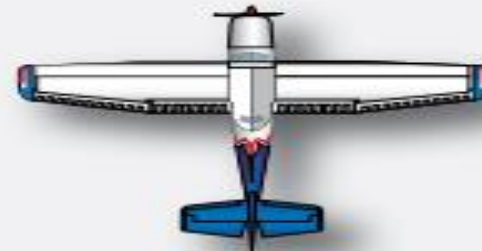
Delta wing



Sweptback wings



Straight leading and
trailing edges



Straight leading edge,
tapered trailing edge



Wing Types

❖ Set of wings, that may be swept back and then returned to its original position during flight.



sweptback Wing (A380)



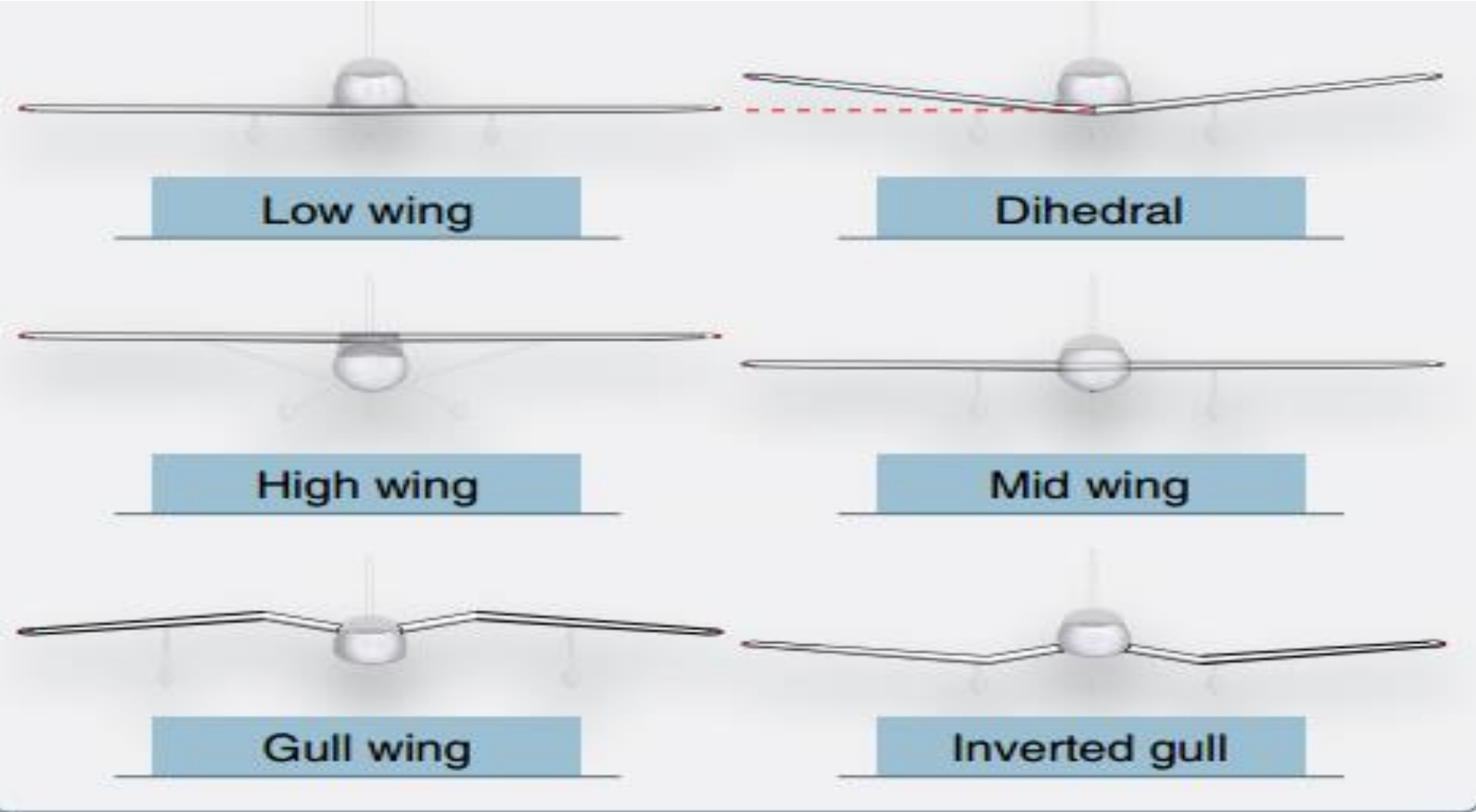
delta wing (concorde)



Variable-sweep wing (Tornado F3)



Wings Positions





Empennage Structure

- The correct name for the **tail section** of an airplane is empennage. The empennage includes the entire tail group, consisting of fixed surfaces such as the **vertical stabilizer and the horizontal stabilizer**. The movable surfaces include the rudder, the elevator, and one or more trim tabs
- A second type of **empennage design** does not require an elevator. Instead, it incorporates a one-piece horizontal stabilizer that pivots from a central hinge point. This type of design is called a *stabilator*, and is moved using the control stick, just as you would the elevator.

