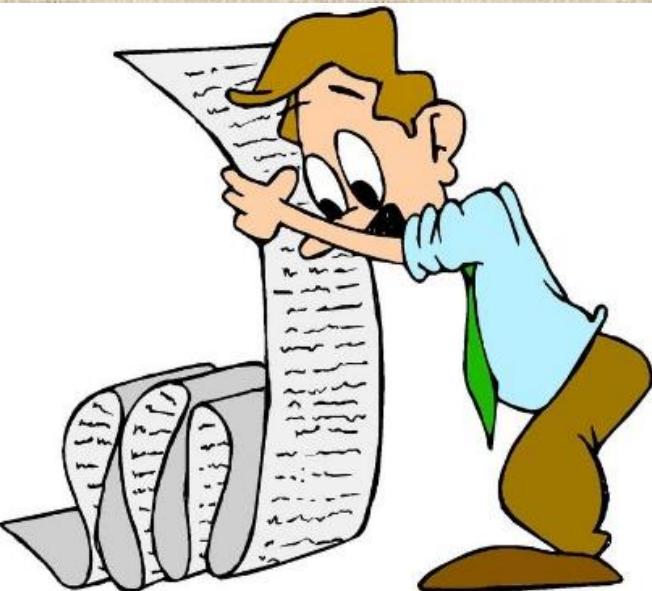




Aircraft Component Nomenclature

At the outset



A list of components
covered in this
presentation >

- (1) Wing
- (2) Fuselage
- (3) Empennage
- (4) Miscellaneous



Dangerous word



Axes of Control

Video Courtesy : Flight Club

1 min 30 s



Lets start with the

Wing



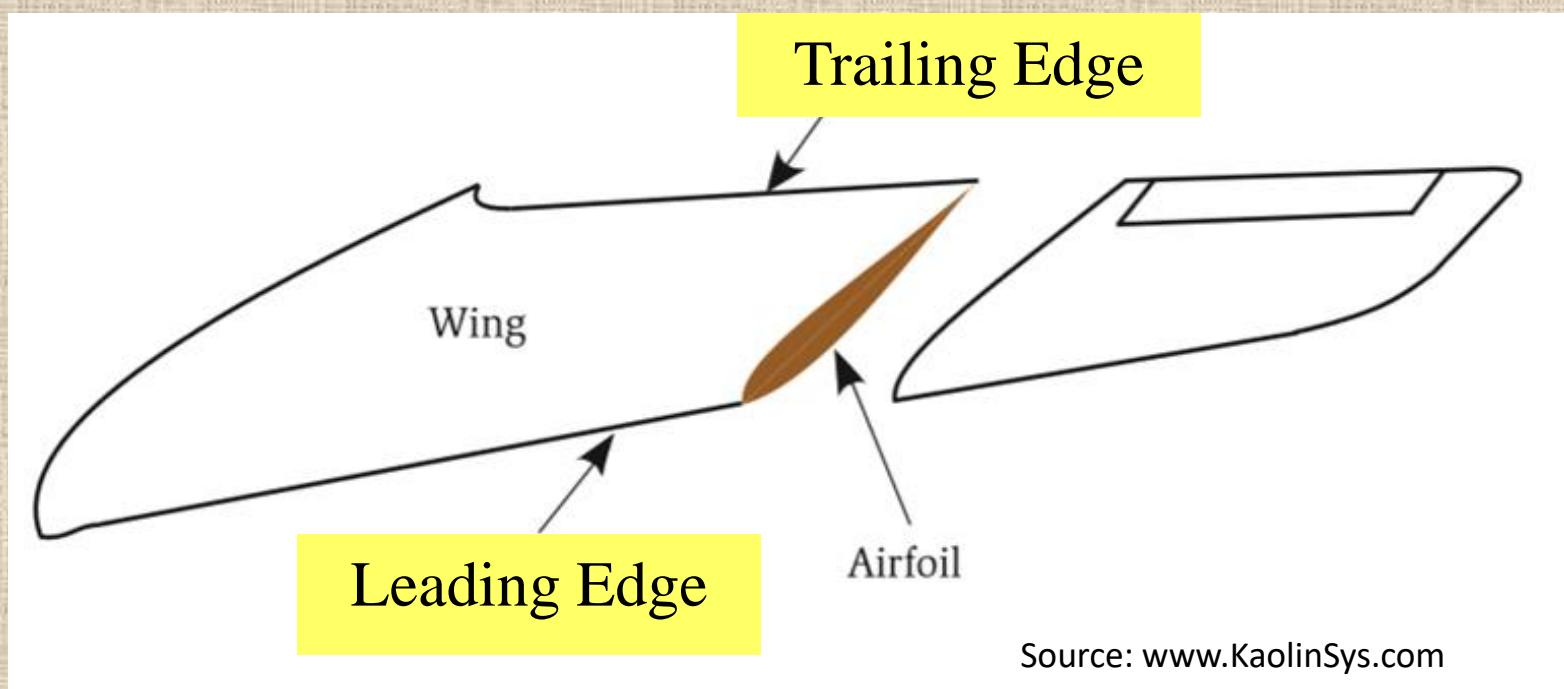
Looks familiar ?

- which edge ?
- What were the moving parts ?
- Missed something ?

Knowing the wing

- The wing has 2 edges namely –

Leading edge and Trailing edge



Knowing the wing

- The wing has 2 edges namely –

Leading edge



Trailing edge



- The wings have specialized aerodynamic devices called **flight control surfaces**
- Of these, the **High lift devices** are those which are used to increase Lift
- Lift ↑ = Better Take off & landing performance



