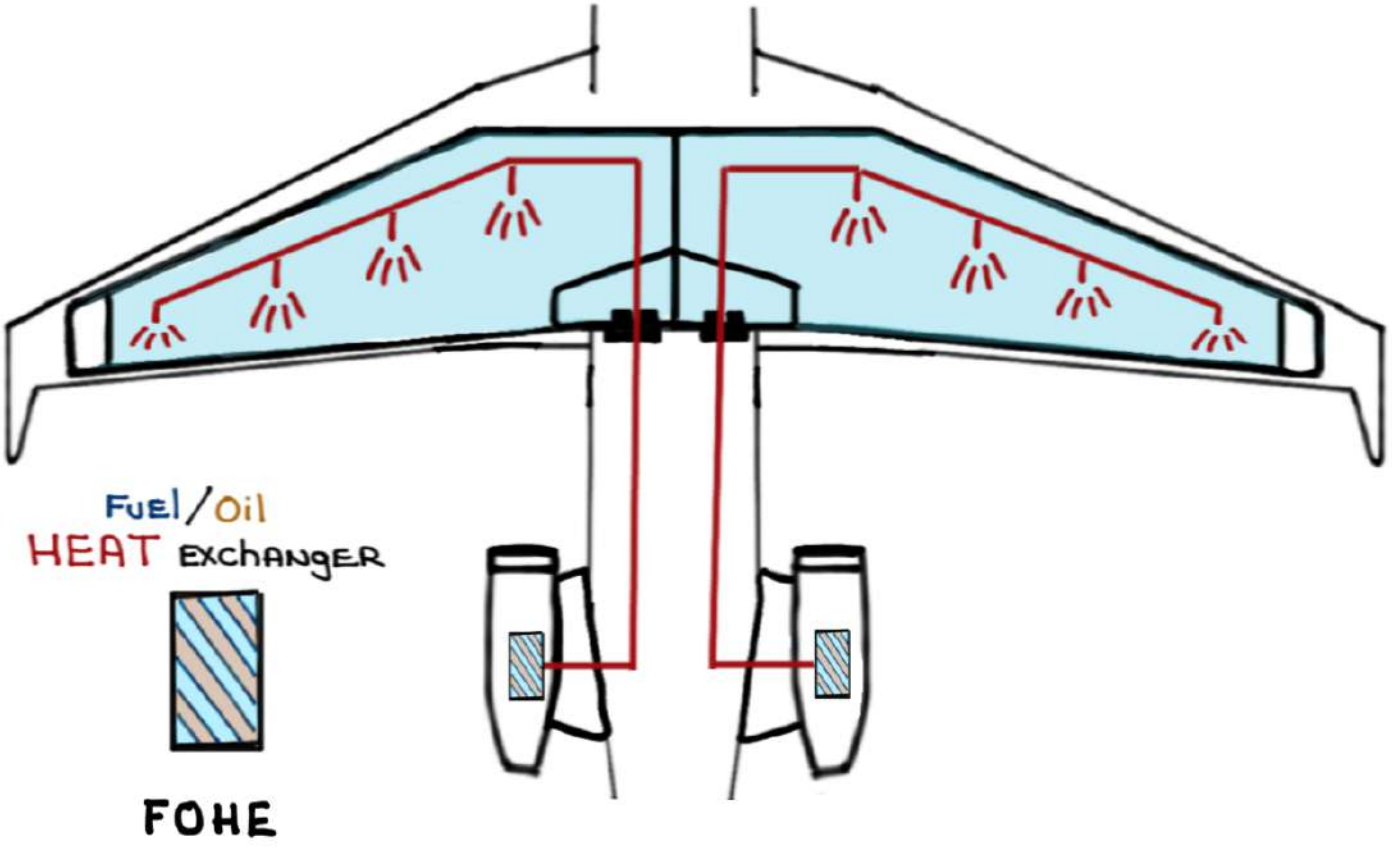
