



SNS COLLEGE OF TECHNOLOGY

(An Autonomous Institution)



Department of Aerospace Engineering

UNIT-3:

23AST101-Fundamentals of Aerospace Engineering

AIRCRAFT
STRUCTURES AND
MATERIALS

Typical wing and fuselage Structure

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The **wing** is the primary lifting surface, designed to generate lift while supporting the aircraft's weight and handling flight loads.

A. Primary Structural Components

Spars – The main load-bearing beams running spanwise (front to rear).

Main Spar – Bears most bending and shear loads.

Rear Spar – Provides additional support.

Often made of **aluminum, steel, or composites (carbon fiber)**.

Ribs – Vertical structures attached to spars, maintaining the wing's airfoil shape.

Form ribs (non-structural, just for shape).

Strength ribs (load-bearing, connecting to spars).

Skin – The outer covering, which can be:

Metal (aluminum sheets) – Riveted to ribs and spars.

Composite (carbon fiber, fiberglass) – Used in modern aircraft (e.g., Boeing 787).

Stringers – Longitudinal stiffeners that reinforce the skin and prevent buckling.

Wing Box – The central structure formed by spars, ribs, and skin, housing fuel tanks in many aircraft.

B. Wing Construction Types

Cantilever Wing – No external bracing (most modern aircraft).

Braced Wing – Supported by external struts or wires (common in light aircraft like the **Cessna 172**).

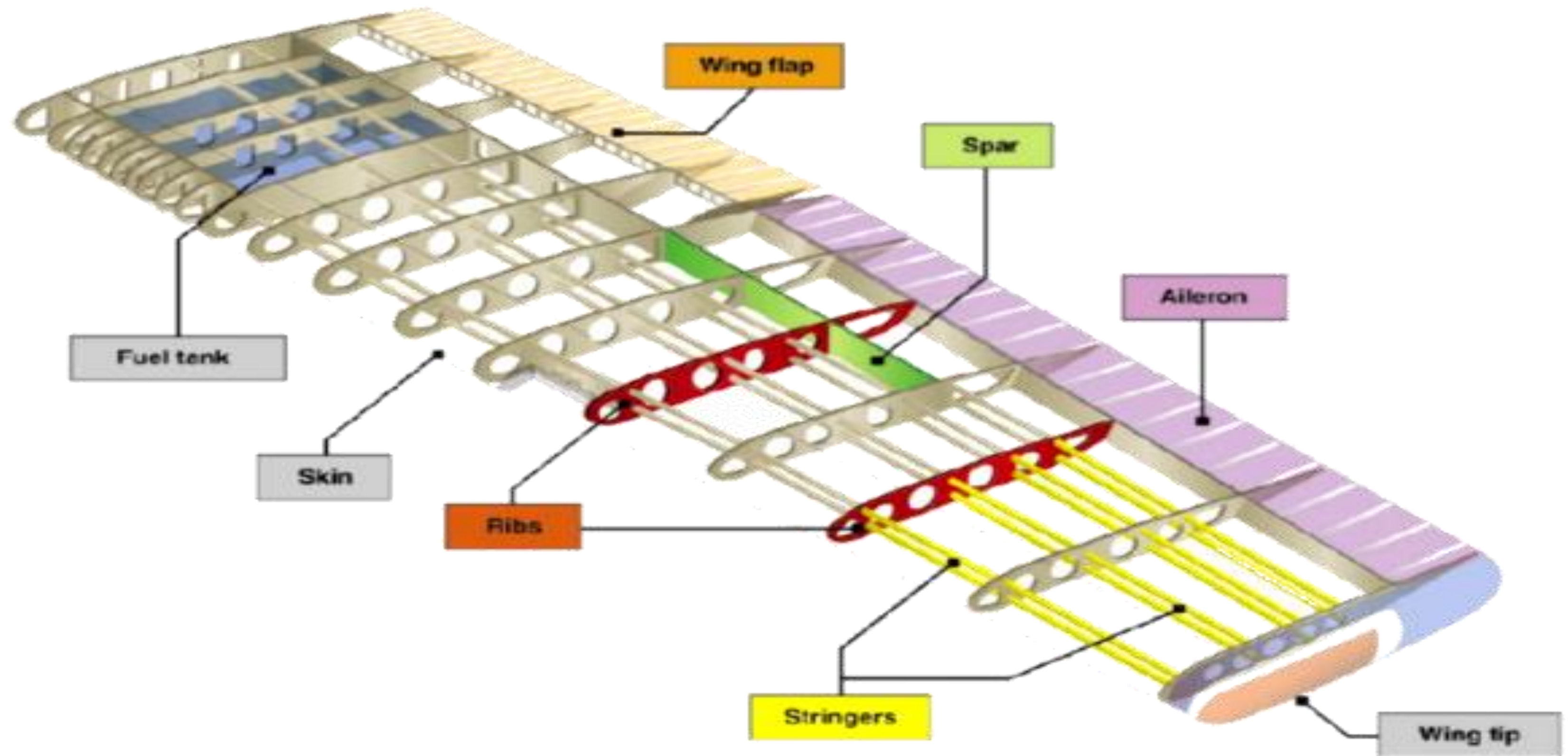
C. Additional Wing Features

Ailerons (roll control).

Flaps (increase lift during takeoff/landing).

Slats & Spoilers (high-lift and drag devices).

Fuel Tanks (often integrated into the wing structure).





