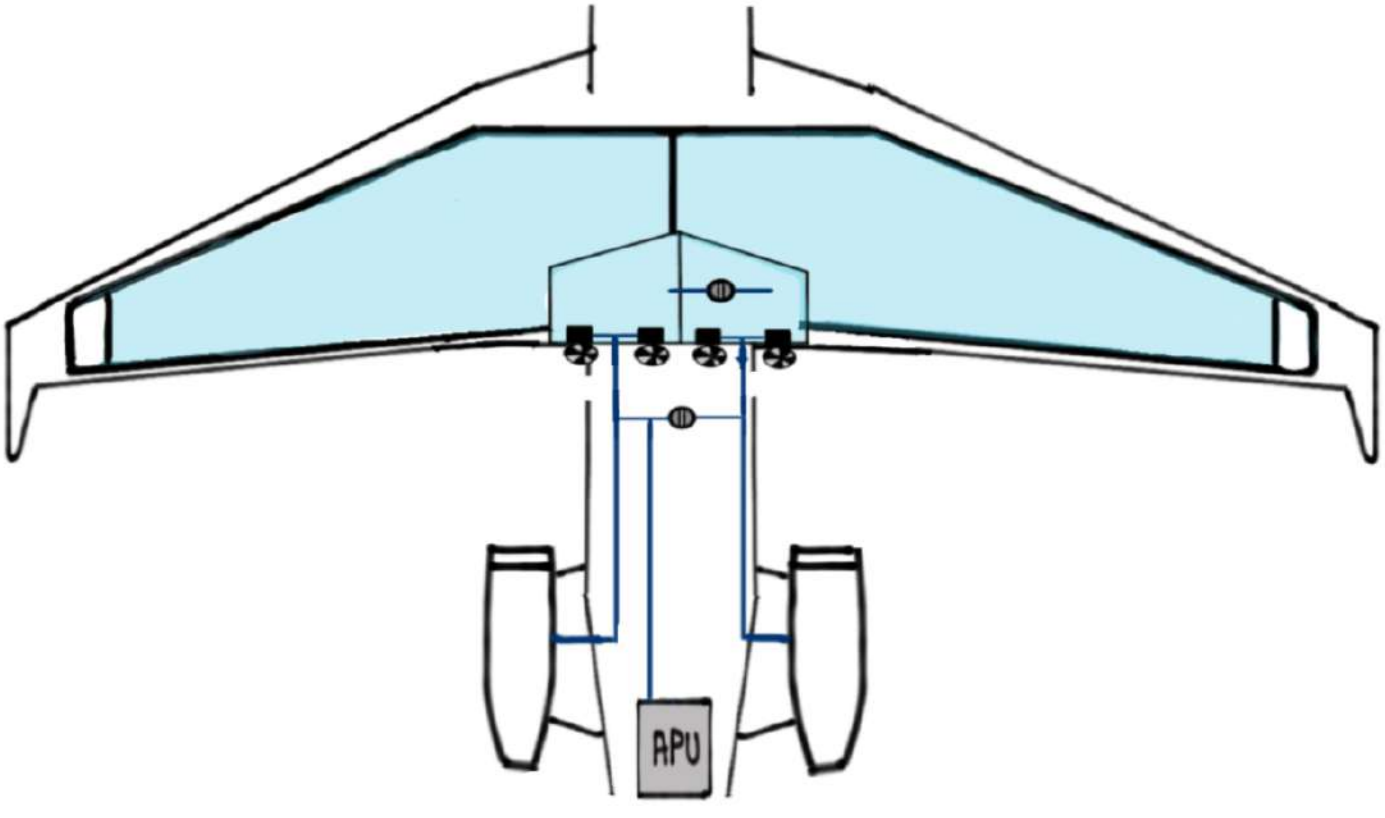
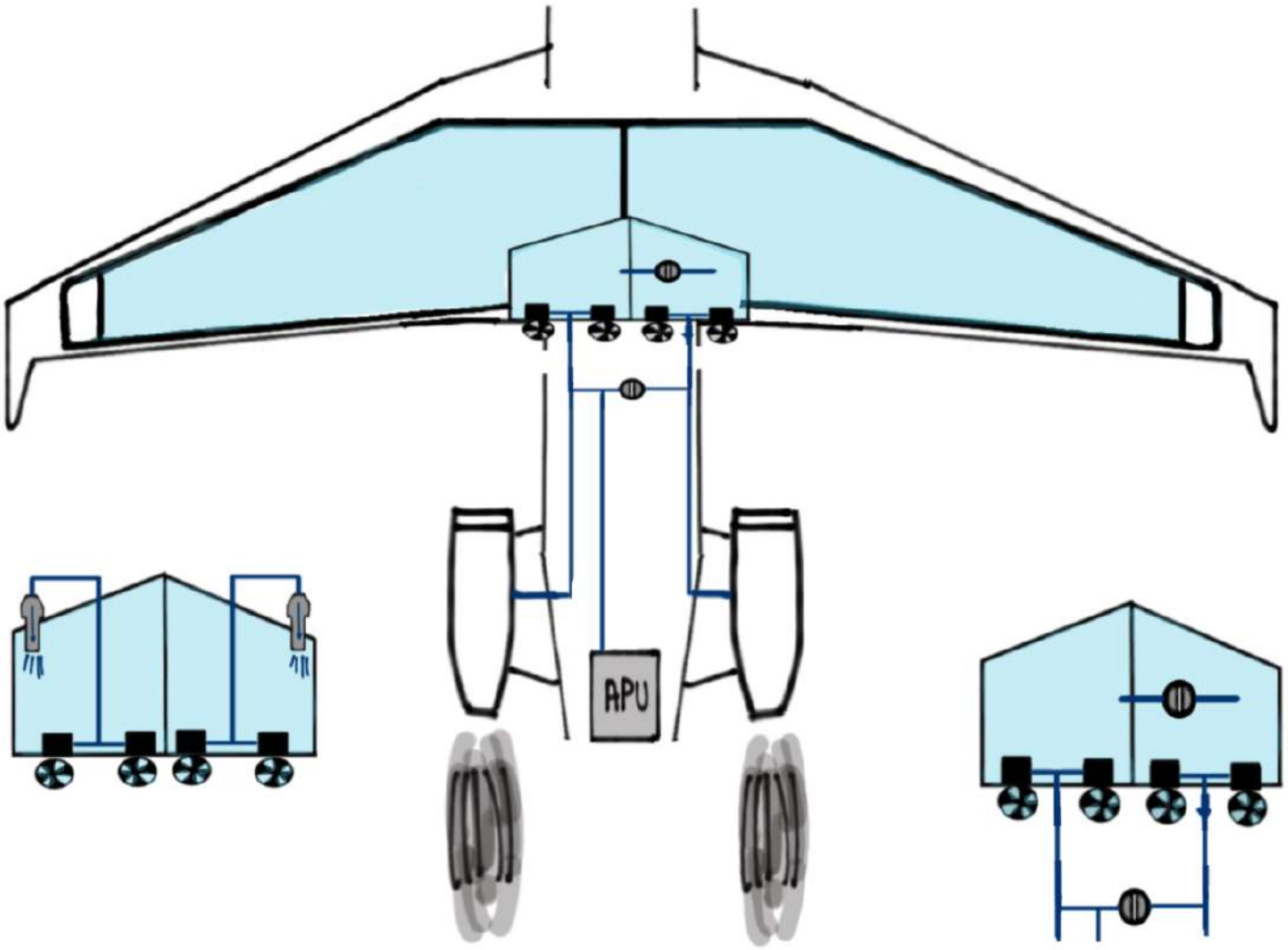
# G450
# FUEL SYSTEM




**For study purposes only**

The Fuel System consists of Two (2) wing Tanks which store all fuel and feed the main engines and APU via low pressure, electrically-driven boost pumps

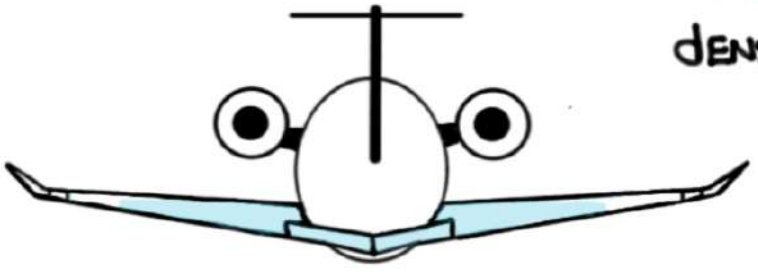



- The wing Tanks are part of the internal wing structure and do not have bladders

# Wing Tanks

- Total fuel capacity:

29,500 lbs



at 60°F and a fuel density of 6.75 lbs/gallon

- It may be possible to upload fuel quantities in excess of the above. This is permitted as long as the following limitations are not exceeded:

1) Maximum Ramp Weight:

75,000 lbs

2) Maximum Takeoff Weight (MTOW):

74,600 lbs

3) Loaded aircraft is within C.G. limit

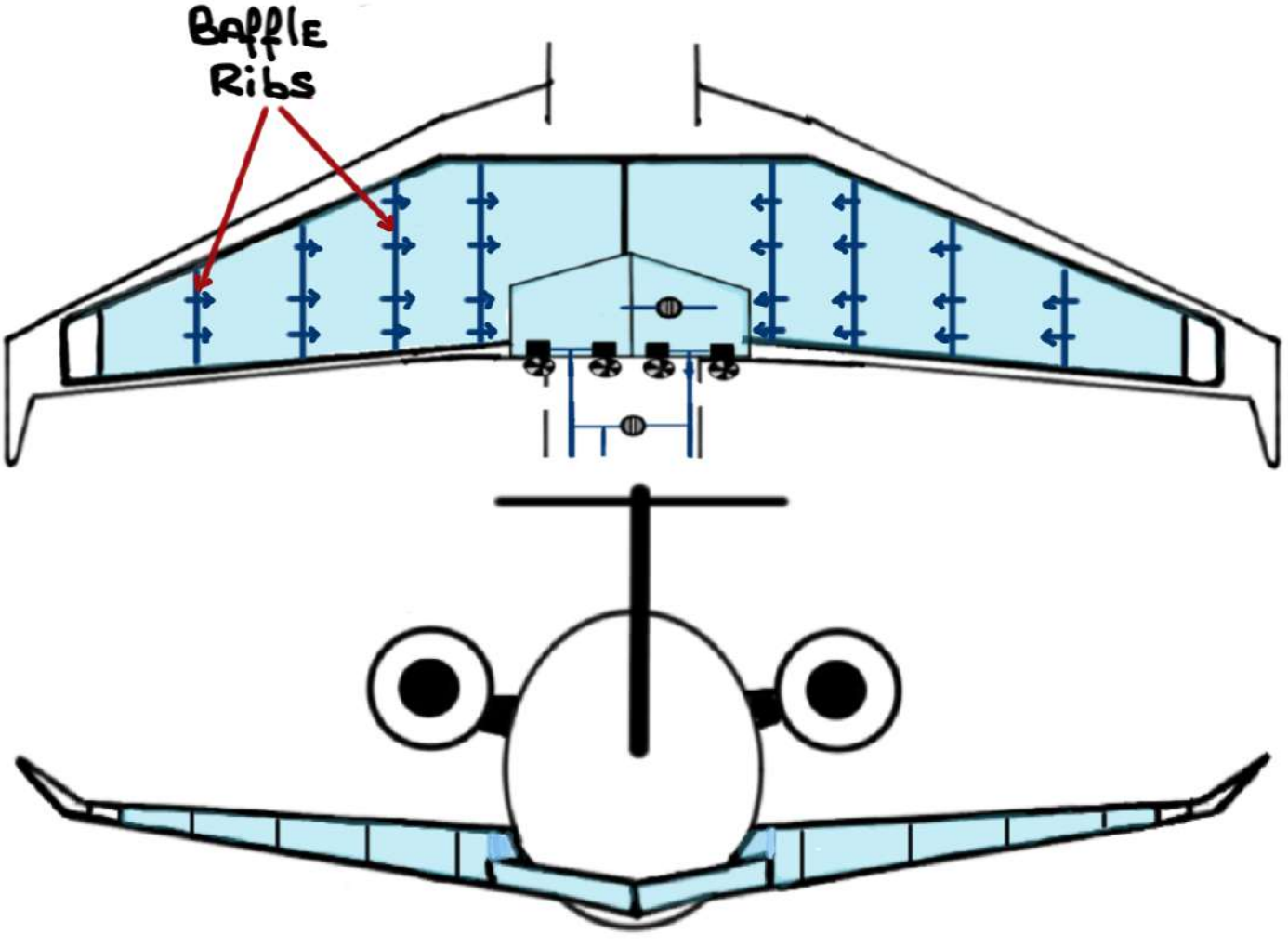
- Refueling:

  ① Single-point pressure refueling (35-55 psi)