Source: www.RockwellCollins.com

AE-705 Introduction to Flight

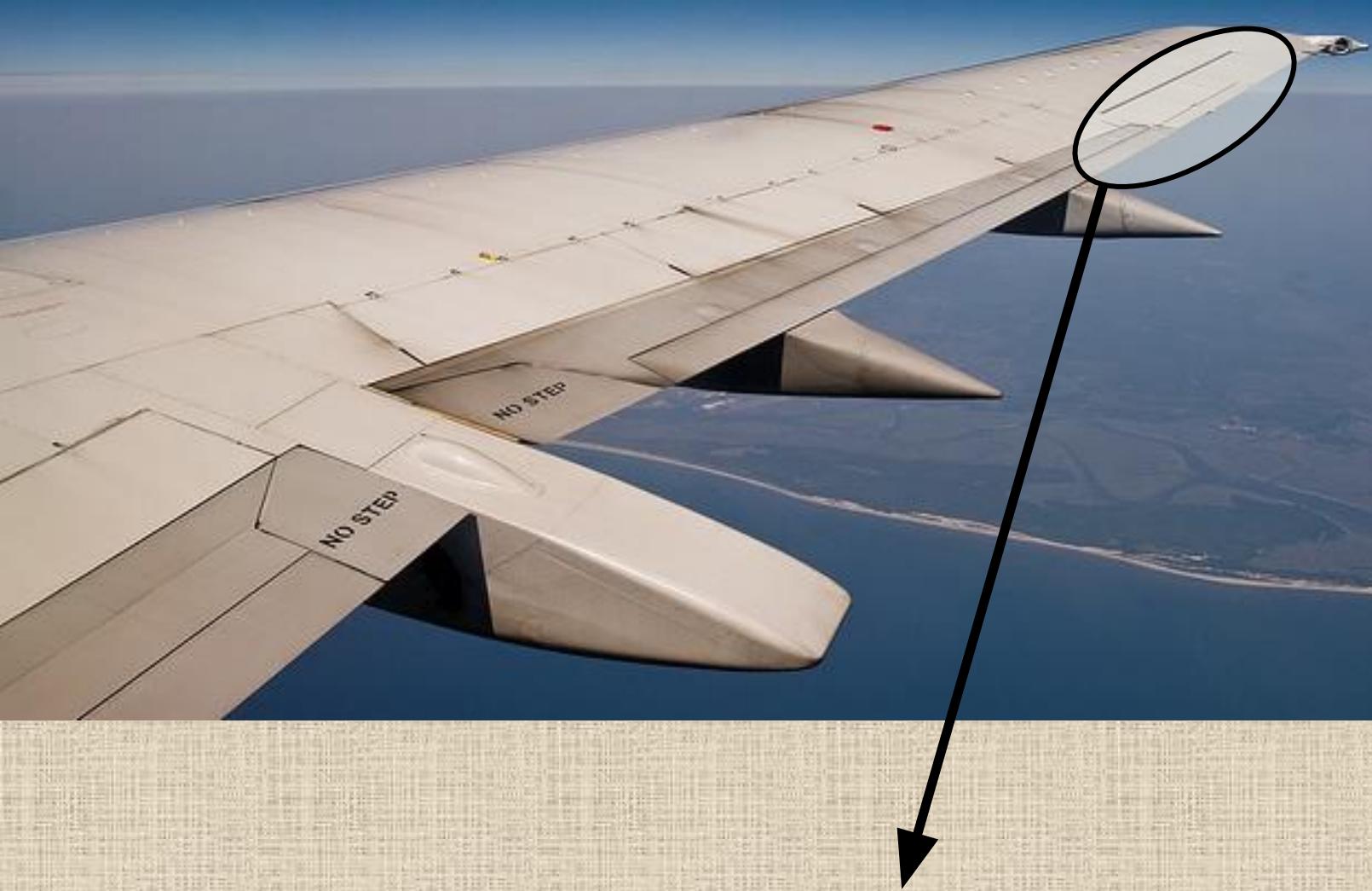


Source: www.Kuwaityat.net

Capsule 01

Lecture 02

Flight Control Surfaces on the Wing



Aileron



easyJet

Ailerons

Location

Outer trailing
edge

Function

Roll Control

Source: Air Team Images

Down going Aileron >> ↑ Lift
Up going Aileron >> ↓ Lift

= Rolling moment

Flaps



Function

- higher Lift at lower speeds
- Hence steepen Landing approach angle

Location

Trailing edge, inboard to Ailerons

Flaps

Based on the relative location along the trailing edge, flaps are of 2 kinds -

Outboard Flaps (1)

Inboard Flaps (2)

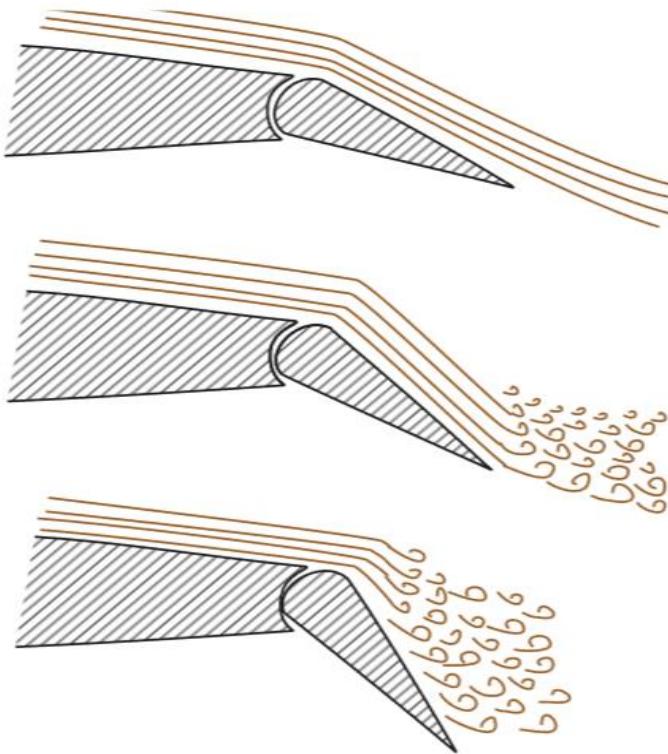
Source: www.AviationStackExchange.com



The Various Types of Flaps

Simple Hinged Flaps (Plain)

- common on smaller aircraft
- ≈20 % of the inboard section of Trailing edge is simply hinged



Source: www.BoldMethod.com

Split Flaps

- Splitting the last 20 % of the wing forms this type of flap
- Top surface → Stationary
- Lower surface → Lowers

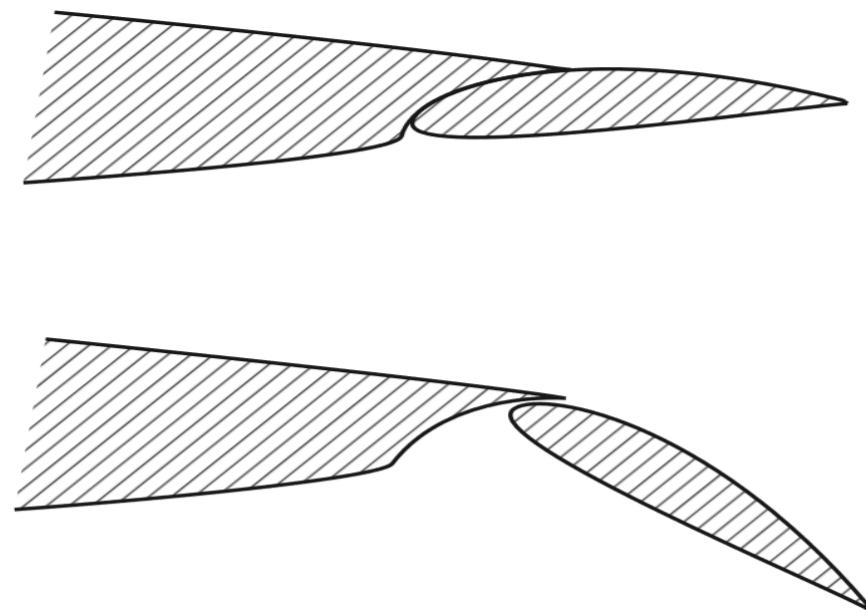
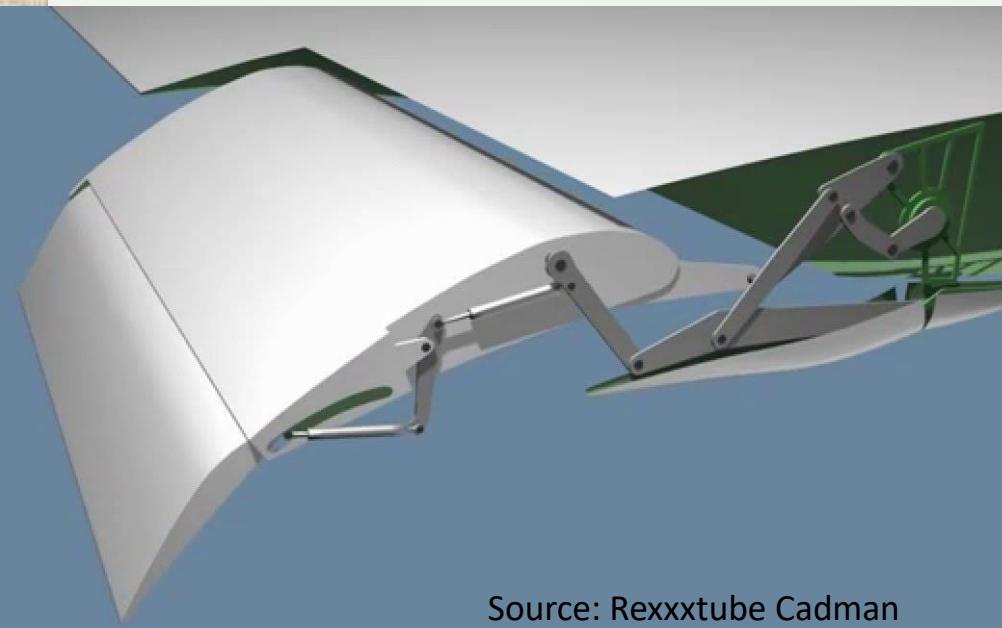