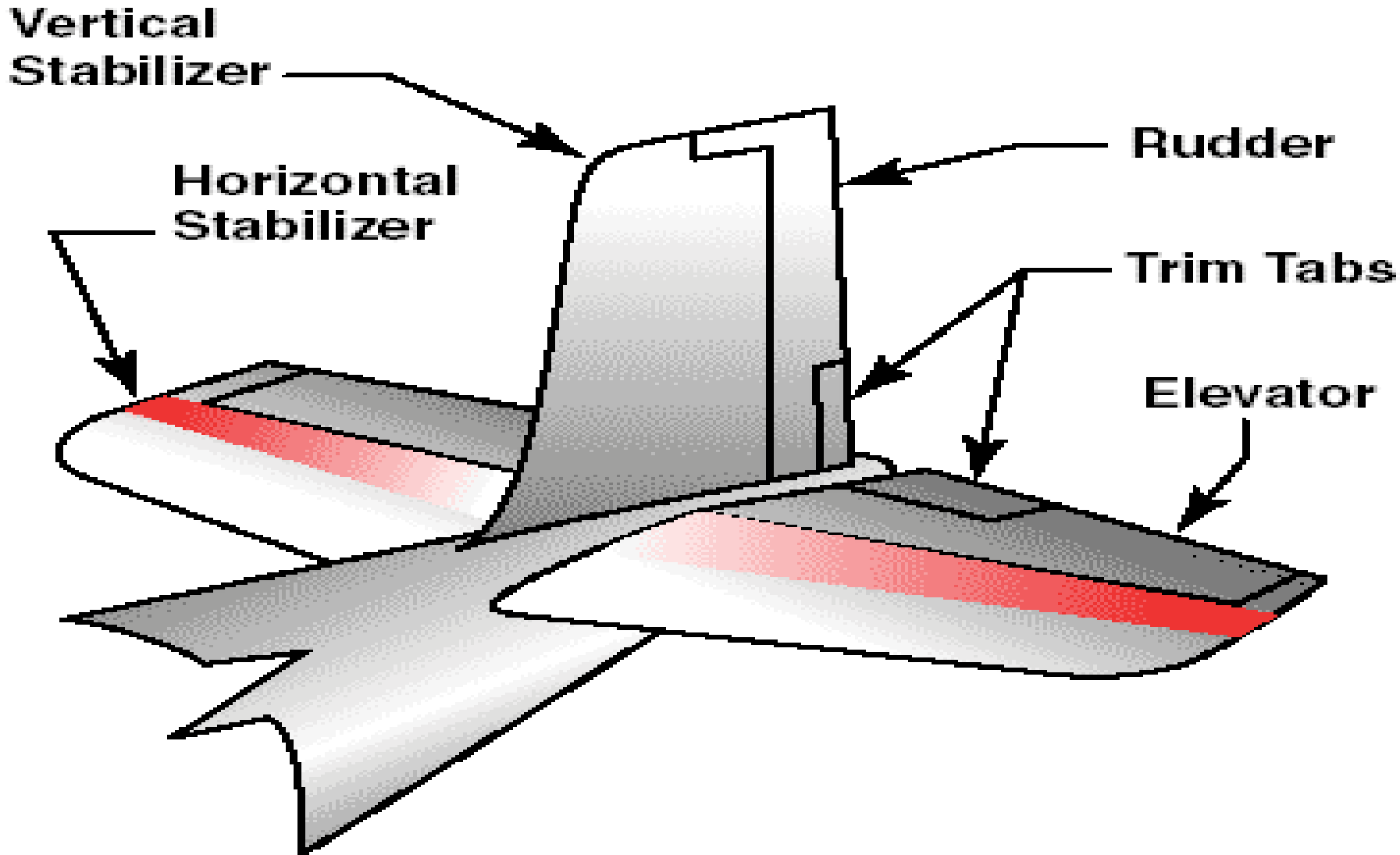


Empennage Structure

- The rudder is attached to the back of the **vertical stabilizer**.
- During flight, it is used to move the airplane's nose left and right.
- The rudder is used in combination with the ailerons for turns during flight.
- The elevator, which is attached to the back of the horizontal stabilizer, is used to move the nose of the airplane up and down during flight.
- Trim tabs are small, movable portions of the trailing edge of the control surface.
- These movable trim tabs, which are controlled from the cockpit, reduce control pressures.
- Trim tabs may be installed on the ailerons, the rudder, and/or the elevator.