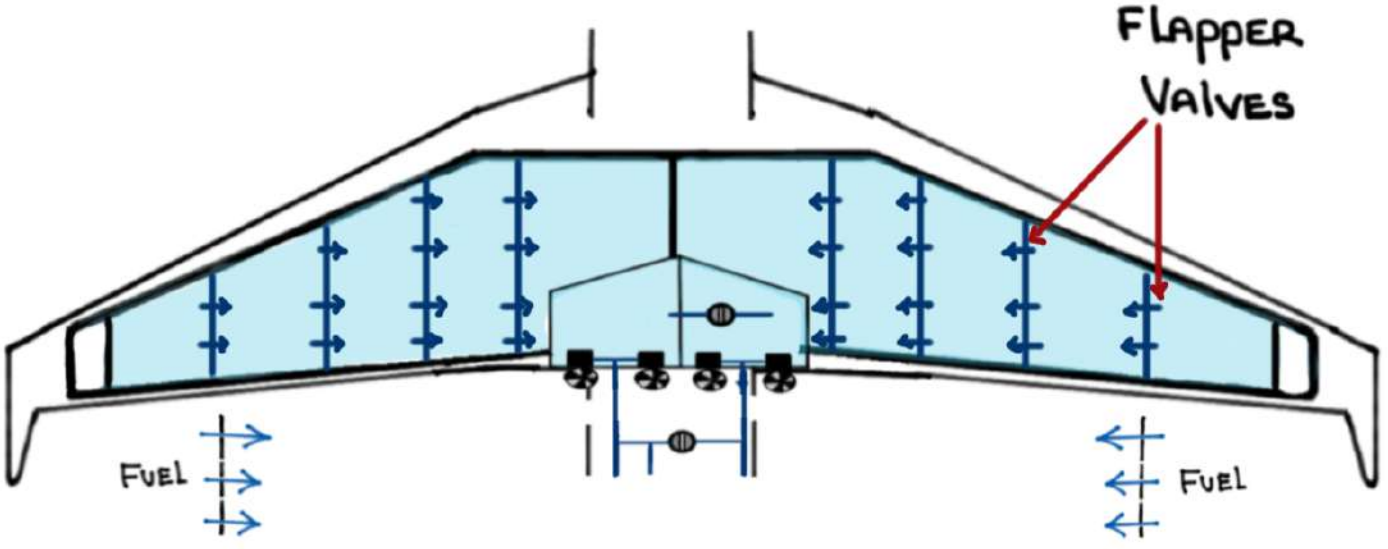
  ② Overwing gravity refueling

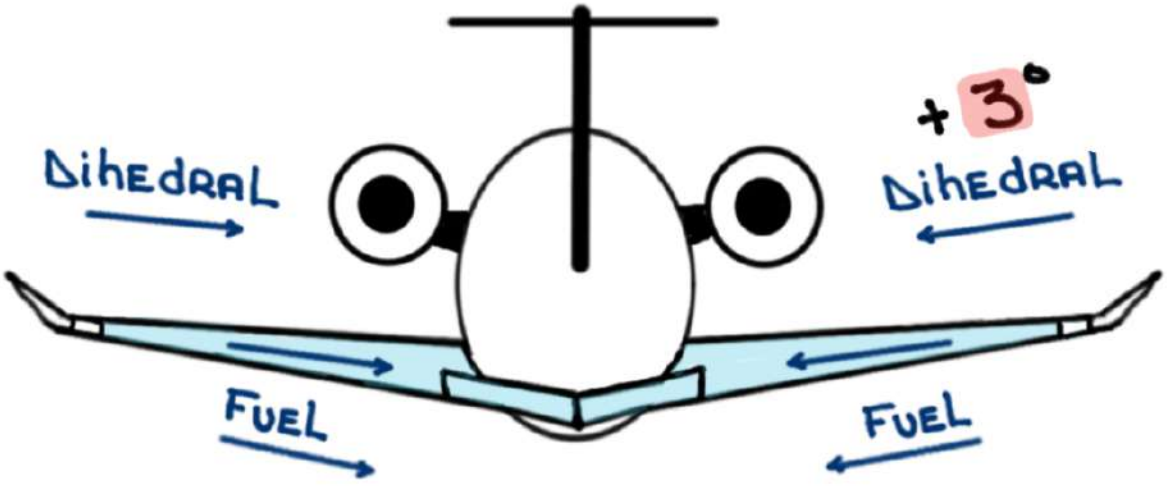
- There are five (5) compartments in each tank

- Rapid changes in C.G. due to slushing are avoided through the use baffle ribs within the tanks. This design creates multiple compartments or bays within the wing tanks



- Flapper valves at the bottom of each baffle rib allow fuel to travel in one direction from compartment to compartment and towards the fuel Hoppers

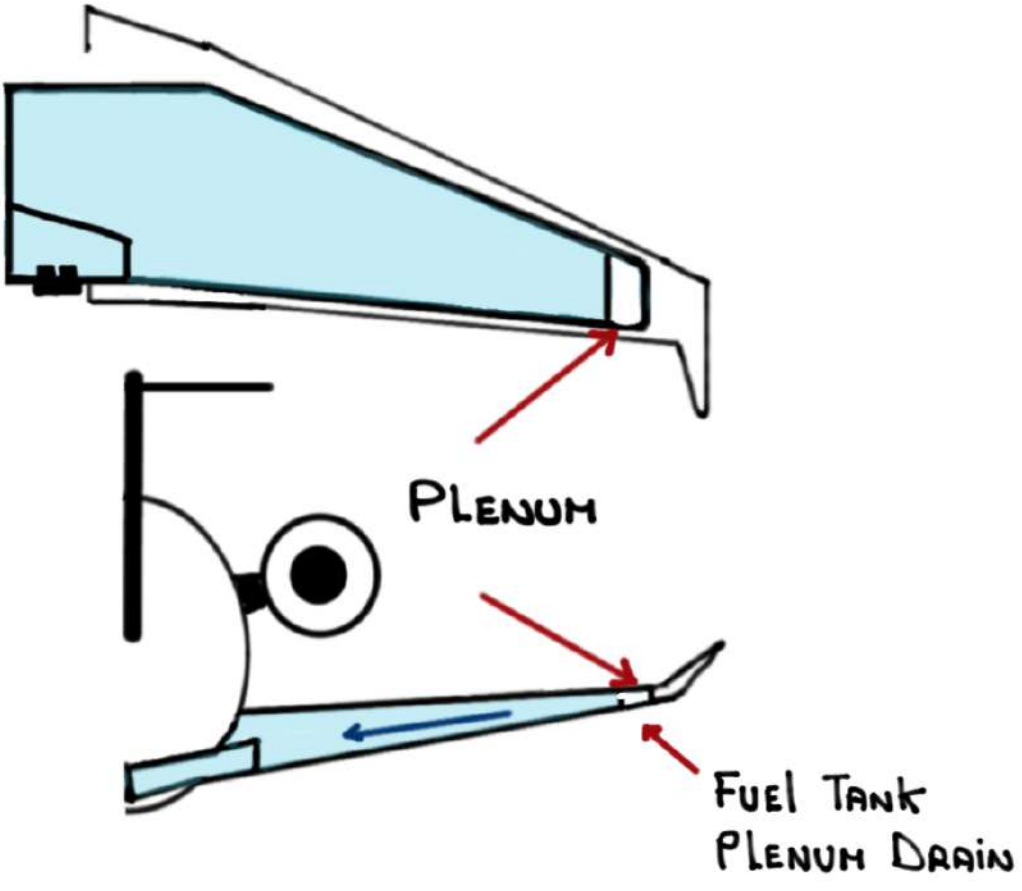



- Any fuel below the flapper valves moves towards the fuel Hoppeas through small orifices called Weep Holes

- The PLENUM, also known as the vent tank, catches fuel vent system during transient maneuvers. This fuel is then drawn back into the fuel tanks when stable flight is resumed

- The Plenum also allows for a Two (2) percent fuel expansion



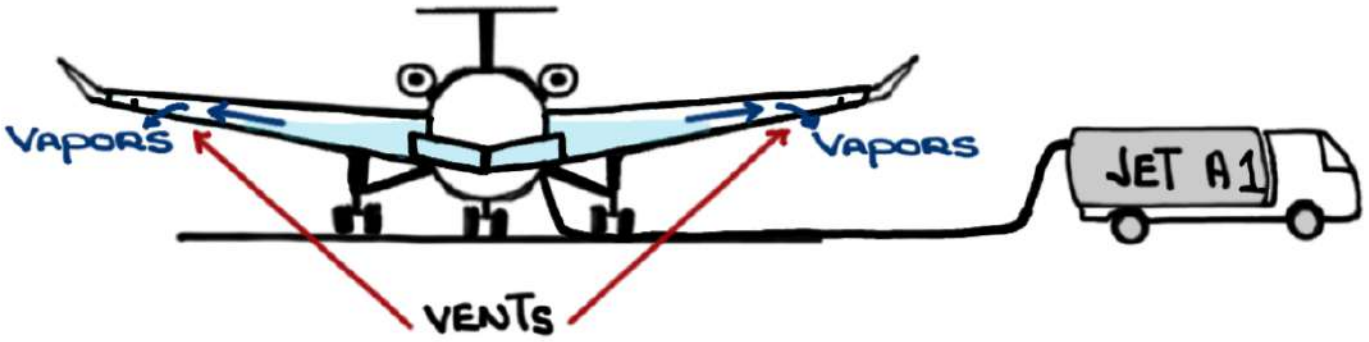

- The Plenum should be drained of any fuel prior to Takeoff

- The fuel tanks are vented (NACA vents) to provide positive internal pressure and to protect against over and under pressurization

- The fuel vent system is fully automatic and does not require electrical power

- The fuel vent system allows vapors and air to escape as fuel goes inside the tanks during refueling

Prevents wing rupture (positive pressure)

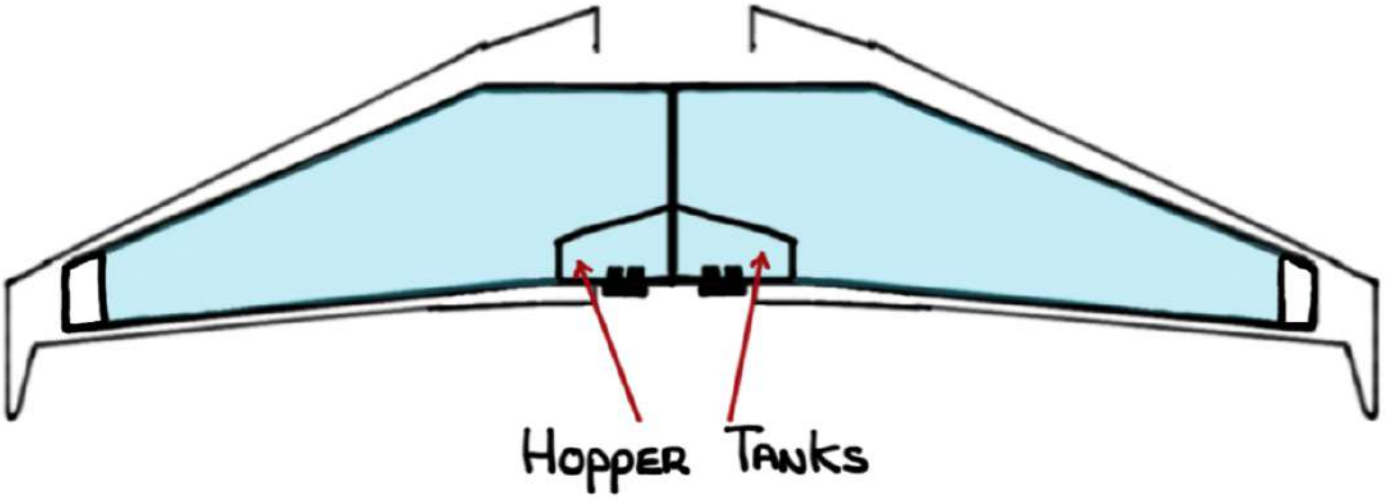


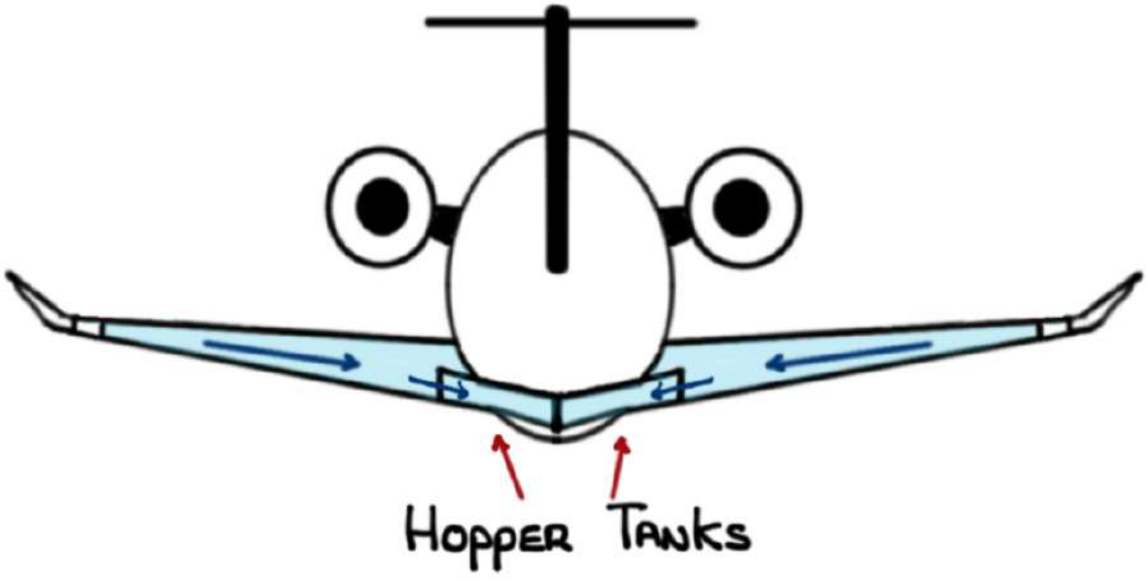

- The fuel vent system allows air to enter the fuel tanks as fuel is consumed during flight


Prevents wing collapse (Negative pressure)

- The Hopper Tanks are <u>segregated</u> tanks within the wing tanks

- They are located adjecent to the centerline rib at the lowest point within the wing tank



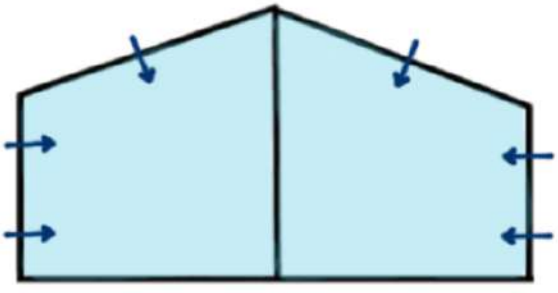




- It is from the Hopper Tanks that fuel is drawn to feed the engines and APU

- The Hopper Tanks are kept full via:

① Flapper-Type valves (Gravity)

- Three (3) flapper valves per Hopper
- Allow gravity flow of fuel from wing to Hopper

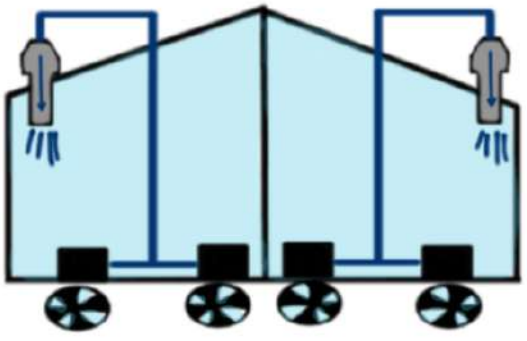


ONE WAY flow

② Ejector pumps which don't have moving parts.