Source: www.BoldMethod.com

Fowler Flaps

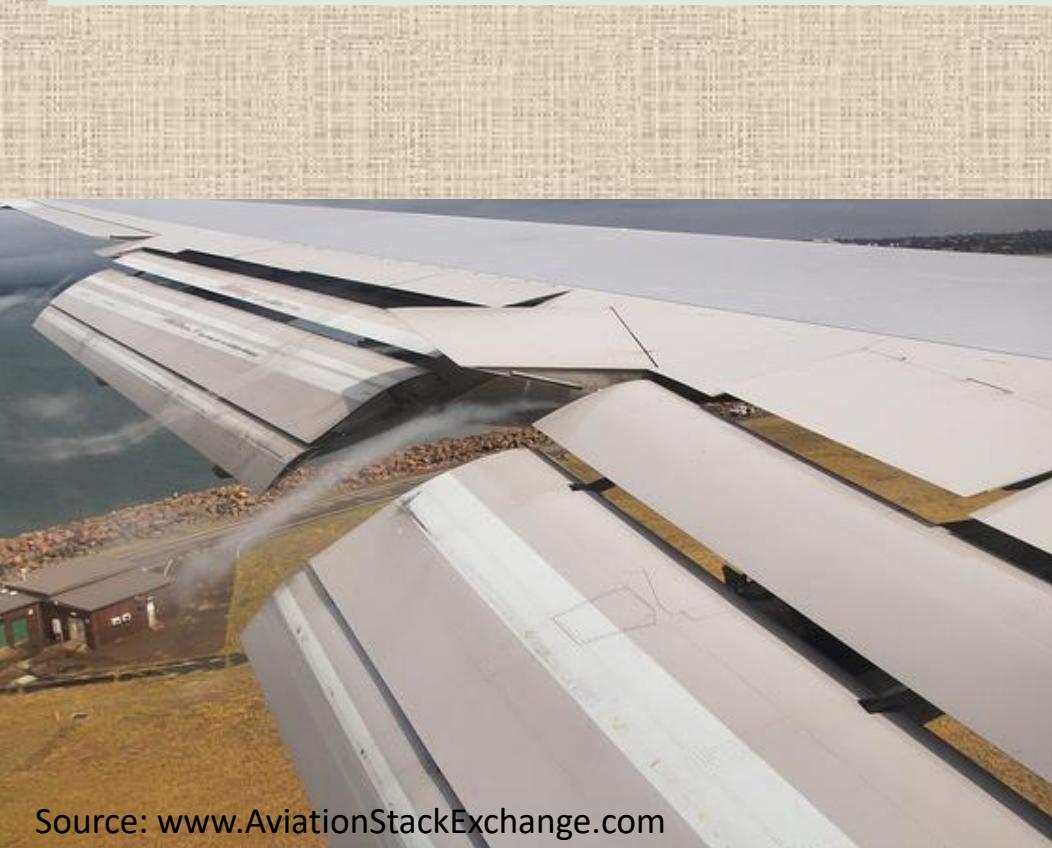
- Highly sophisticated ; uses complex mechanism
- Rear section of the wing not only changes angle but also moves aft.

The **Result** = Wing area \uparrow + Camber \uparrow

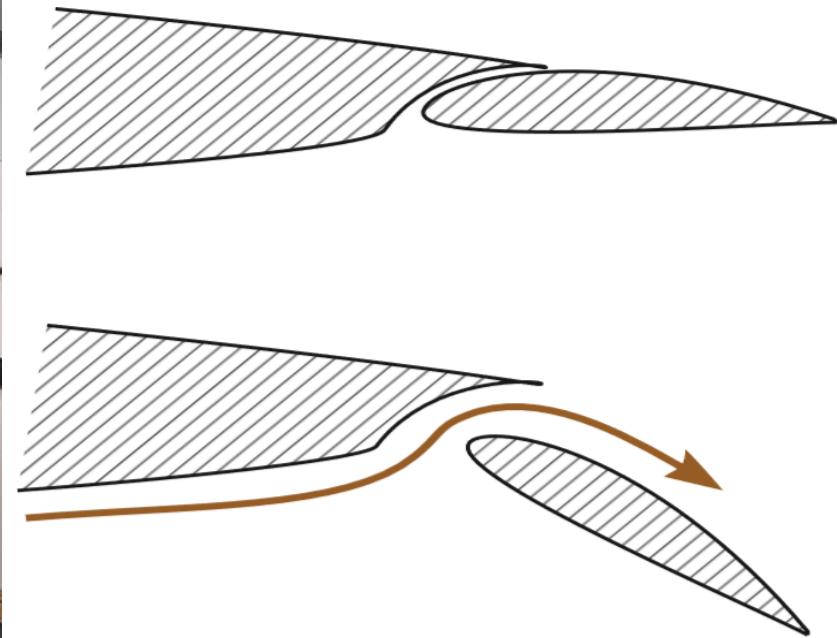


Slotted Flaps

- Operates like fowler flaps
- Slot diverts Higher energy, lower surface air to the top of the flap



Source: www.AviationStackExchange.com



Ailerons



Roll Control

Flaps



Lift improvement

Aileron + Flap = ??