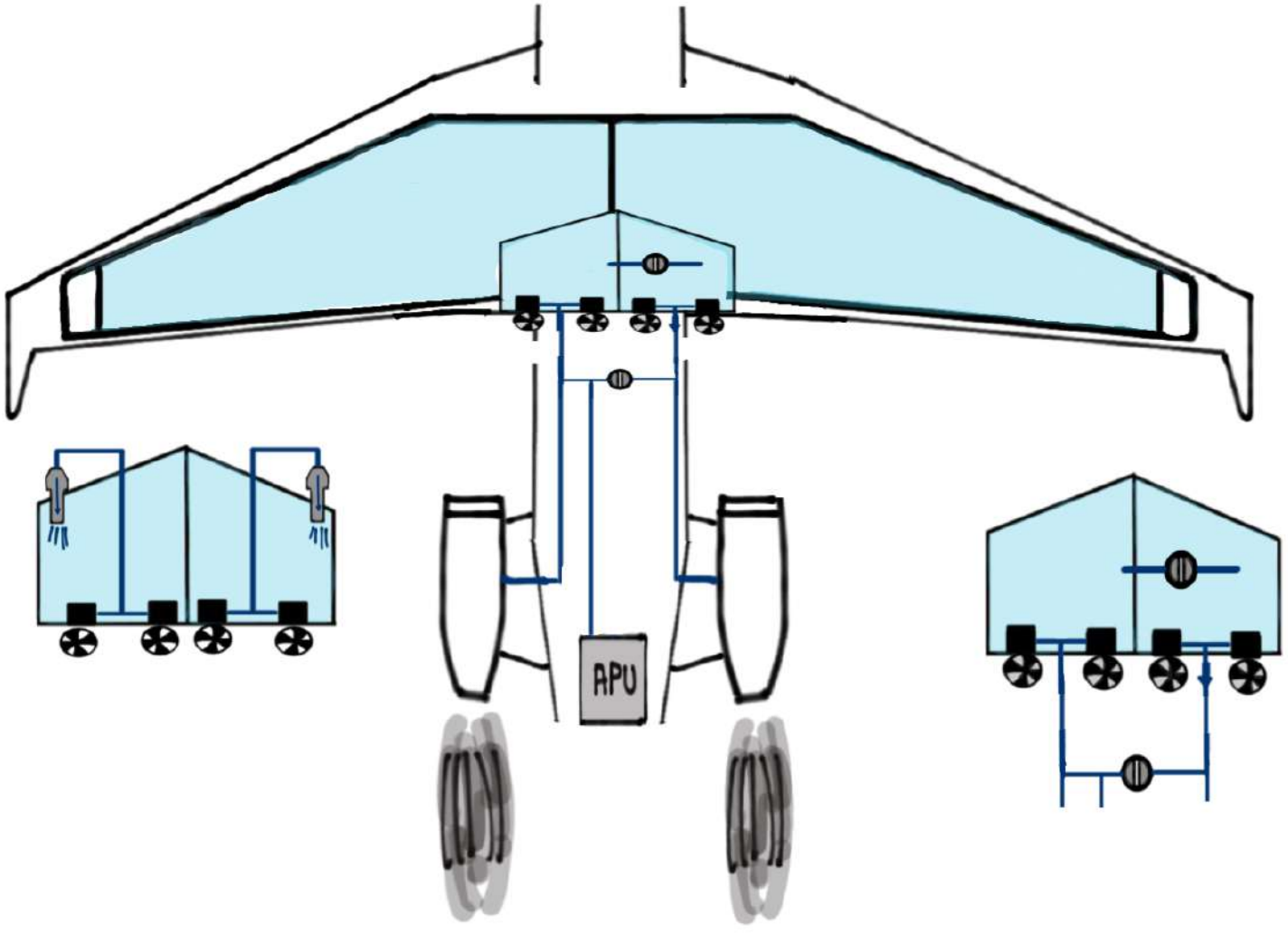
G500 FUEL SYSTEM