They use motive flow from fuel boost pump pressure to draw fuel from the wing tanks into Hopper Tanks

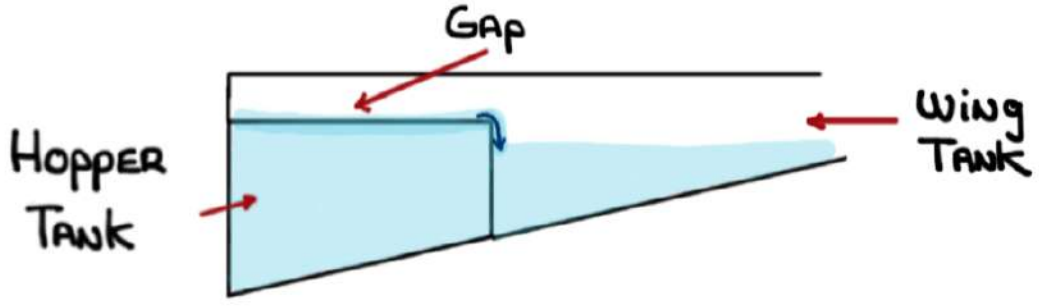
- Deliver steady flow of fuel from wing to Hopper
- Low pressure, high volume pumps
- 4,450 pounds per hour



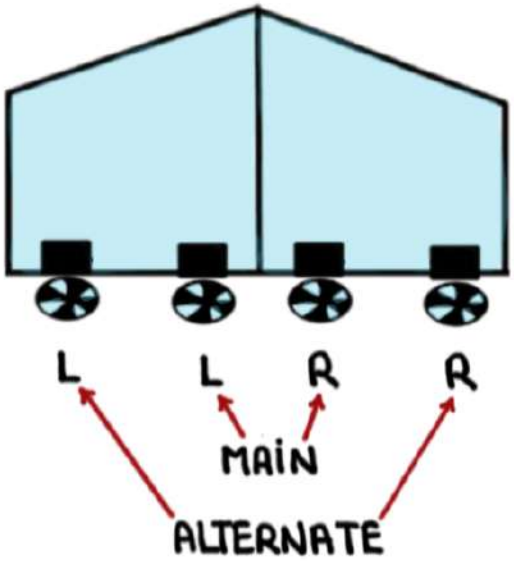
- The Hopper Tanks have a fuel capacity of:

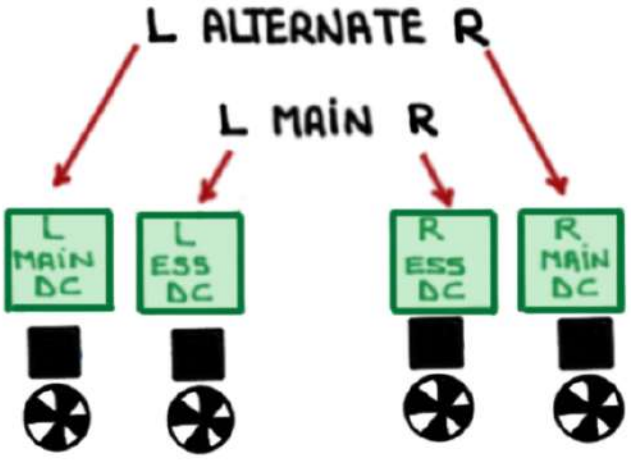
190 gallons / 1,283 Lbs.

- Excess fuel in the Hoppers can spill back into the wing Tanks via a gap above the Hopper walls




- The Hopper Tanks contain the electrically-driven boost pumps which deliver low pressure (25 psi) fuel to the Engines and APU



- Two (2) boost pumps per Hopper
- Boost pumps are identical and interchangeable
- Located in the wheel well and attached to the aft portion of the Hopper
- Two (2) Main powered by respective

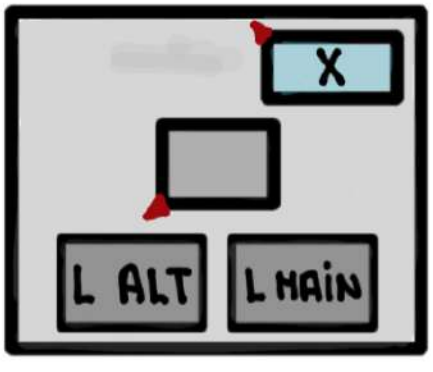

- Two (2) Alternate powered by respective

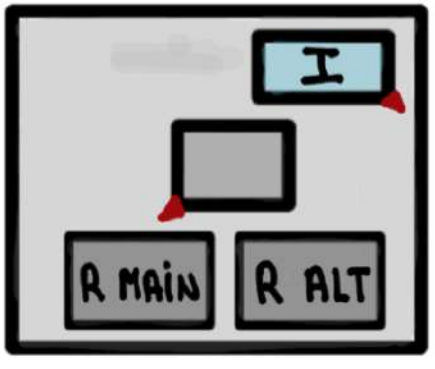

- Without Boost pump pressure the engines will:

  ① < 20,000' = suction feed

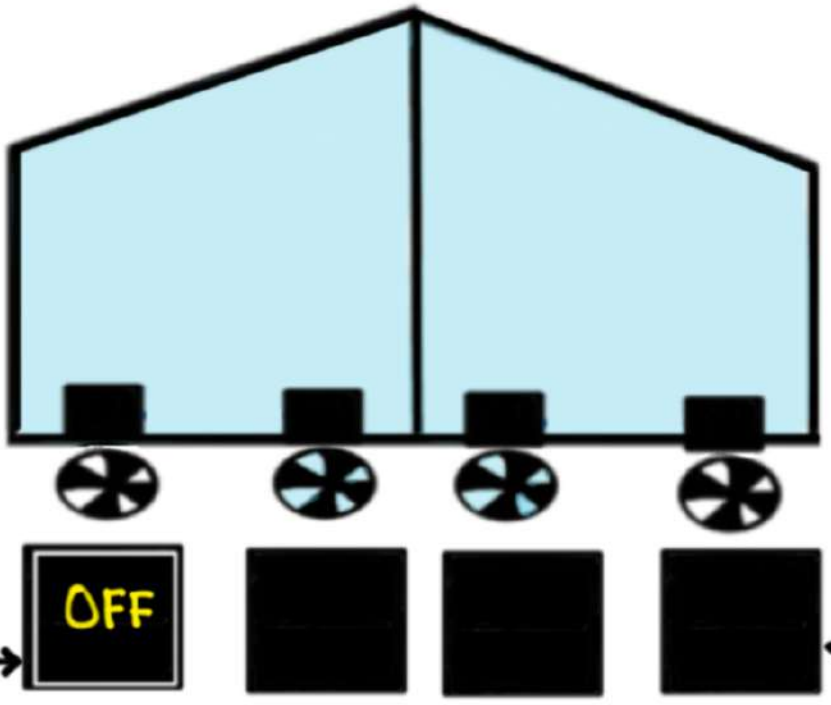
  ② ≥ 20,000' = run erratically and flameout

- Each boost pump draws < 25 amps
- All operable boost pumps must be selected **ON** for all phases of flight unless fuel balancing is in progress or as directed by the checklist
- Rear wing beam



# – Boost pump switch (indications)



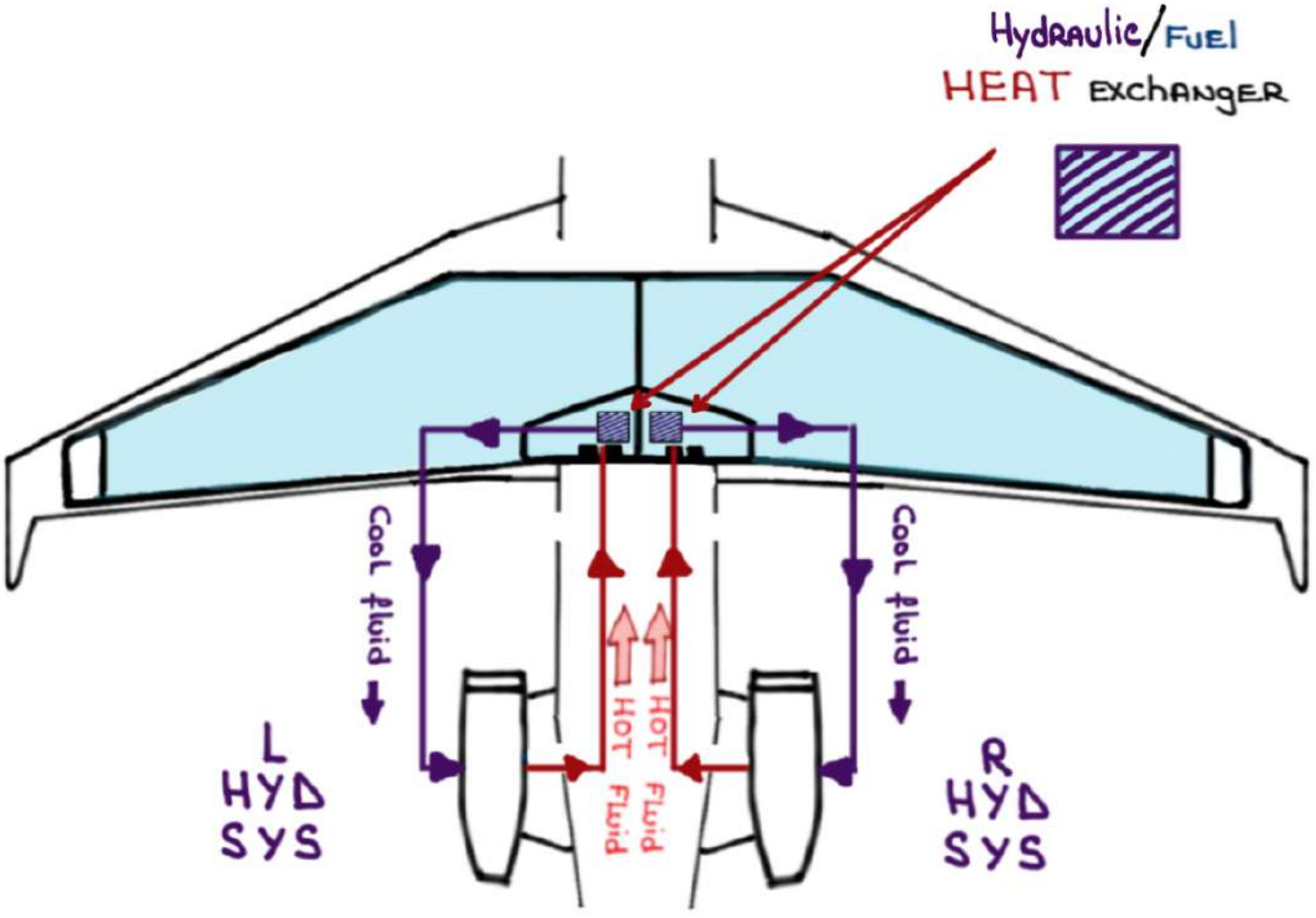

Pump switch Pushed out and unpowered

Pump switch Pushed in and operating (blank)

Pump switch Pushed in and failed (blank)

R ALT Fuel Pump FAIL

- The Hopper Tanks contain the Hydraulic fluid -To- Fuel Heat Exchangers




The Heat Exchanger unit is inside the onside fuel Hopper. HOT hydraulic fluid flows continuously Through the Heat Exchanger without pilot input

HOT Hydraulic fluid is cooled while COLD fuel in the Hopper is warmed up

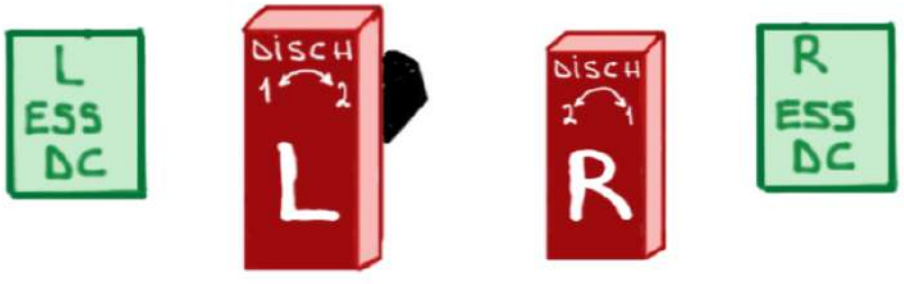
# Fuel Shutoff Valves

- There are three (3) fuel shutoff valves (SOV)