Ailerons



Roll Control

Flaps



Lift improvement

Aileron + Flap = Flaperon



Source: www.GettyImages.com



Source: www.AviationStackExchange.com

Aileron + Flap = Flaperon



Source: www.GettyImages.com



Source: www.AviationStackExchange.com

- Multifunctional
- motion more prominent than aileron



Source: www.IndianaFlight.com



Source : www.Kuwaitat.net

- Drag ↑ , Lift ↓
- Enable swift descent without speed increase
- Fully deployed on Landing
- Spoilers ≠ Airbrakes

Leading Edge Devices

The leading edge of the wing also carries important lift improving devices

Such as ...

Slats (Fixed Type)



Source: www.StolSpeedAerodynamics.com



Source: www.AviationStackExchange.com

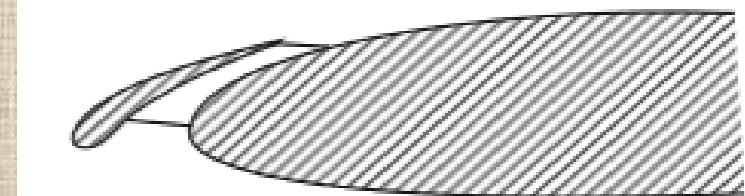


Fig. 3.32. Fixed slat.

Slats (Retractable)

- During **cruise**,
Slats are retracted →→ Reduced Drag

Source: www.Matronics.com



Source: www.StolSpeedAerodynamics.com



Krueger Flaps

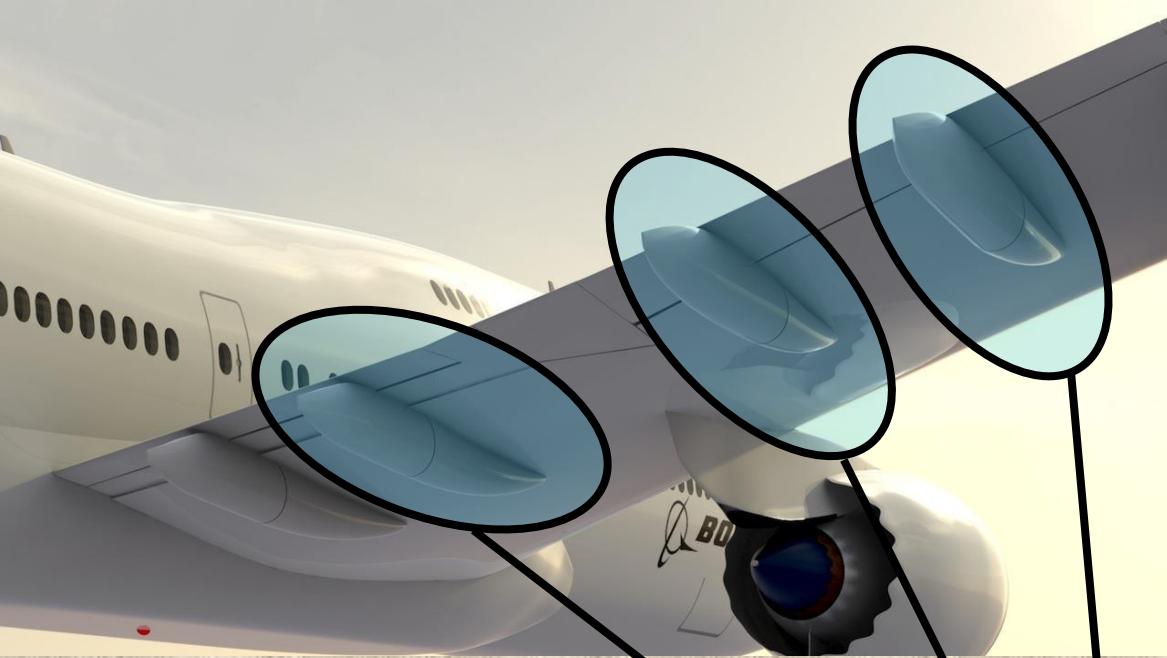
- A portion of the lower wing is rotated out in front of the wing leading edge
- found between the fuselage and closest engine, where the wing is thickest



Source: www.AviationStackExchange.com



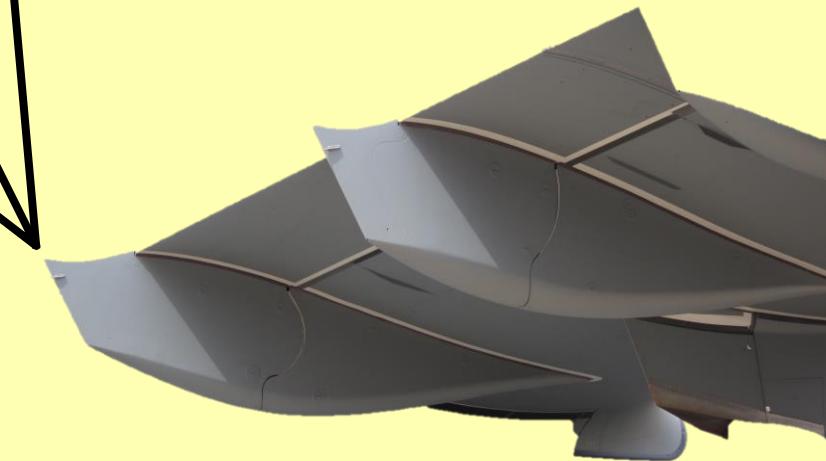
Source: www.AviationStackExchange.com



Ever noticed
these bodies
under a wing ?