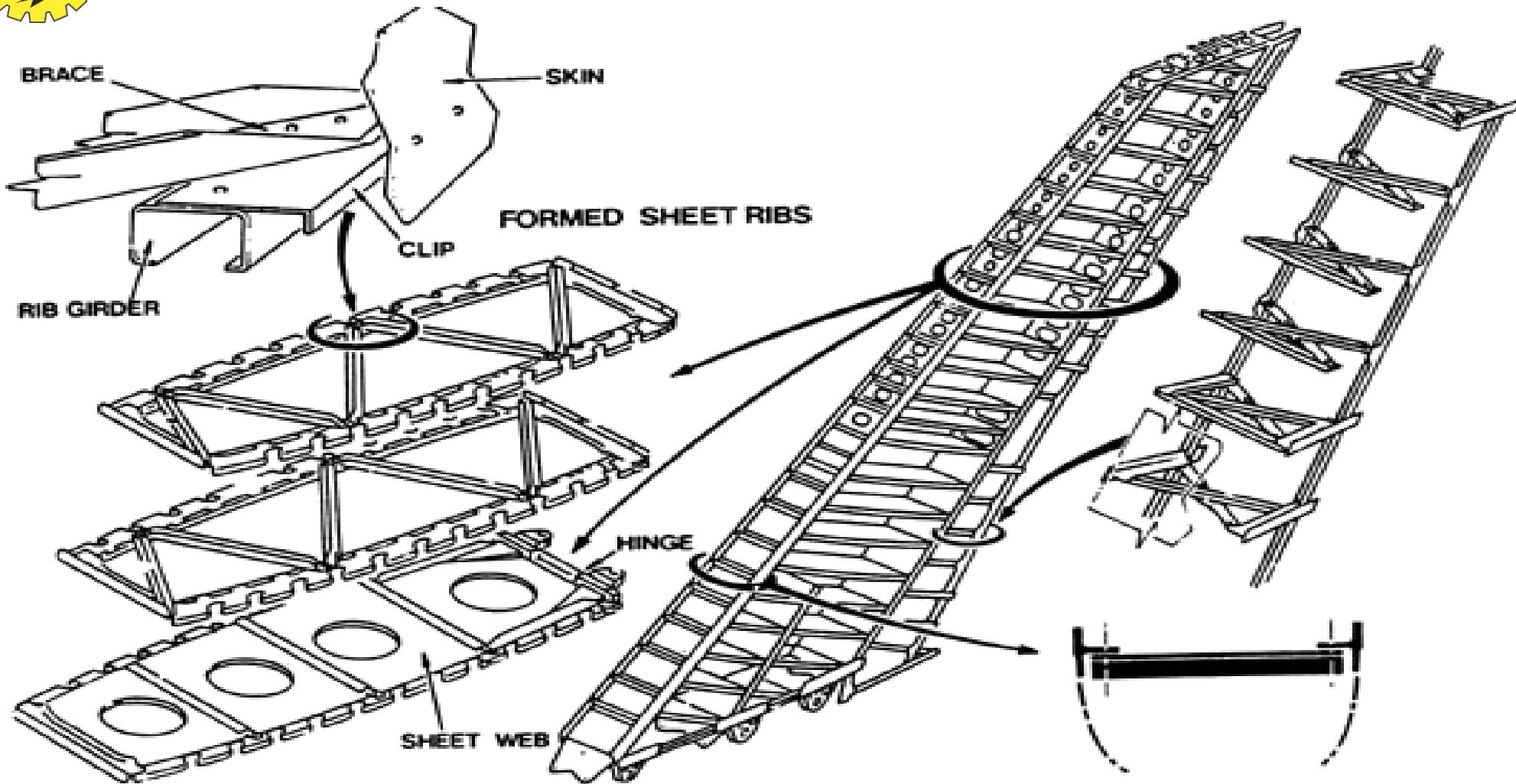


Empennage of an airplane



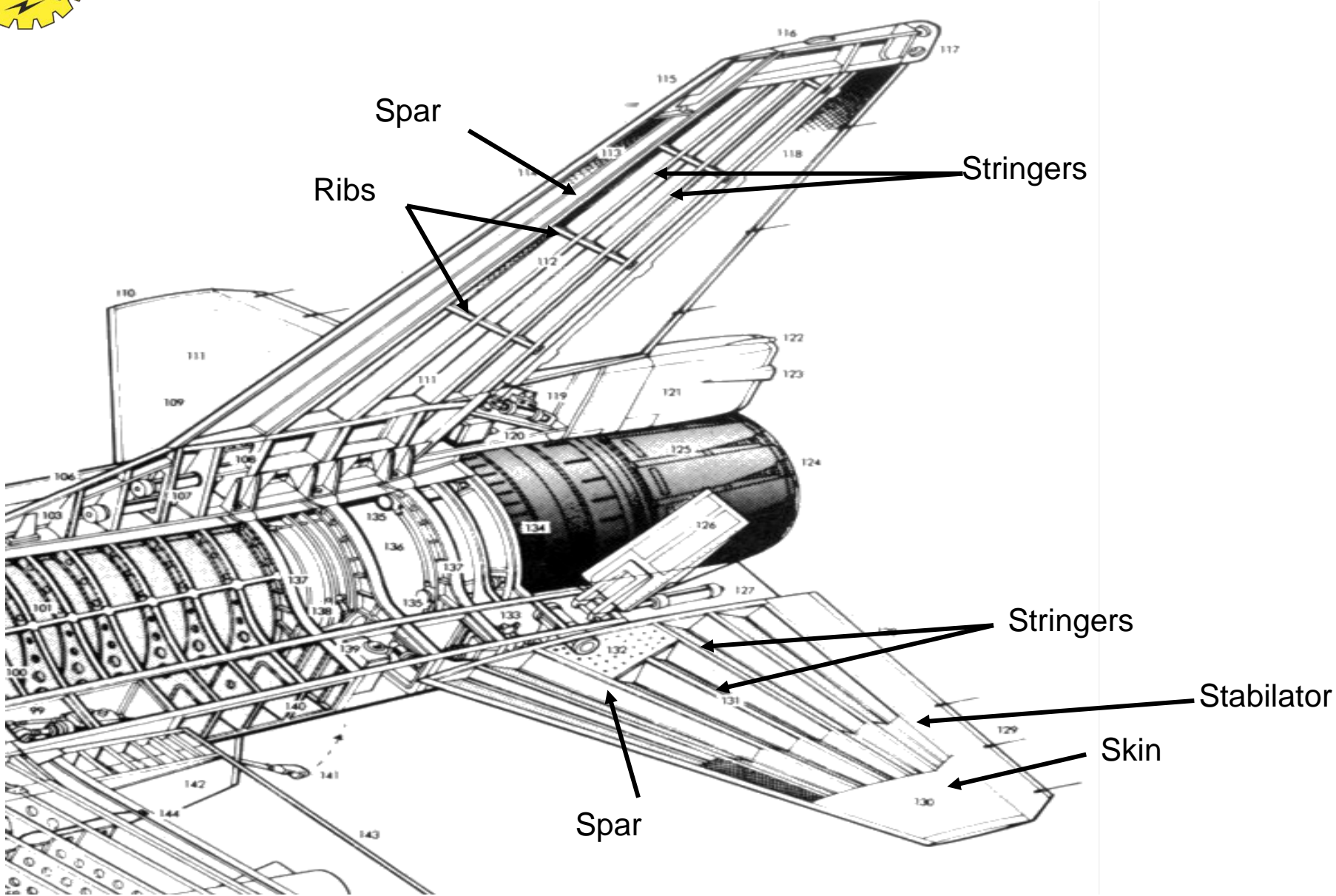


Empennage Structure of an airplane



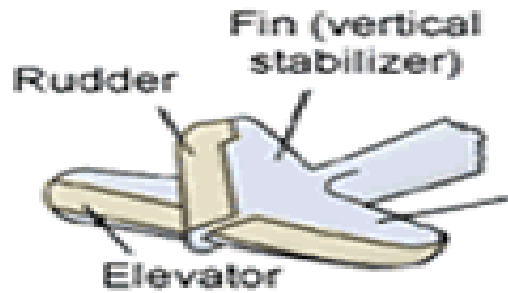
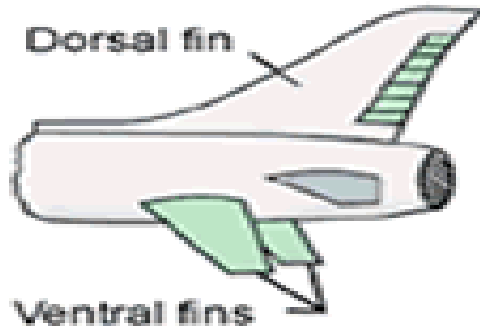