  ① Left Engine (Left wheel well)
  ② Right Engine (Right wheel well)
  ③ APU (There is no visible indication of valve position)

- Located in the wheel well and attached to the aft portion of the Hopper

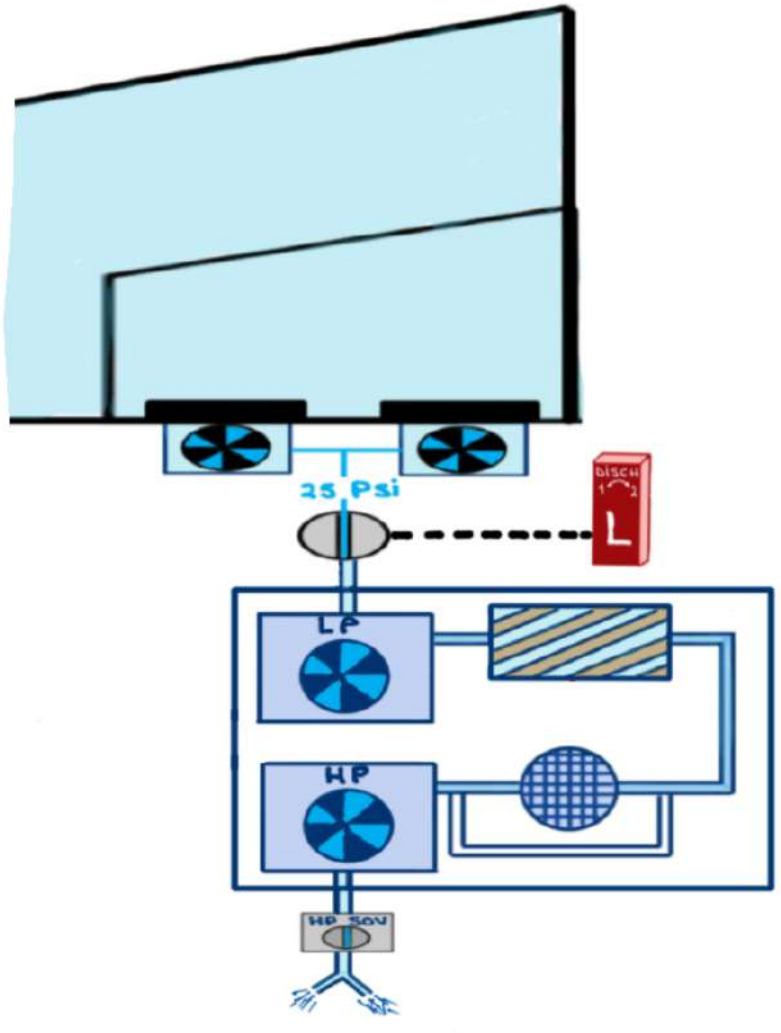
- Main engine SOV is operated by the respective **FIRE** handle in the cockpit and powered by its respective DC ESS bus



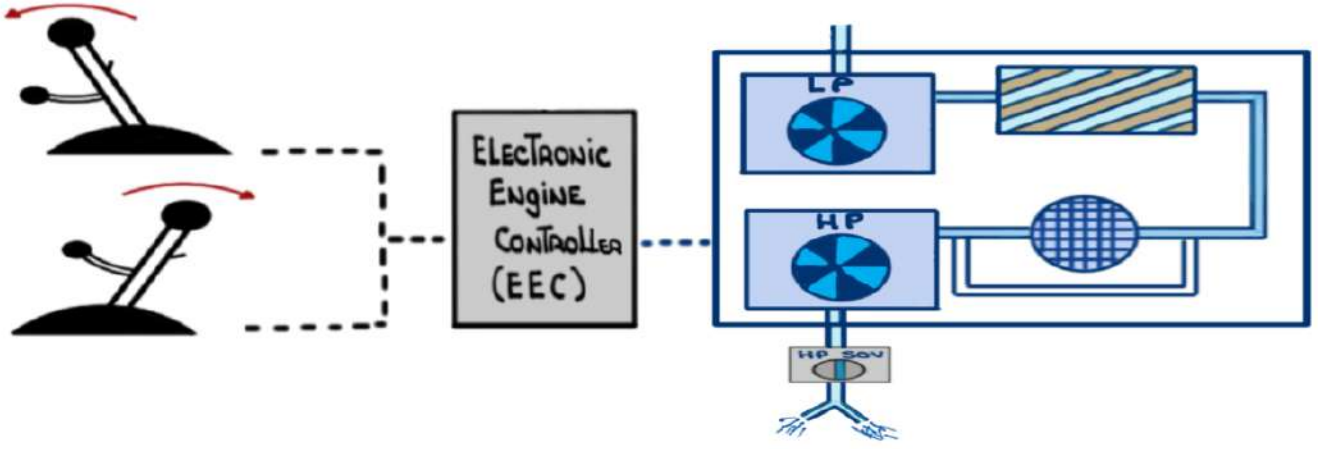

- SOV position indicator - wheel well

# Engine Fuel System

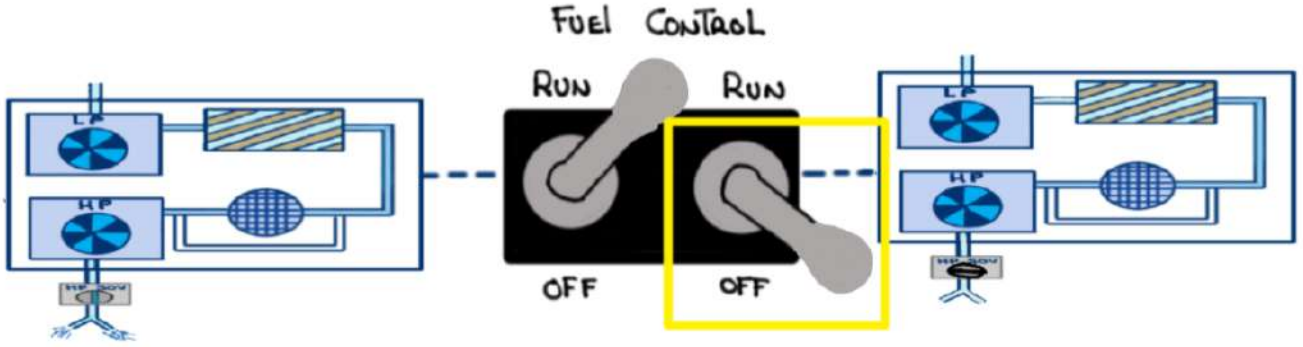
- Metered fuel from Tanks' boost pumps to nozzles
- Introduction of fuel is controlled by the EEC
- Low pressure fuel coming from the wings
- High pressure fuel coming from the Fuel Metering Unit (FMU)



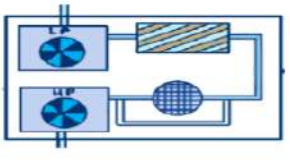
- As Thrust Levers are advanced or retarded the EEC commands the FMU to modulate fuel to nozzles

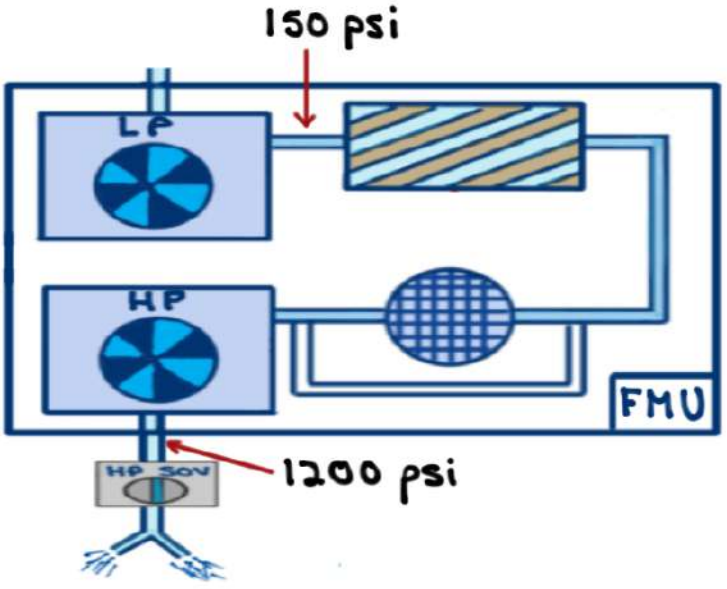



- Placing a fuel control switch to OFF closes FMU
  All fuel is cutoff to the fuel nozzles and the engine shuts down




- The FMU contains Two (2) internal pumps:
  - Low pressure (LP) 1st stage →
  - High pressure (HP) 2nd stage →






- THE LP AND HP PUMPS ARE DRIVEN BY THE ENGINE ACCESSORY GEARBOX

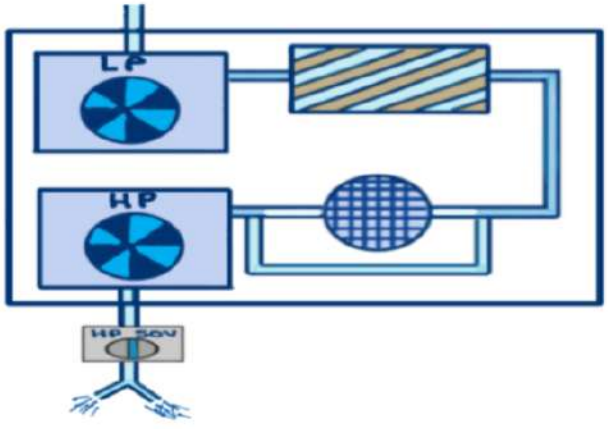
- A FUEL FILTER RECEIVES FUEL FROM THE 1ST STAGE LP PUMP AND REMOVES DEBRIS AND CONTAMINANTS

- A FILTER BYPASS VALVE ENSURES CONTINUAL FUEL FLOW TO THE ENGINE IF FILTER IS BLOCKED

- EXCESS FUEL IS RECIRCULATED THROUGH THE FUEL/OIL HEAT EXCHANGER 

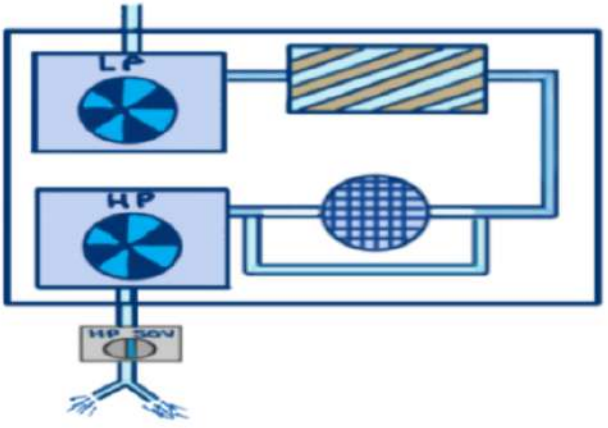
# Impending fuel filter blockage in indicated engine