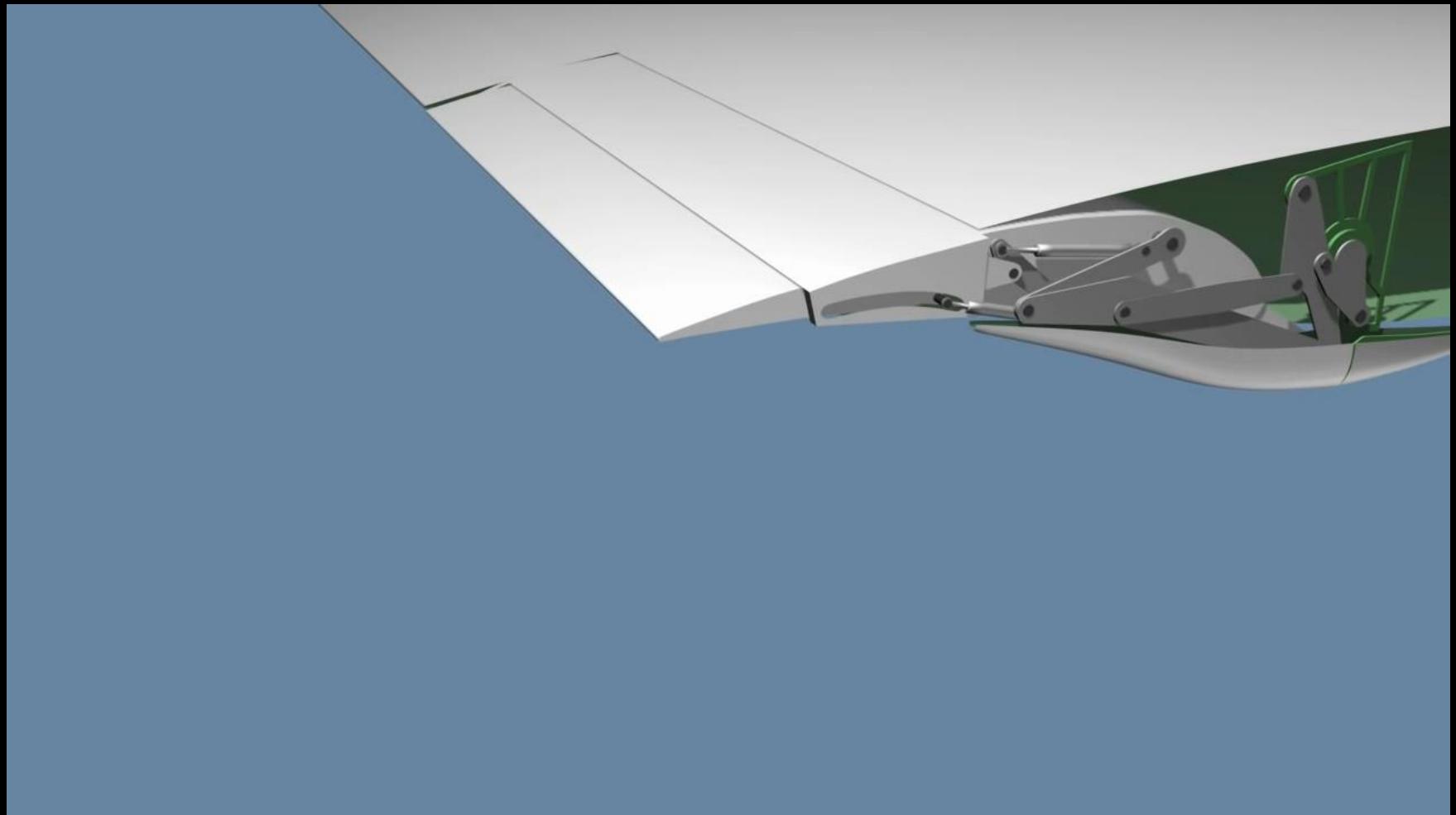
Source: www.AviationStackExchange.com

Flap Track Fairings
Kuchemann Carrots
Antishock bodies



Source: www.GettyImages.com

➤ Houses flap deployment mechanism



Flap deployment mechanism

Video Courtesy : RexxTube

40 s

Putting it together . . .



Take a close look ...



Accidental Damage ?



Source : AviationStackExchange



Nope !

- Air Brakes deployed on a
BAe 146
- Used to ↑ **Drag**

Source : www.Airliners.net

- Modern airliners have combined spoiler and airbrake controls



Source : [Wikimedia](https://commons.wikimedia.org)

BAe 146-300 Speed Brake Deployment



HDcpocketts

NEXT

BACK

17 s

Other variants involve -



Source :ARC Forums



Source :ScaleCAD

- Many Fighter aircraft have airbrakes just behind the cockpit
- McDonnell Douglas F-15 'Eagle'
- Sukhoi Su-27



Source: Wikipedia



Source: www.Corbis.com

The Fuselage And Various parts found on it



Conventional



Twin Boom

Types of Fuselage



Twin Fuselage



BWB

Twin Boom Fuselage

de Havilland Vampire



Source: www.AviationStackExchange.com

Cessna O-2 Skymaster



Source: www.FlyingBulls.com

Twin Fuselage

XP-82 Twin Mustang



Source: www.SkyLiberation.in

White Knight II



Source: VirginGalactic

Blended Wing Body (BWB)

X-47 Pegasus



Source: www.FlyingBulls.com

RQ-170 Sentinel



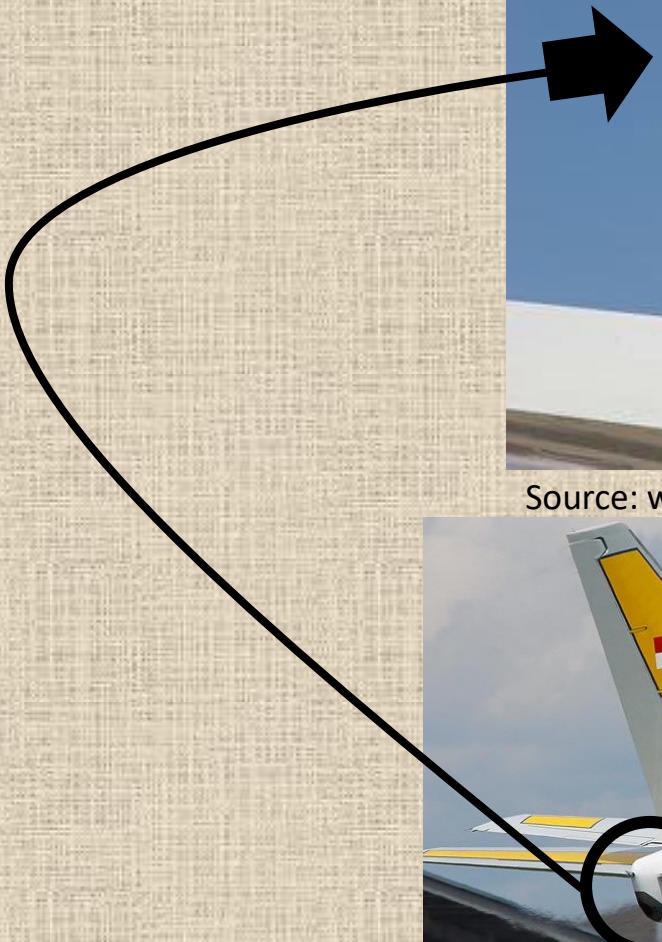
Source: Rexxxtube Cadman

Ever heard this sound while boarding a plane ?



**A P U
Auxiliary
Power
Unit**

Location



Source: www.AviationStackExchange.com



Source: www.AviationStackExchange.com

Role of APU

- Gas turbine engines ; provide power for ground operations
- Run accessories and systems when engines are shutdown



Source: www.LOUDMouth.com



Provide power to start main engines

Now consider this scenario ...

- Main engines **fail** (in mid-flight)
 - APU **fail**
-
- Air Canada Flight 143 found itself in an identical situation on July 23, 1983

Outcome =

catastrophe

?