Empennage Structure of an airplane

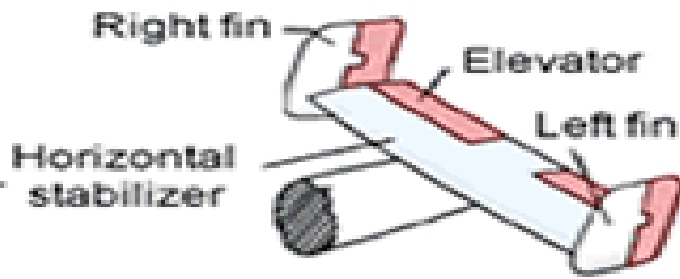




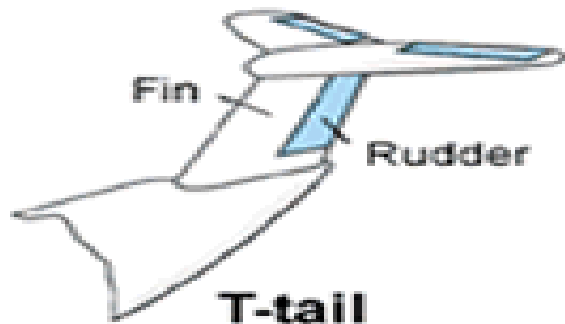
Aircraft tails Types



Standard Tail



Twin Tail



T-tail

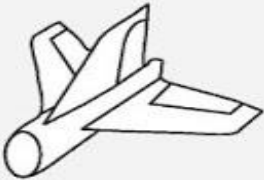
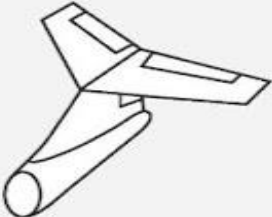
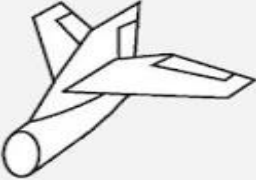
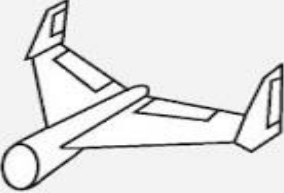
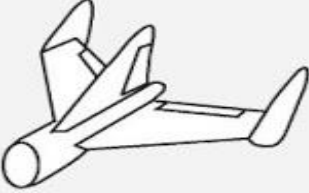
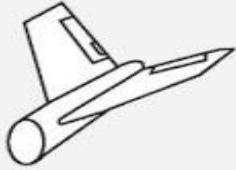
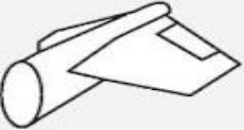
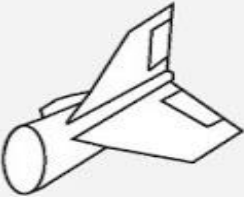

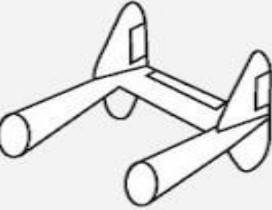
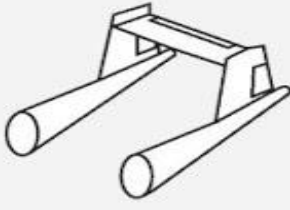
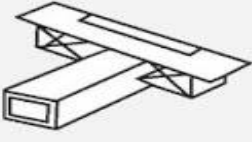


V-Butterfly-Tail



Aircraft tails Types

Airplane Tail Designs

 <p>Conventional</p>	 <p>T tail</p>	 <p>Cruciform tail</p>
 <p>Dual tail</p>	 <p>Triple tail</p>	 <p>V tail</p>
 <p>Inverted V tail</p>	 <p>Inverted Y tail</p>	 <p>Twin tail</p>
 <p>Boom tail</p>	 <p>High boom tail</p>	 <p>Multiple-plane tail</p>



Aircraft tails Types



Standard/Conventional



ANTONOV AN-148-100 (DMITRIY MOTTL / PD)

T-tail



ANTONOV AN-22 (DMITRY MOTTL / CCSA)

Twin tail



V-tail/ V-butterfly tail

A stylized illustration of two biplanes flying in a light blue sky with white clouds. One biplane is dark blue and the other is brown. The text 'Thank You' is written in a dark blue, cursive font in the center of the image.

Thank You