L Fuel Filter




OR

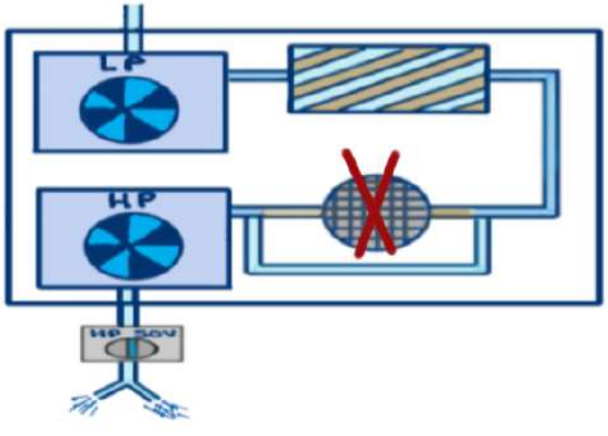
R Fuel Filter



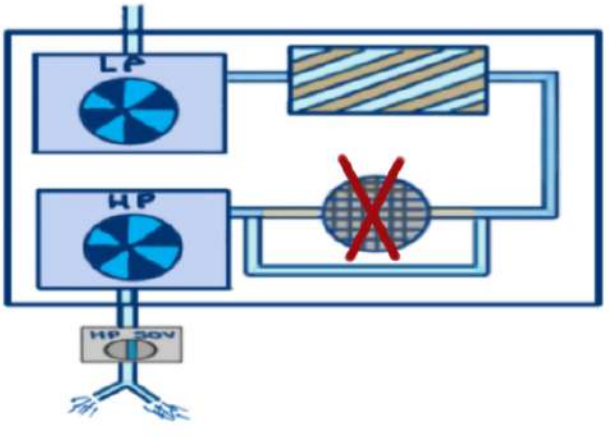

5 psi differential = Cyan CAS message

# Impending fuel filter blockage in both engines

L-R Fuel Filter

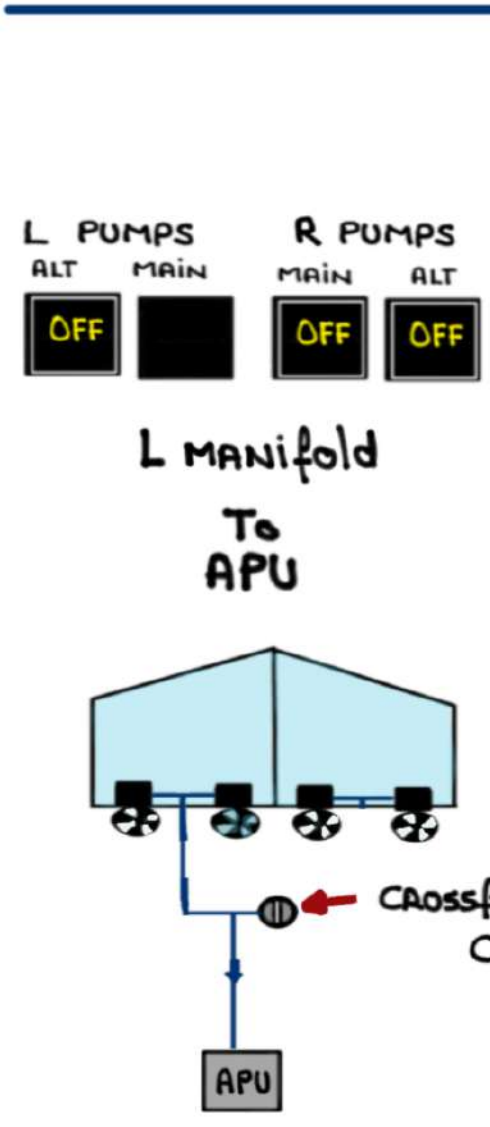


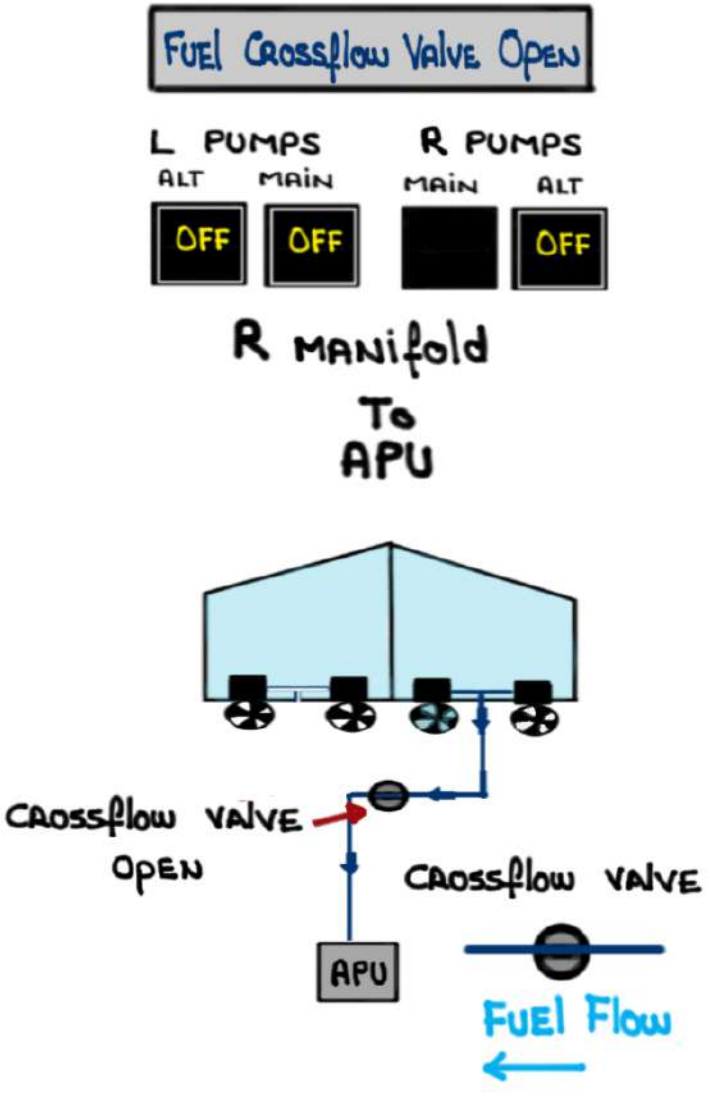

AND



# APU Fuel Supply

Fuel is normally supplied from the left fuel manifold but can also be supplied from the right manifold by temporarily opening the crossflow valve



# - Fuel Tank Temperature:

If in flight, and the fuel tank temperature is -40°C or less:

< -37° C

Fuel Tank Temperature

Descend to altitude where SAT is -60°C or warmer

-35°C to -36°C

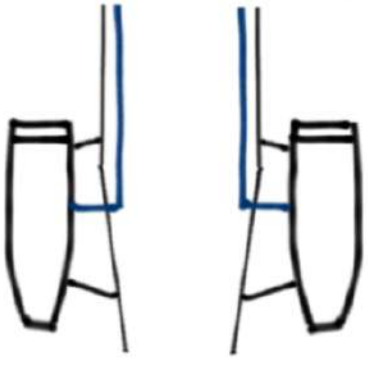
Fuel Tank Temperature

Delay Takeoff

>+ 54° C

Fuel Tank Temperature

# - Engine Fuel Temperature:

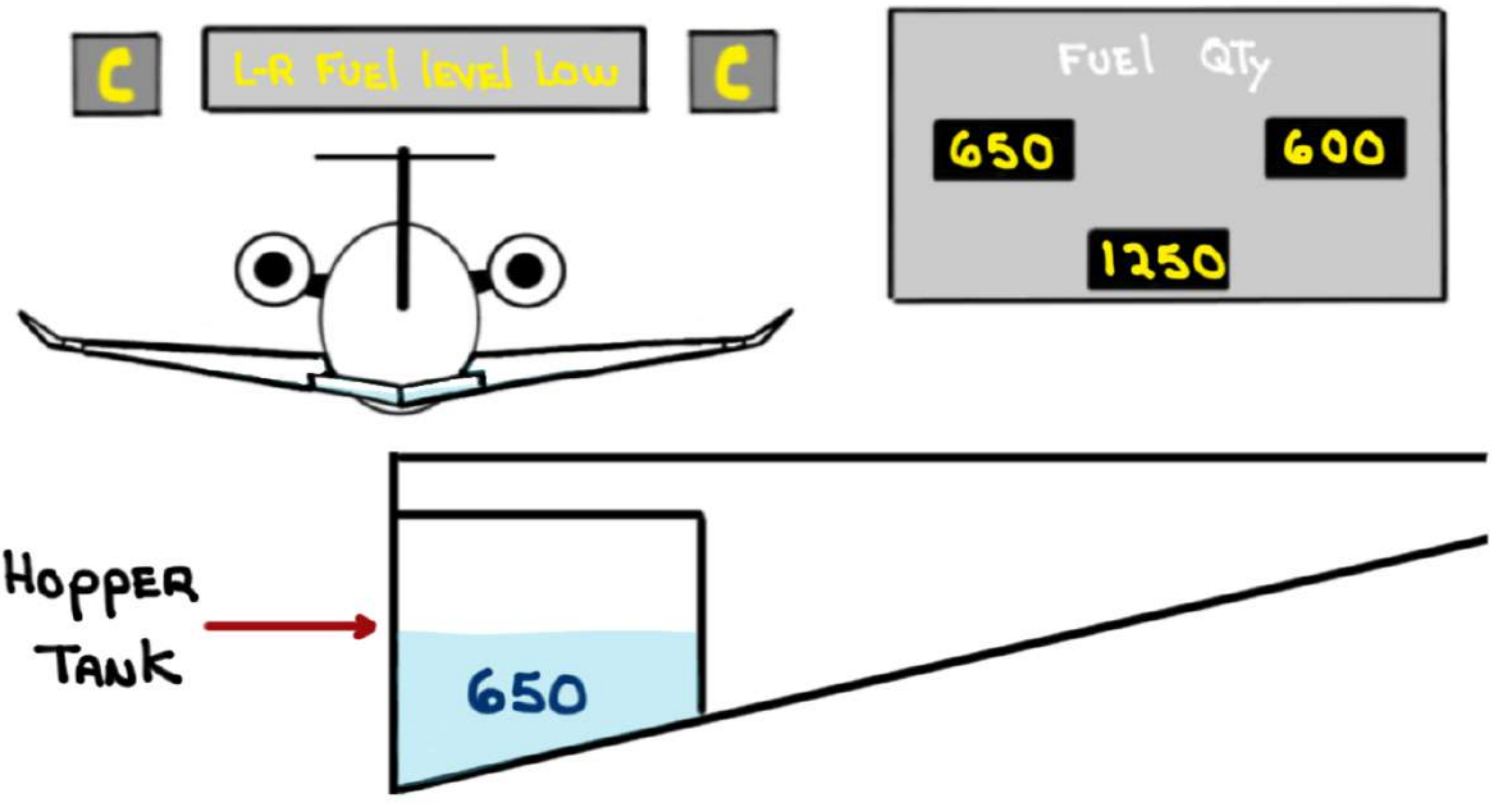


MAX: +130°C (15 minutes)

MAX: +95° C

MIN: -40°C

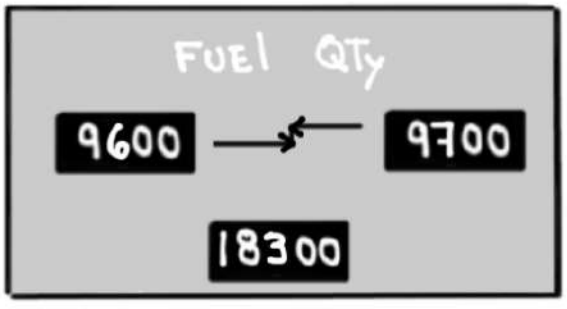
- ≤ 650 lbs remaining in either or both hoppers



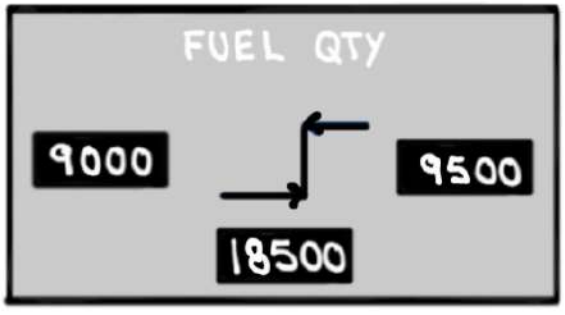

- NEVER fly with less than 650 pounds of fuel in either side of your 650!
- PROCEED to nearest available airport and land
- AVOID extreme nose high/low attitudes, excessive forward acceleration and uncoordinated flight maneuvers
- DO NOT go-around with <600 pounds in either tank

# Fuel Imbalance Arrows

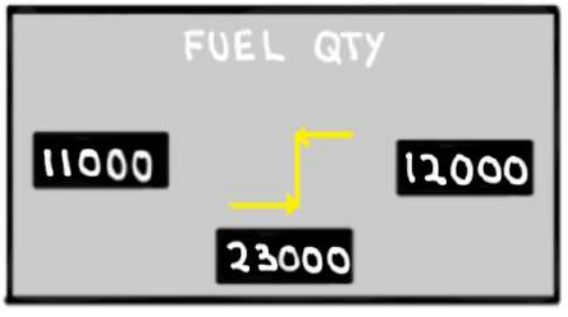
- Fuel arrows appear when a fuel imbalance condition exists
  - Arrow colors and deflection indicate severity level
  - Higher side higher arrow




Appear at 100 lbs imbalance

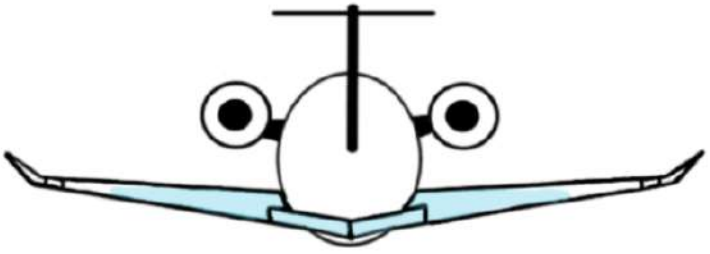



Full scale deflection at 500 Lbs imbalance




Full scale turns amber at 1000 Lbs imbalance

# Maximum Fuel Inbalance



**FUEL IMBALANCE**

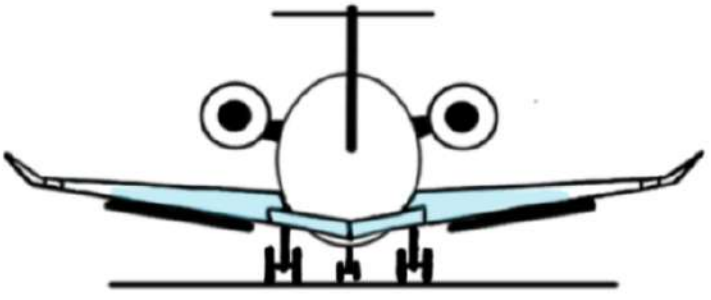
InflighT:

55,000 lbs or less:

≤ 2,000 lbs

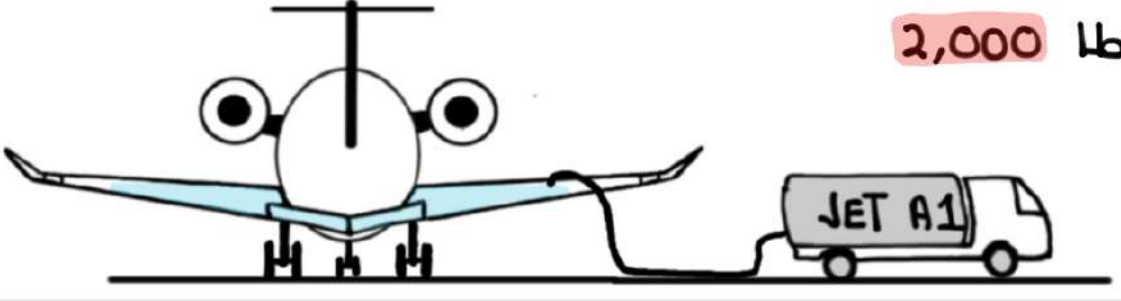
60,500 lbs or more:

≤ 400 lbs



**FUEL IMBALANCE**

Takeoff: 1,000 lbs.