Safe landing

The Boeing 767 lands safely with all passengers and crew unscathed

Source : www.PinInterest.com



A rather “less famous” component had greatly contributed to the successful landing

RAT





Source : www.AviationStackExchange.com

RAT

Ram

Air

Turbine

- generates power from the ram pressure of airstream
- RAT powers flight critical instruments in emergencies.
- Usual Location of RAT



Tail Skid Device

- Protects the rear fuselage from damage due to tail scrape
- Over-rotation → Tail strike



Radome (Radar Dome)



Source:www.TheAviationWeek.com

- Weather-proof antenna enclosure
- Minimal attenuation
- Rotating antenna concealed



Source:www.Pinterest.com **Lecture 02**

Horizontal Stabilizers



Source: Wikipedia



Source:www.BoldMethod.com

- Maintains aircraft in longitudinal balance
- Many aircraft have Trimmable Horizontal Stabilizers



Airbus A320 with Adjustable Horizontal Stabilizer

Video Courtesy : FlightSimulationMania

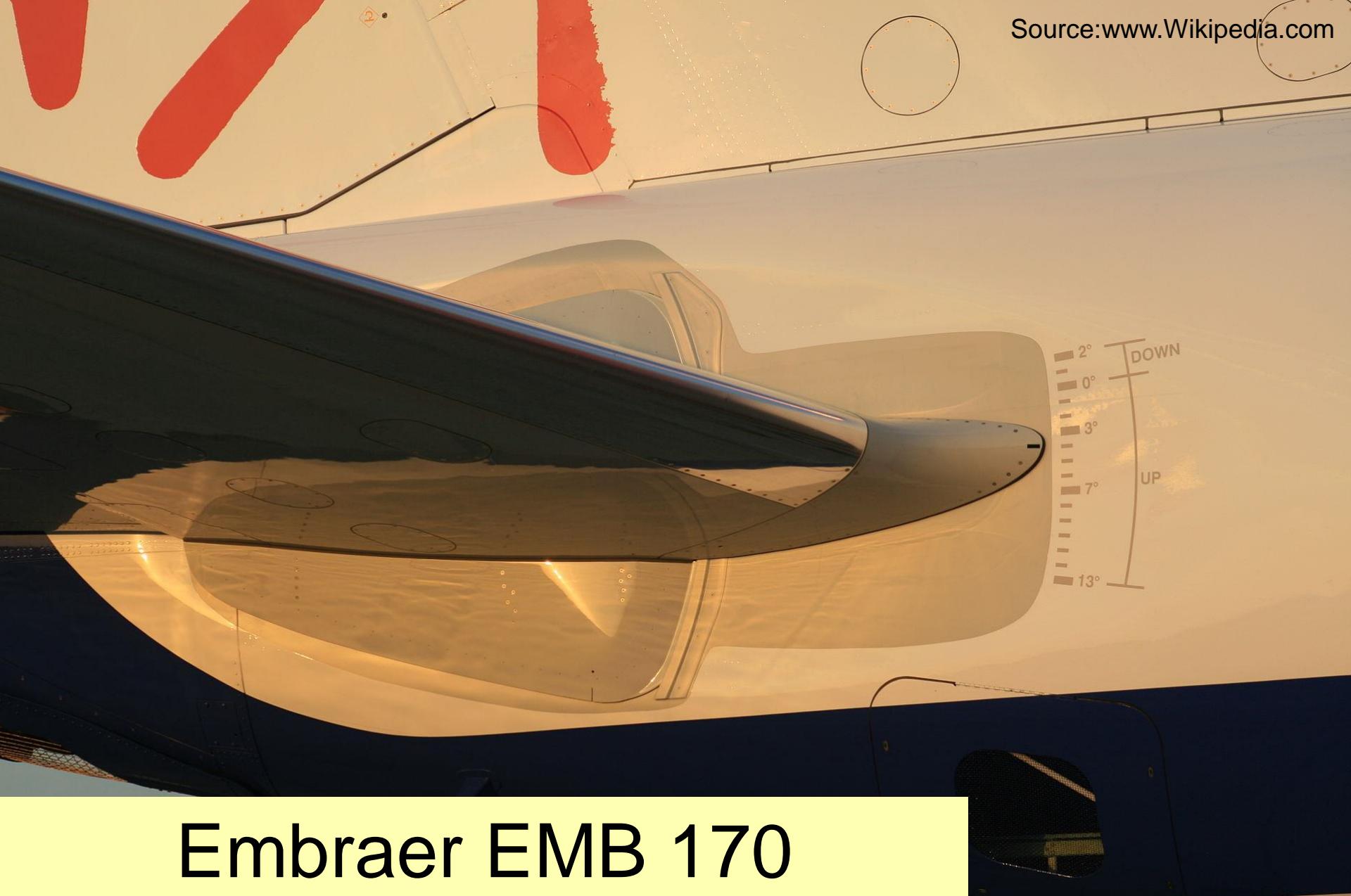
Next

13 s



Airbus A319

Source:www.FLickr.com



Embraer EMB 170

Horizontal Stabilizer configurations

Conventional

Source:www.AviationStackExchange.com



- Image - Airbus A330 with conventional configuration
- Small Tailplane located at rear of Aircraft

Horizontal Stabilizer configurations

Canard Configuration



Source:www.Crazy4planes.net

Gyroflug SC-01 B160



Source:OnlineFlightMuseum

Saab 37 'Viggen'

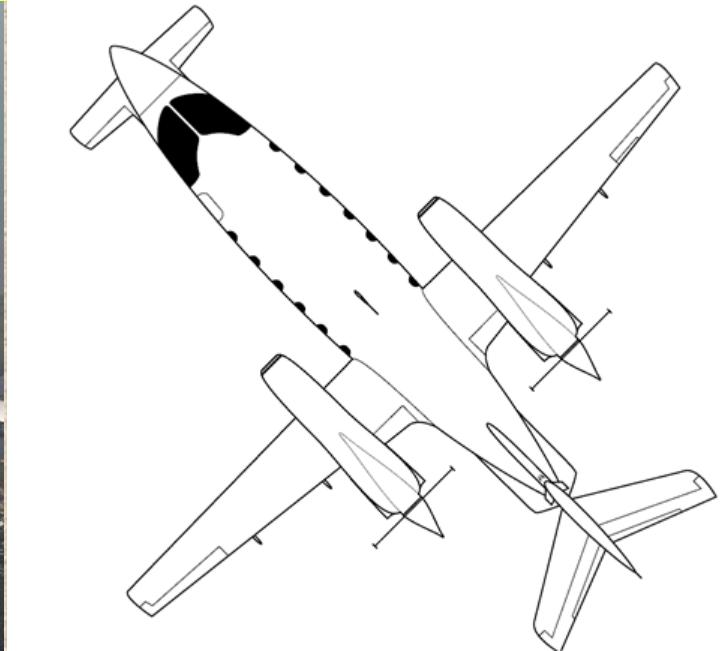
- Small wing (canard) located in front of the main wing

Horizontal Stabilizer configurations

Three Surface configuration



Source:www.FlyCorporate.com



Source:Wikipedia

Piaggio P180 'Avanti'

- Conventional Tailplane + Foreplane (Canard surface)

Elevators



Source: Wikipedia

Movable control surfaces hinged to Horizontal Stabilizers

Control Pitch angle

Motion controlled by yoke

Source:Wikipedia



Source:www.TheBoldMethod.com

Elevator
over an
elevator ?