2. Fuselage Structure

The **fuselage** is the main body, housing the cockpit, passengers, cargo, and systems.

A. Primary Structural Components (Semi-Monocoque Design – Most Common)

Skin – The outer shell, carrying part of the load.

Frames (Bulkheads) – Circular or vertical supports maintaining shape.

Longerons – Primary longitudinal (lengthwise) load-bearing beams.

Stringers – Smaller longitudinal supports reinforcing the skin.

Floor Beams – Support cabin flooring and cargo loads.

B. Fuselage Construction Types

Monocoque – Rare in modern aircraft; used in small planes (e.g., **Piper Cub**).

Semi-Monocoque – Most common (e.g., **Boeing 737, Airbus A320**).

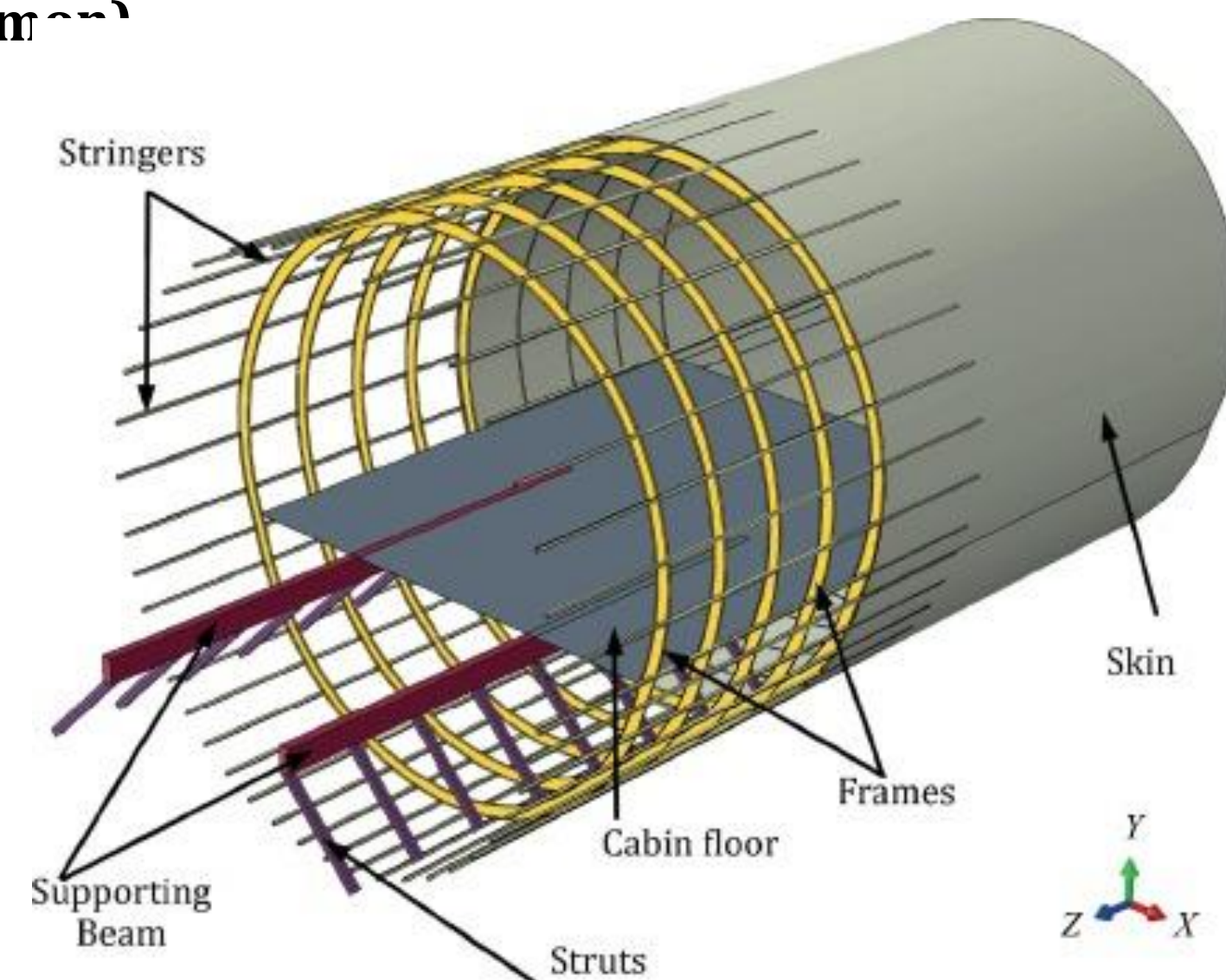
Truss Frame with Fabric Cover – Found in older aircraft (e.g., **Wright Flyer**).

C. Fuselage Sections

Nose Section – Houses cockpit, radar, avionics.

Mid Section – Passenger/cargo cabin.

Tail Section (Empennage) – Supports vertical/horizontal stabilizers.





Comparison: Wing vs. Fuselage Structure

Feature	Wing	Fuselage
Primary Loads	Lift, bending, torsion.	Compression, bending, pressurization (for cabins).
Main Components	Spars, ribs, skin, stringers.	Frames, longerons, stringers, skin.
Common Materials	Aluminum, composites, titanium.	Aluminum, composites, steel (in high-stress areas).
Construction Type	Mostly semi-monocoque.	Mostly semi-monocoque (some monocoque in small planes).
Key Differences	Designed for aerodynamic efficiency.	Designed for cabin space & structural integrity.



THANK YOU!