Gravity refueling

2,000 lbs

- In the event of a fuel imbalance condition two methods are available to balance fuel:

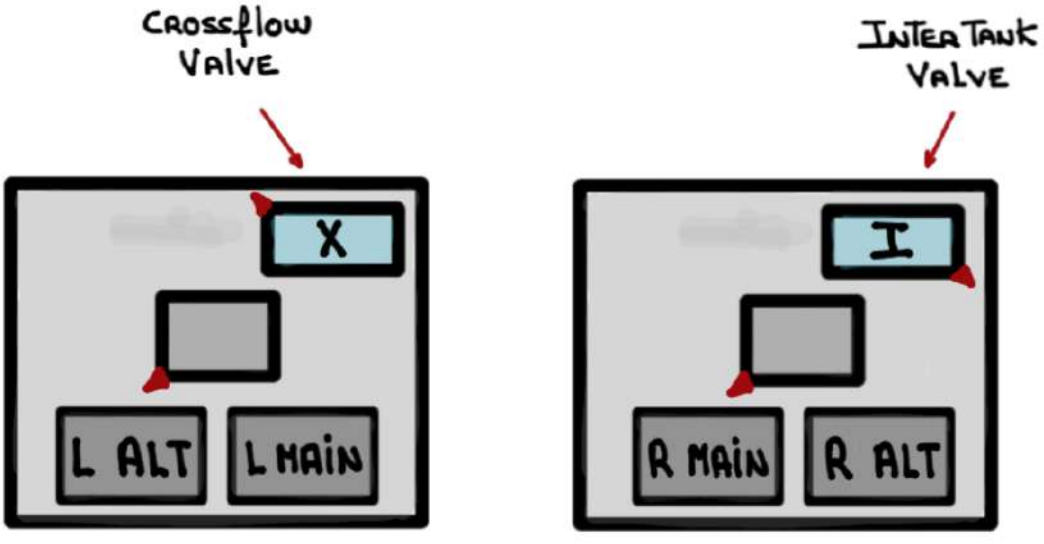
  ① InterTank Valve:

  - When OPEN it allows fuel to gravity flow between the right and left fuel tanks via the Hoppers
  - Approximately 1/2 zoid displacement when applying rudder trim

  ② Crossflow Valve:

  - When selected OPEN and boost pumps on light side are selected OFF it allows fuel from heavy tank to feed both engines

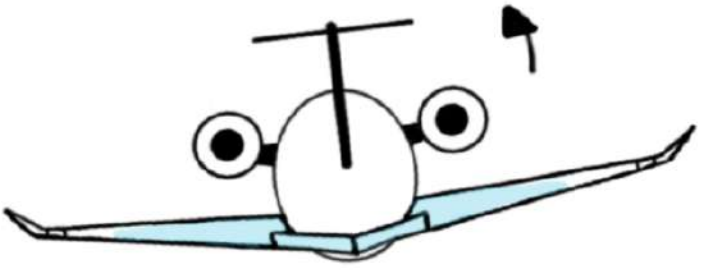
- Rear wing beam



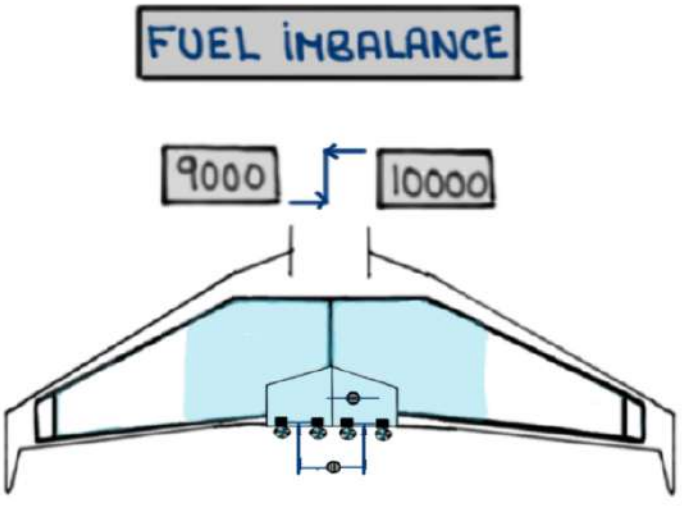
# Method 1: Inter Tank

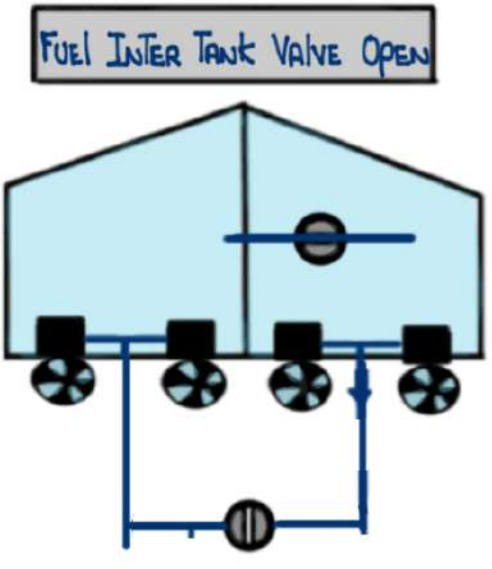
① Autopilot ON, Level flight

② Manually adjust Rudder Trim Towards The heavy wing




③ Open Inter Tank valve and monitor fuel progress



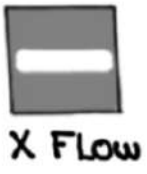

④ Close Inter Tank valve when within 100 lbs or so


⑤ Retrim rudder

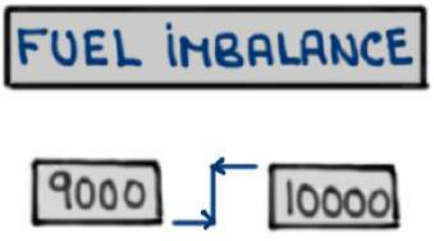
# Method 2: Crossflow

**NOTE:** Ensure fuel tank temperature is above 0°C prior to turning boost pump OFF

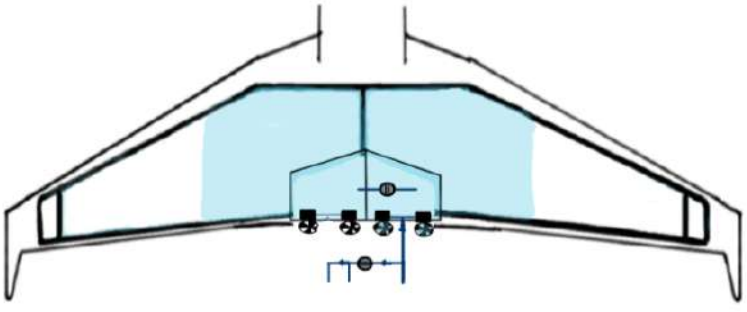
① Open crossflow valve

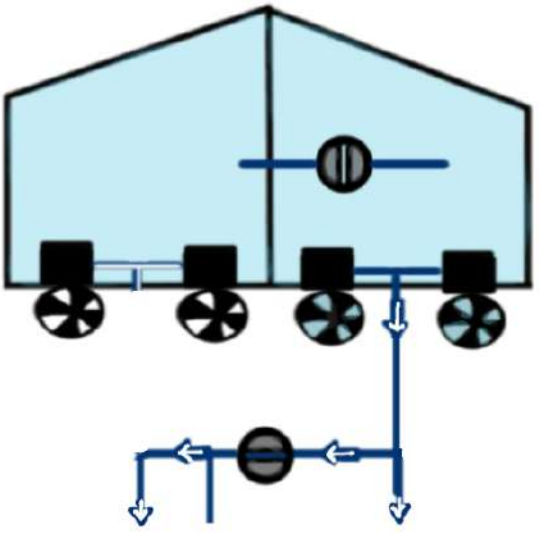




② Turn **OFF** boost pumps, one at a time, on lighter wing







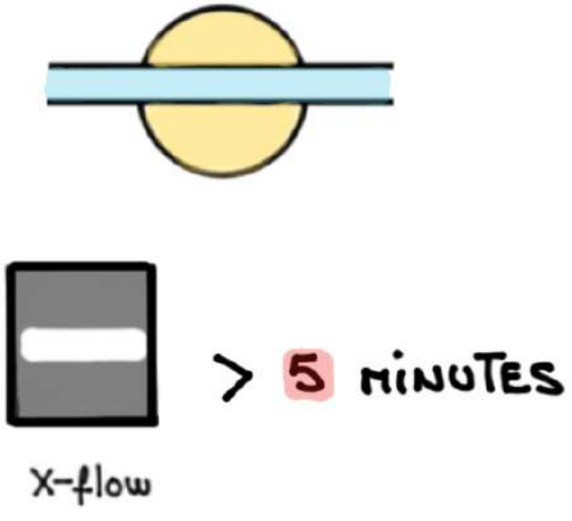


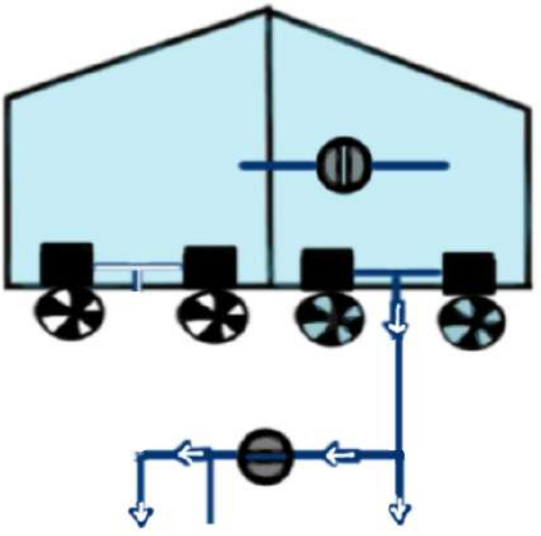
③ Turn **ON** boost pumps

④ Close Crossflow valve when desired balance is achieved

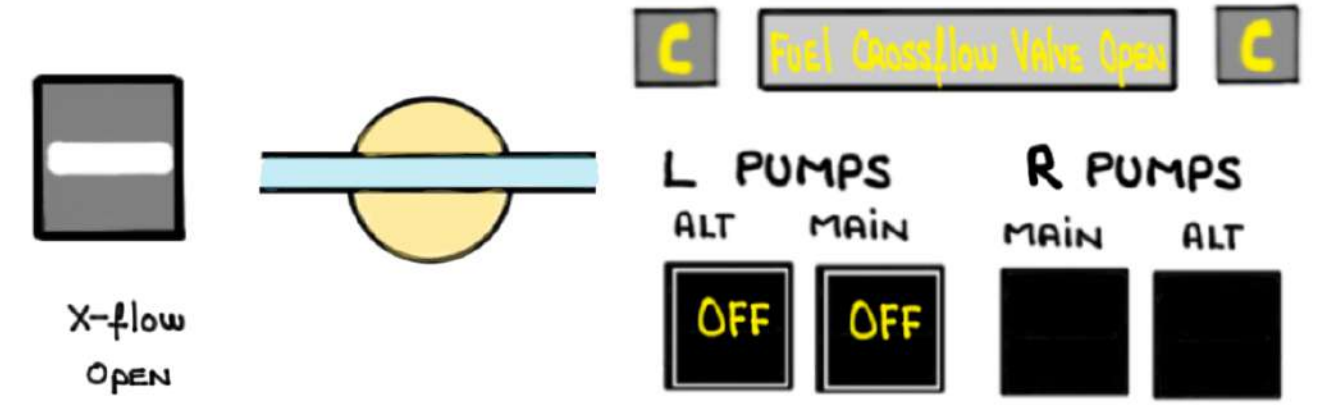

- The crossflow valve has a five (5) minute Timer To alert the crew that it is still open. The CAS message turns amber (CAUTION) and a double-chime aural tone will sound