Source:Wikipedia



Trim Tab



Reduces force on
Control Yoke

Easier for maintaining
desired attitude

Source:www.TheBoldMethod.com

Vertical Stabilizer



Source:www.AviationNews.com

Functions

- Provide Directional stability
- Movable Rudder controls yaw

Source:www.Pinterest.com



Source:AlamyImages



Vertical Stabilizer configurations

Single Conventional

Source:www.Airliners.net



Source:www.Airliners.net



- Horizontal stabilizer is directly mounted to empennage
- Most common configuration

Vertical Stabilizer configurations

T Tail Configuration

Source:www.FlyCorporate.com



Source:Wikipedia



Piaggio P180

Antonov An-72

- Horizontal stabilizer mounted at the top of vertical fin

Vertical Stabilizer configurations

Twin tail Configuration



Source:www.PinsDaddy.com

Beechcraft Model 18

- Tail fins mounted towards end of horizontal stabilizer

Vertical Stabilizer configurations

Twin tail Configuration (Twin Boom)



Source : www.TheAviationZone.com

Fairchild C-82

- Rear airframe consists of two separate fuselages

Vertical Stabilizer configurations

V Tail Configuration



Source:Pinterest

Source:www.MegaFlug.com

Beechcraft Model 35

Lockheed F-117

Vertical Stabilizer configurations

Triple Tail Configuration



Lockheed Constellation

Source: www.AviationNews.net

- Three equidistant vertical stabilizers; two at the end of horizontal stabilizer

when a tail isn't enough

Ventral Fin



MiG 23 with Ventral Fin

Source: AviationStackExchange

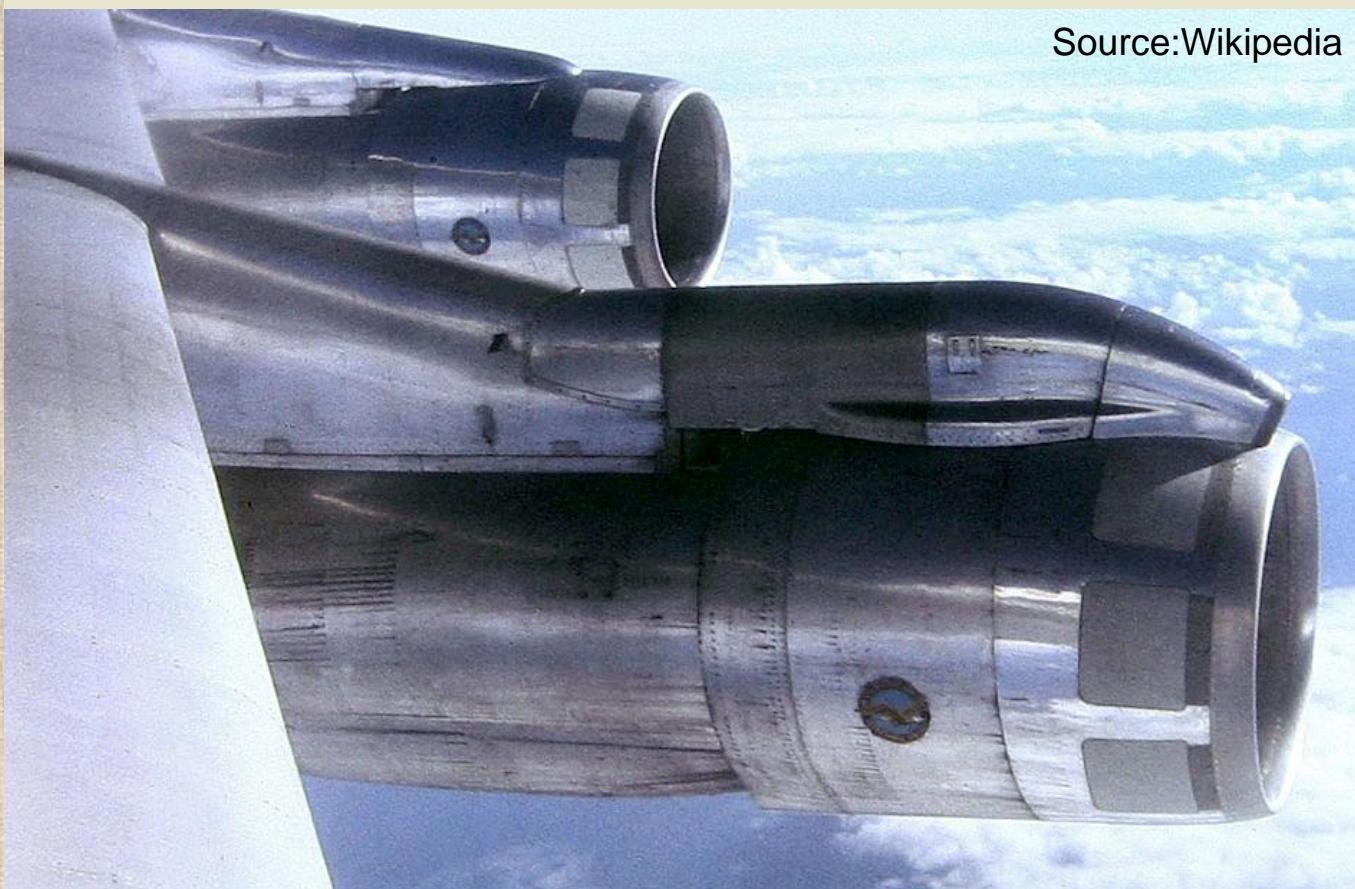


Purpose of Ventral fins

- Fin located at rear underside of fuselage
- Improves responsiveness towards rolling
- Improves directional stability

Podded Engines

- Jet engine inside a pod
- Pod is known as a nacelle



Source:Wikipedia

Variants of Podded Engines



Source:AviationWeek



Source:Airliners.net

Underwing mounted

- Engine attached to undersurface of wing
- Most common in commercial aircraft
- Pylons used for attachment

Variants of Podded Engines

Source:FlightAltair



VFW-Fokker 614

Source:FlyingMagazine



Softex Aero V24L

Overwing mounted (with pylon)

- Engine placed clearly above wings using pylons

Variants of Podded Engines

Source:Airliners.net



Antonov An-72

Source:Wikipedia



Boeing YC-14

Overwing mounted (without pylon)

- Engine placed very close to the wings

Variants of Podded Engines

Source:PlaneSenseAviation



Cessna Citation

Fuselage mounted

- Engine located to the rear of the Fuselage
- Suited for small jet airplanes (Why ??)

Variants of Podded Engines



Source: AviationHistoryOnlineMuseum

Heinkel He 162



Source: GeneralAviationNews

Cirrus Vision SF50

Over-Fuselage mounted

- Engines receive good airflow
- safe from the ground

Ejection Seats

A pilot's last savior from martyrdom



A pilot ejecting from
a blazing RAF Sea
Harrier



Next

Ejection Seats in Action

Video Courtesy : Top 10 Everything

1 min 35 s



The inspiring story of a legend ...