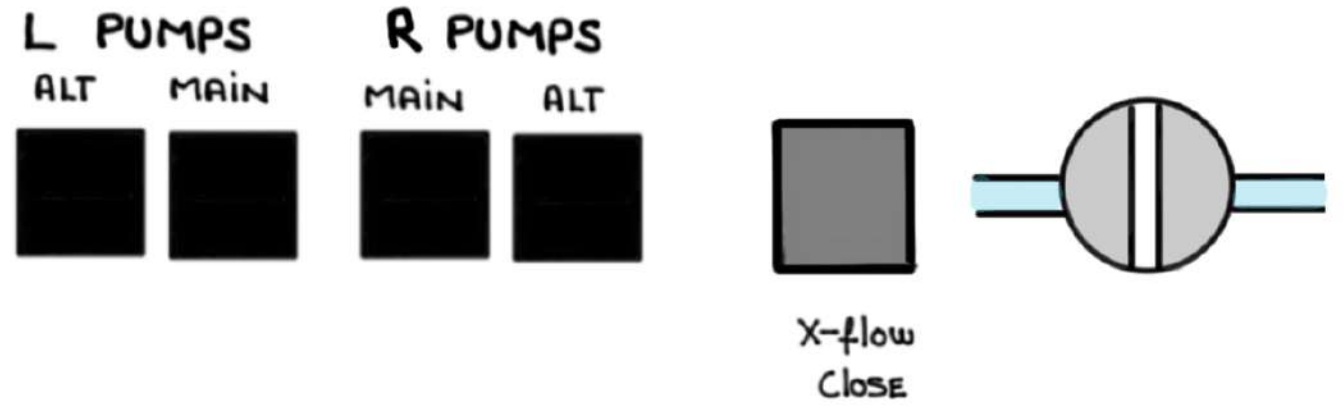

The crossflow valve on the fuel synoptic page will also turn amber

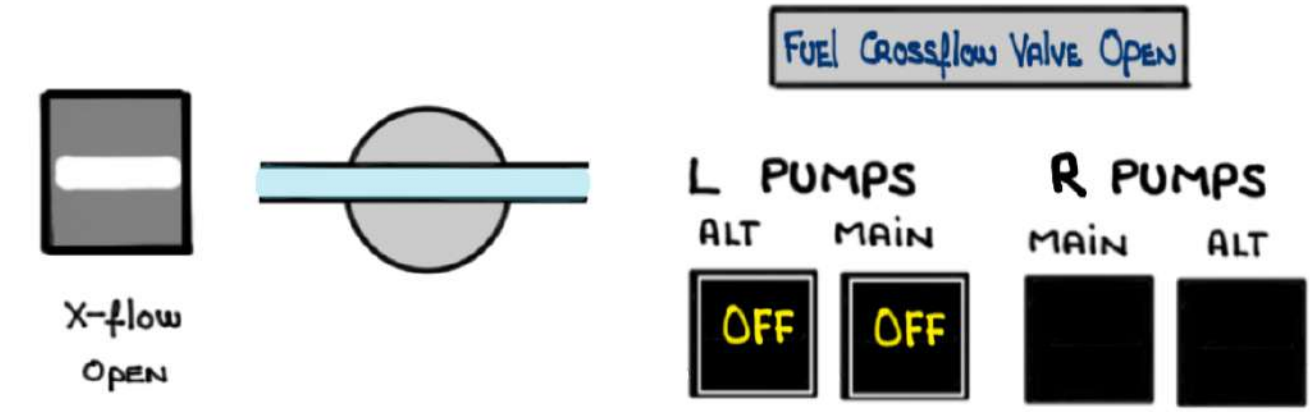


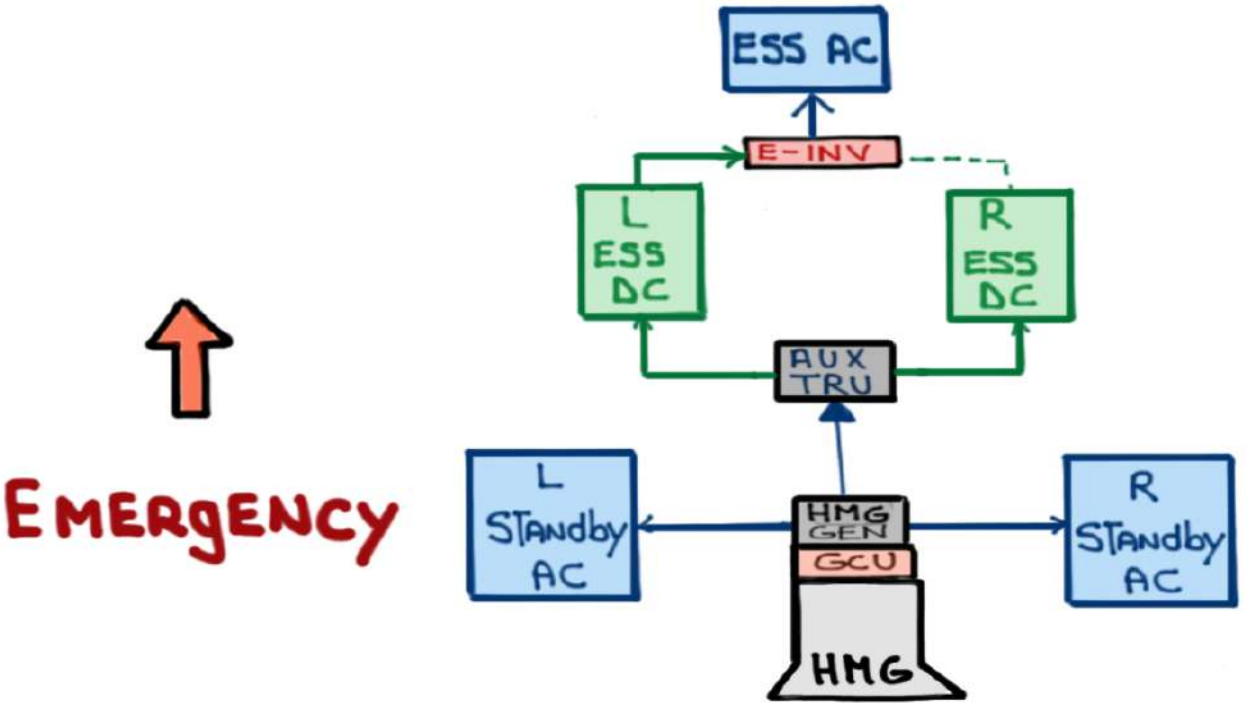
After reassessing the status of the fuel imbalance reset the timer by cycling the crossflow valve closed and then, if required, open it again

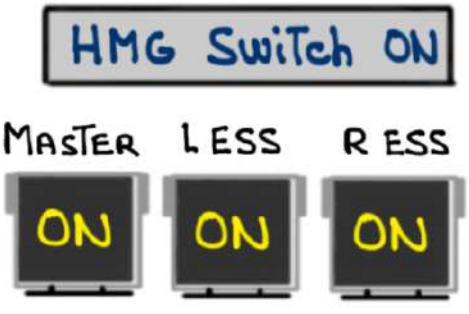


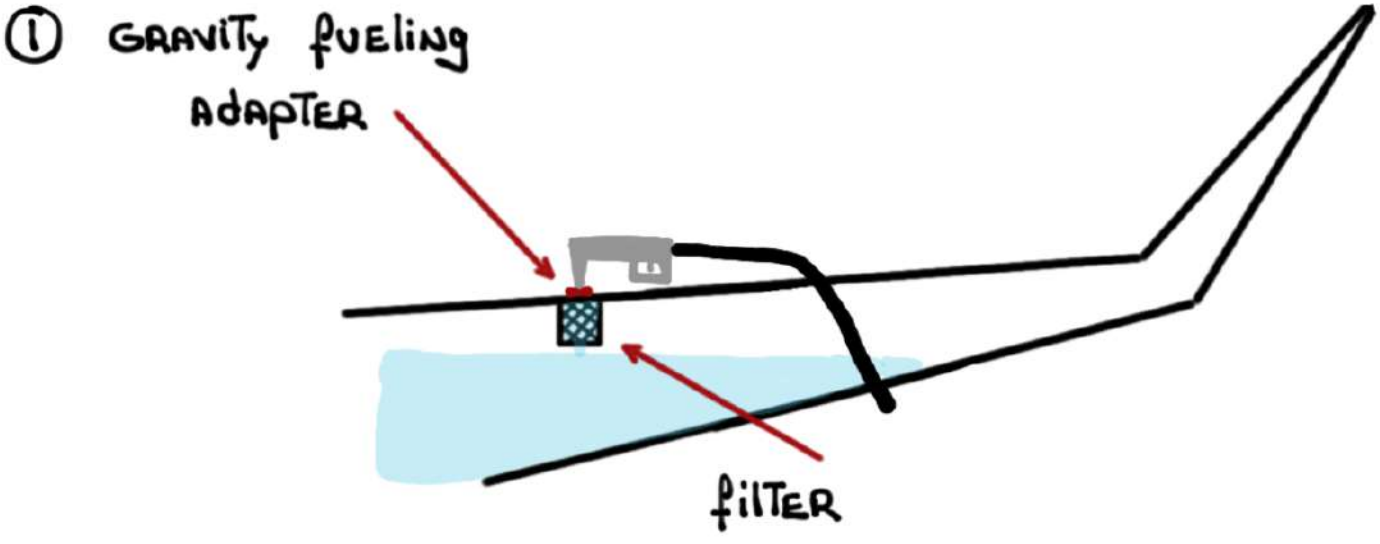
# HMG Operations

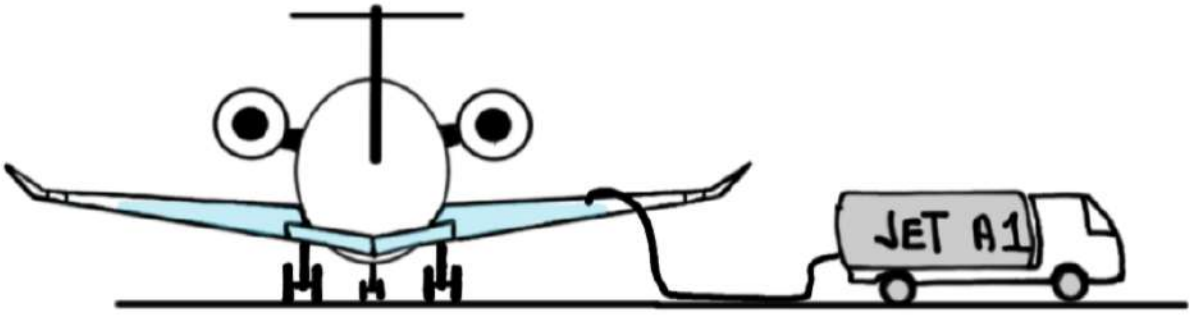


# Fuel Filtration

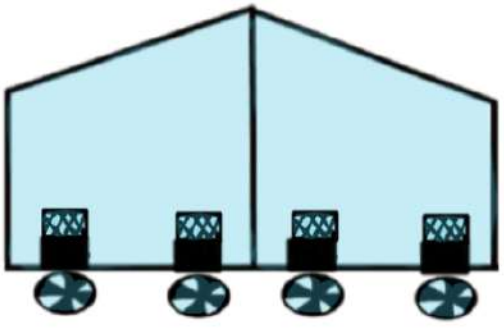
The fuel filtration system prevents contaminants from entering the wing tanks during <u>overwing gravity refueling</u>



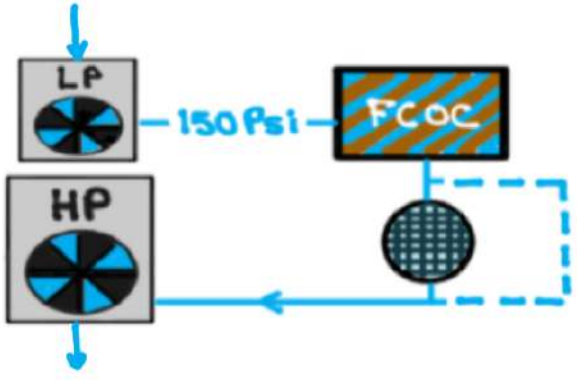



filTRATION is also ACCOMPLISHED AT:

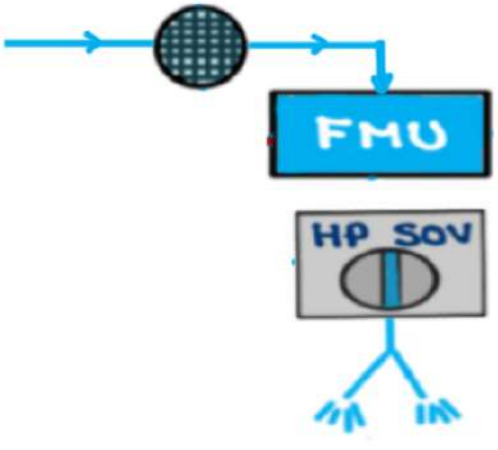
(2) THE INLETS of all four (4) boost pumps



(3) PRIOR TO THE HP PUMP (LP filTER)

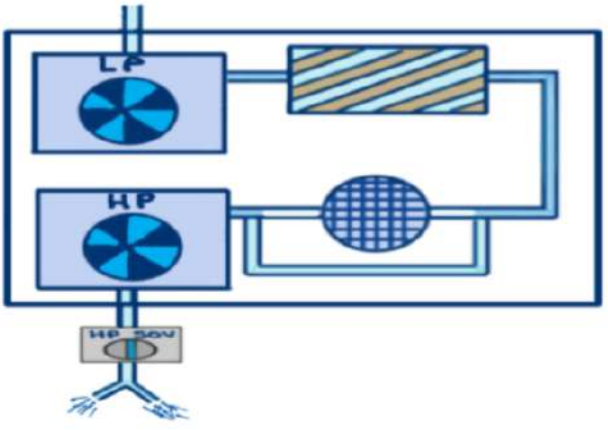



(4) PRIOR TO THE FUEL METERING UNIT (FMU)



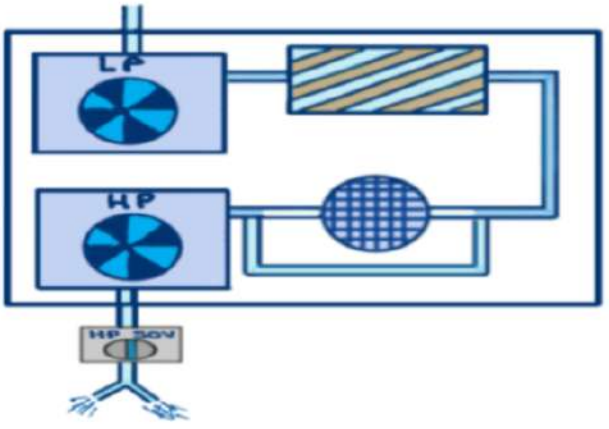
## Impending fuel filter blockage in indicated engine

L Fuel Filter




OR

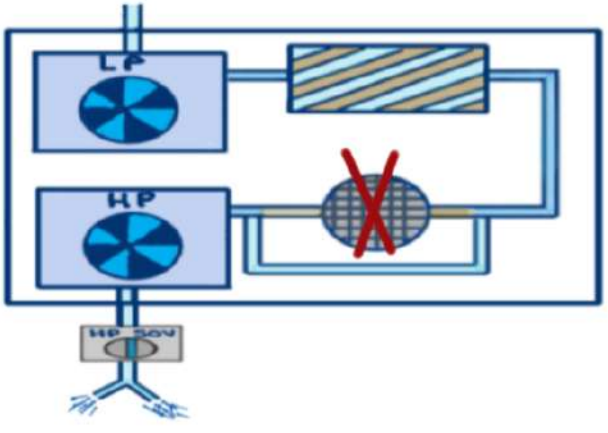
R Fuel Filter



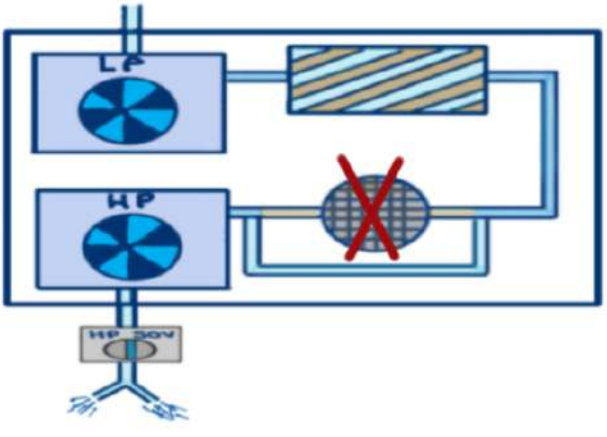

5 psi differential = Cyan CAS message

## Impending fuel filter blockage in both engines

L-R Fuel Filter

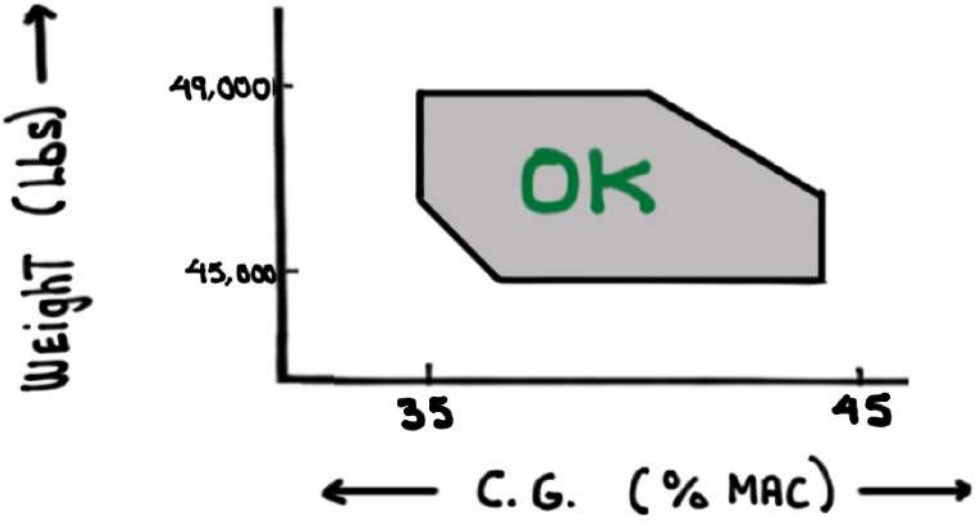



AND



# Maximum Zero Fuel Weight: 49,000 lbs

## ZFW C.G. Envelope AFM 01-03-70

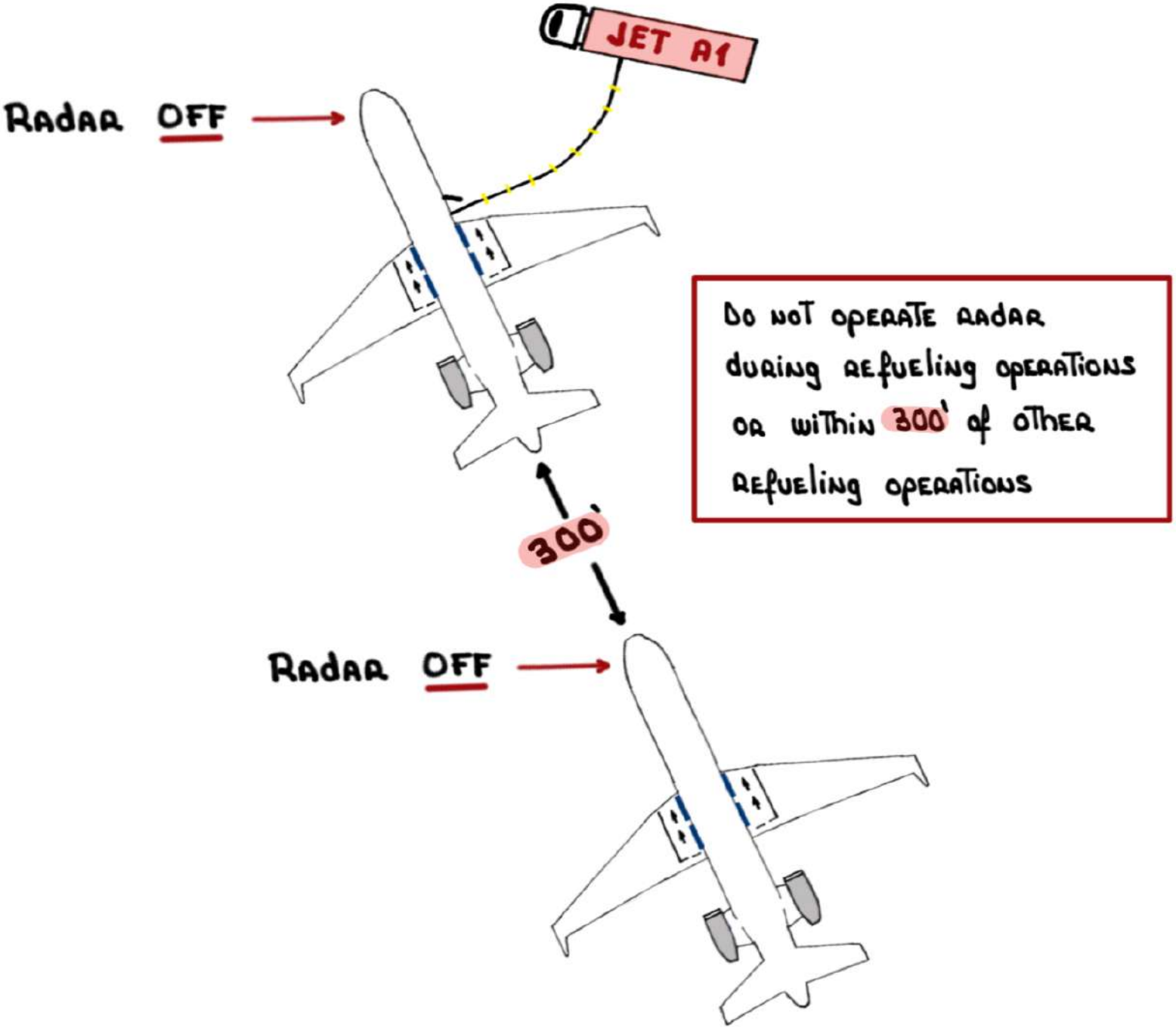



ZFW must be within ZFW C.G. Envelope

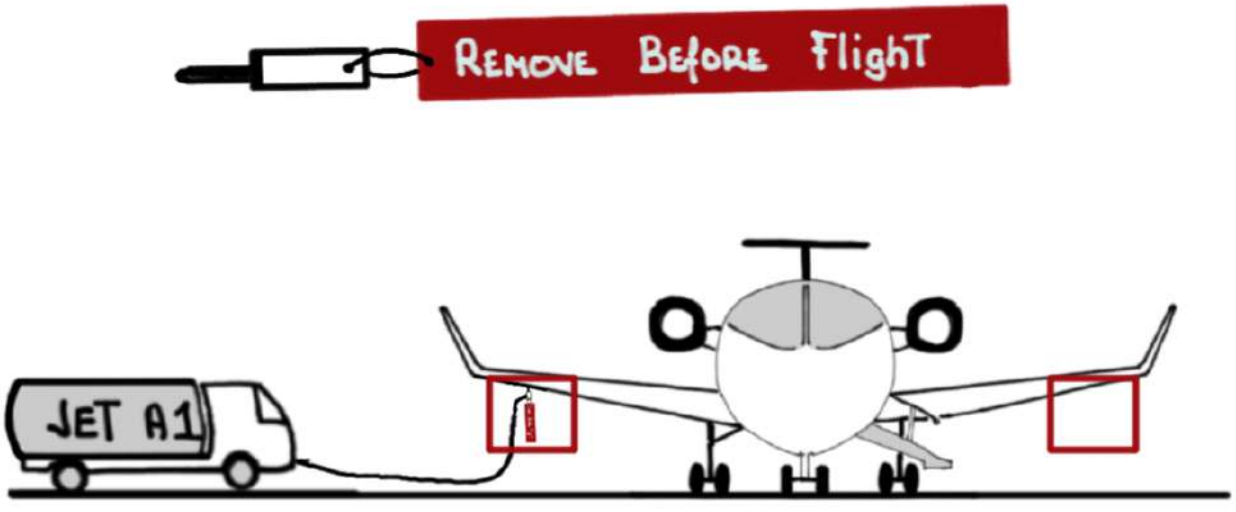
Fueled airplane C.G. will then remain within C.G. for:

- Taxi
- Takeoff
- Inflight
- Landing

# Fueling operations



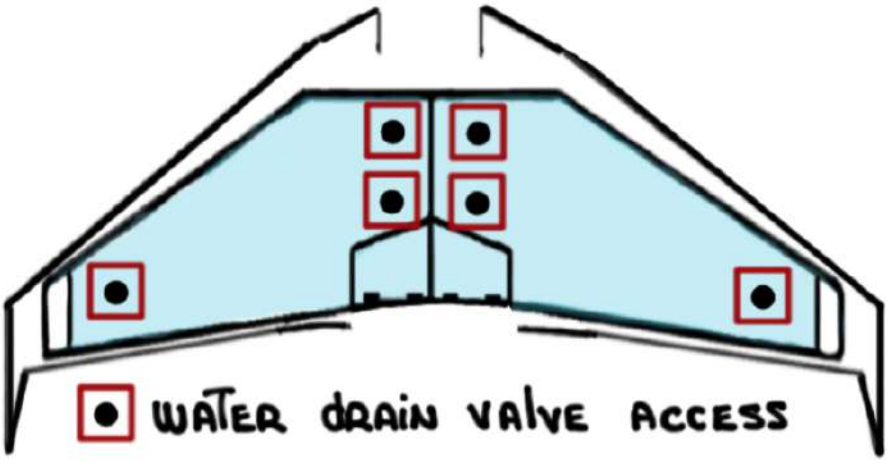
Before refueling, ensure airplane is bonded to the fuel source




Grounding jacks are located in the lower trailing edges near the wingtips

# Water contamination/fuel tank damage prevention measures

- Biobor JF aviation fuel biocide treatment:
  - * kills and prevents microbial growth
  - * Prevents microbial corrosion issues and filter plugging
- Fuel tank sumping at consistent water draining frequencies

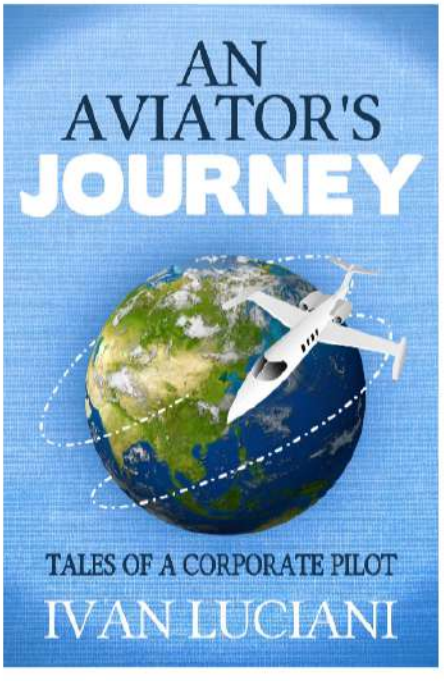


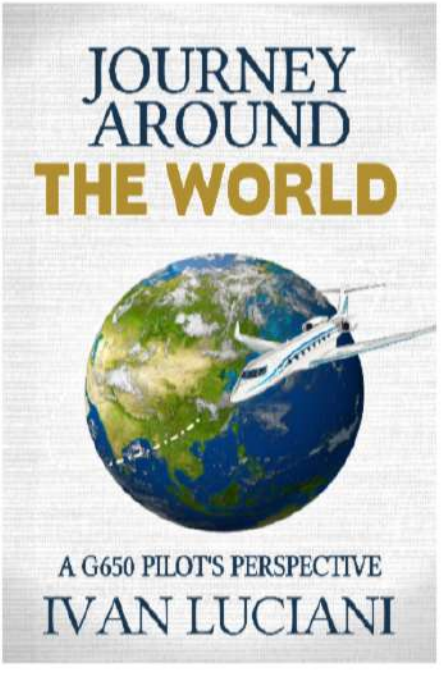

- Fuel quality check of fuel source prior to each refueling operation

REMINDER: these system notes are intended for study purposes only. Always refer to official Gulfstream manuals and other approved references when operating your aircraft.

NOTE: these system notes are updated from time to time and what is posted on Code450.com will always be the most recent version.

Questions, comments or errors...please do send me an email: ivan@code7700.com




Thank you!