Marium Mukhtiar

1992 - 2015

Tuesday 24 November 2015

An ill-fated FT-7PG aircraft



Took off with



Saqib
Abbasi
**Squadron
Leader**



Marium
Mukhtiar
**Flying
Officer**

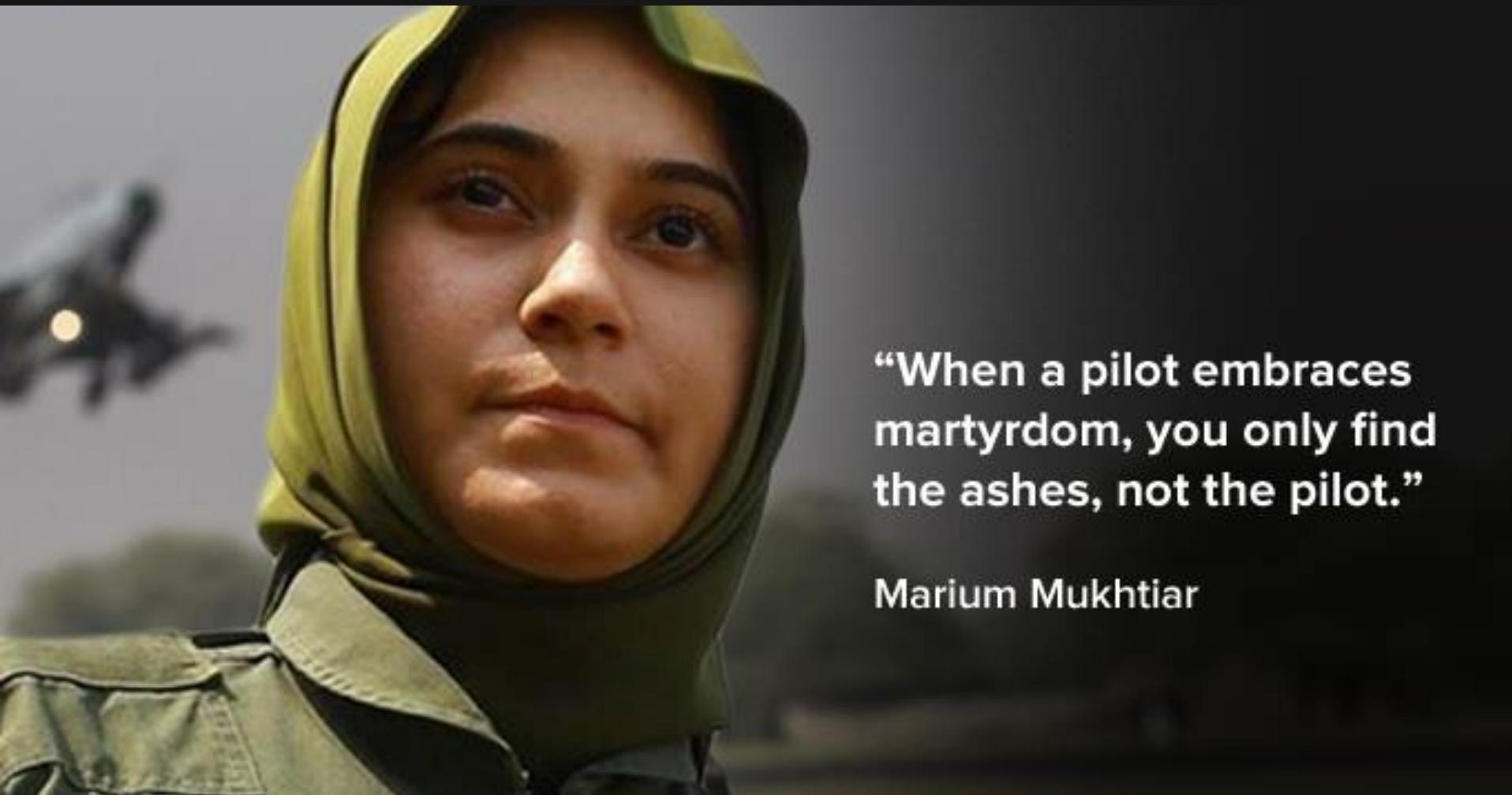


The plane crashes near Kundian, Punjab



Abbasi survives after ejecting,
but
Mariam Mukhtiar becomes a **Martyr**

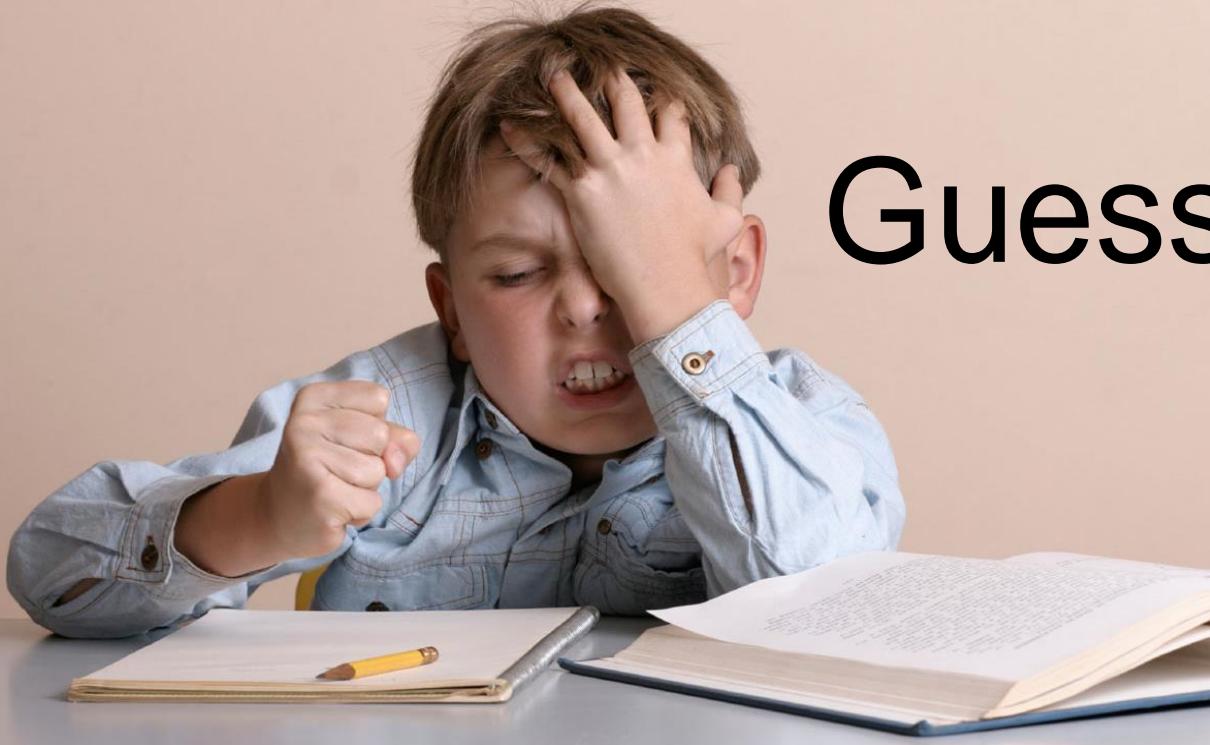
A lesson to learn



**“When a pilot embraces
martyrdom, you only find
the ashes, not the pilot.”**

Marium Mukhtiar

Guess what ??



**Homework
Time**



Back

Elevator and Pitch Control

Video Courtesy : ExpertVillage

37 s



Back

Elevator Trim Tab

Video Courtesy : Mr XYZ

35 s



Back

Ailerons and Roll control

Video Courtesy : ExpertVillage

36 s



Back

Rudder and Yaw control

Video Courtesy : ExpertVillage

26 s



Back

APU Location and Purpose

Video Courtesy : Destination Tips

50 s