For study purposes only

G500 Fuel System

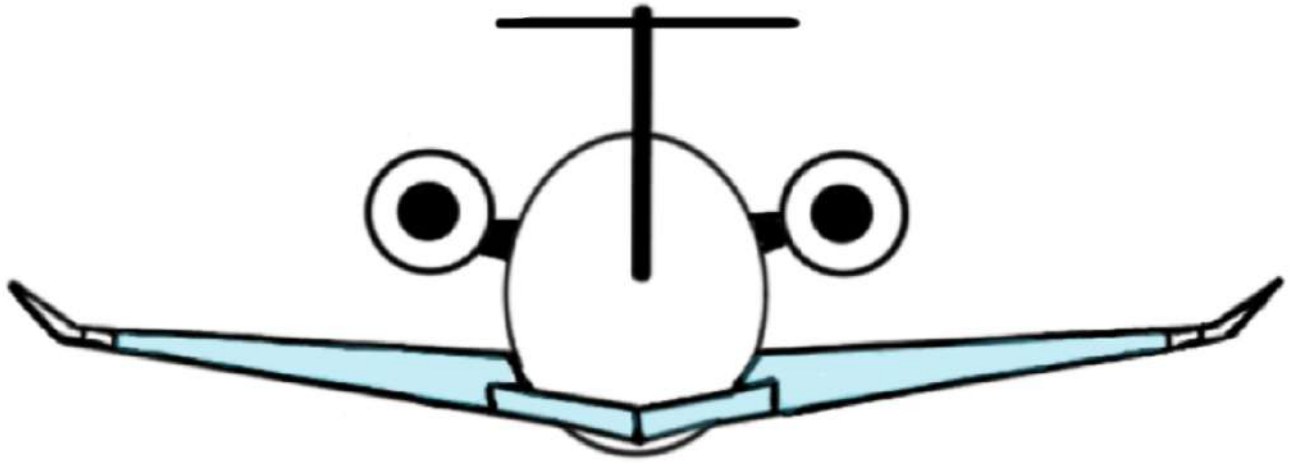
The Fuel System consists of Two (2) wing Tanks which <u>store</u> all fuel and <u>feed</u> the main engines and APU via low pressure, electrically-driven boost pumps



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

Wing Tanks

- Pressure refueling capacity:
  - Right Tank: 15,125 lbs
  - Left Tank: 15,125 lbs
  - Total: 30,250 lbs



If either fuel tank quantity exceeds 15,125 lbs the fuel quantity digital readout on the engine instruments and synoptics displayed on the DUs will have white dashes on the affected side(s) and the total fuel quantities

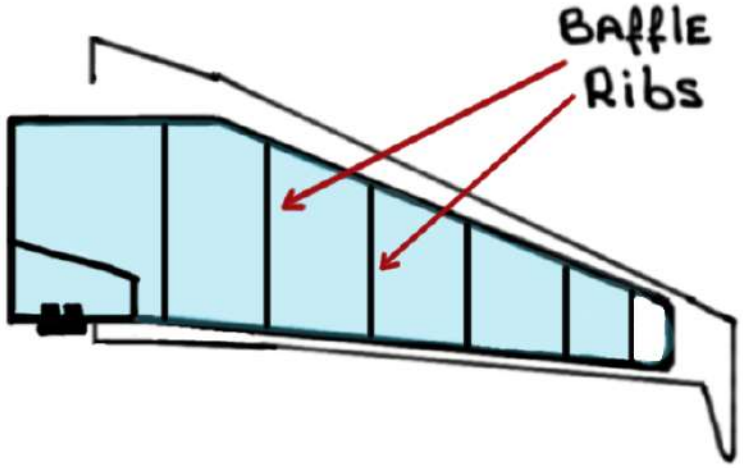
- Refueling:

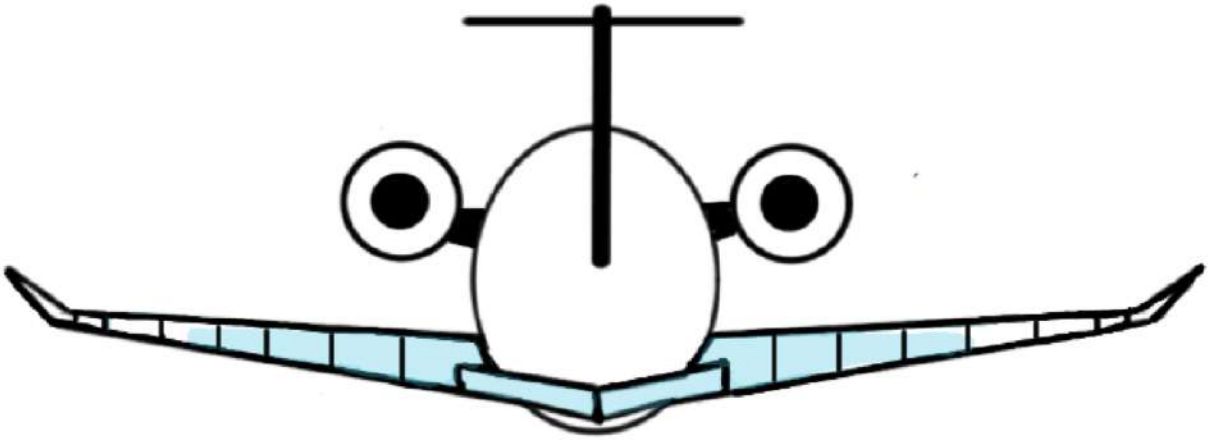
① Single-point pressure refueling (35-55 psi)

② Overwing gravity refueling – Maximum capacity:

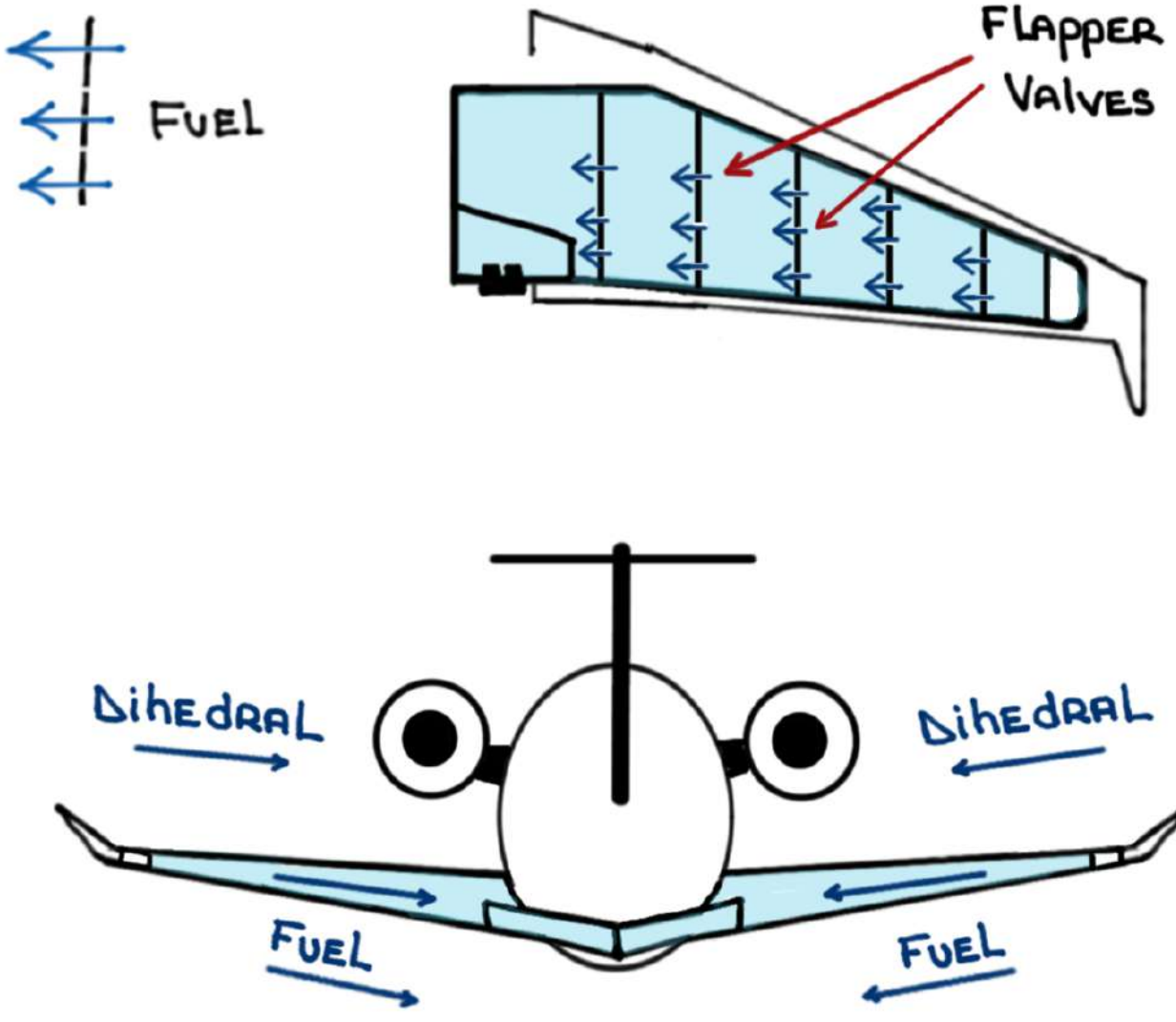
22,500 lbs

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





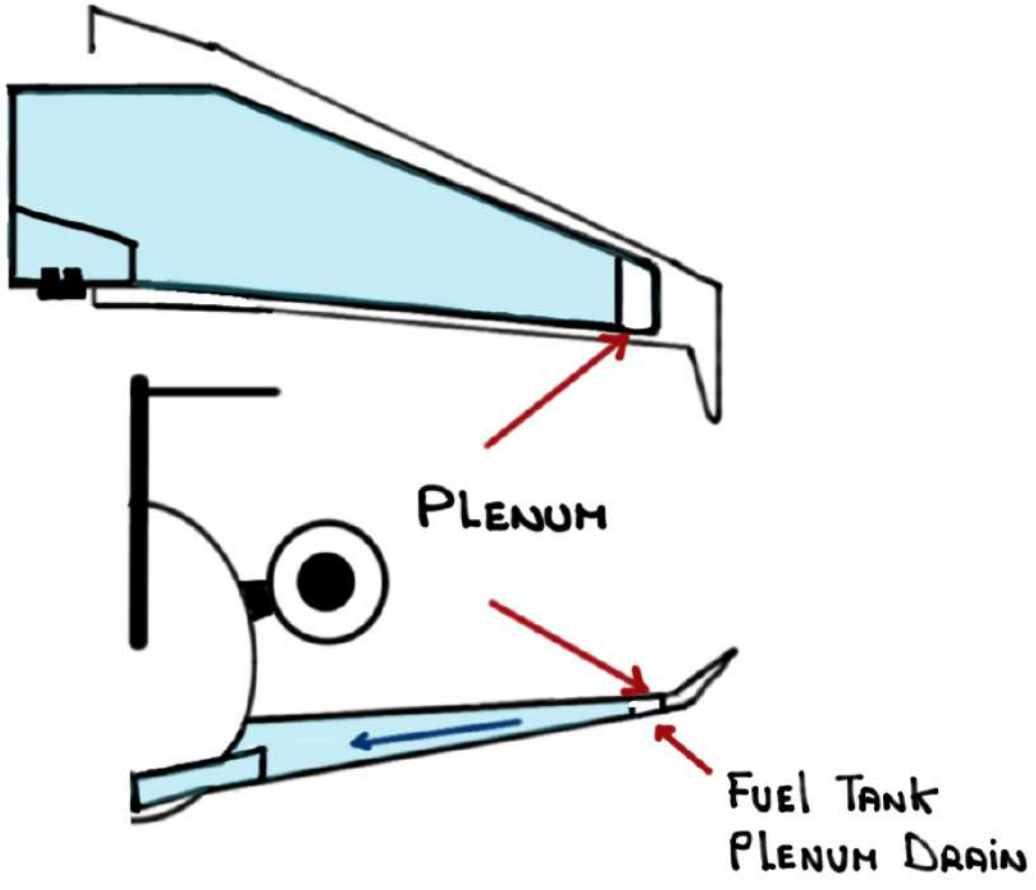
- Flapper valves at the bottom of each baffle rib allow fuel to travel in one direction from compartment to compartment and towards the fuel Hoppers



- Any fuel below the flapper valves moves towards the fuel Hoppers 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



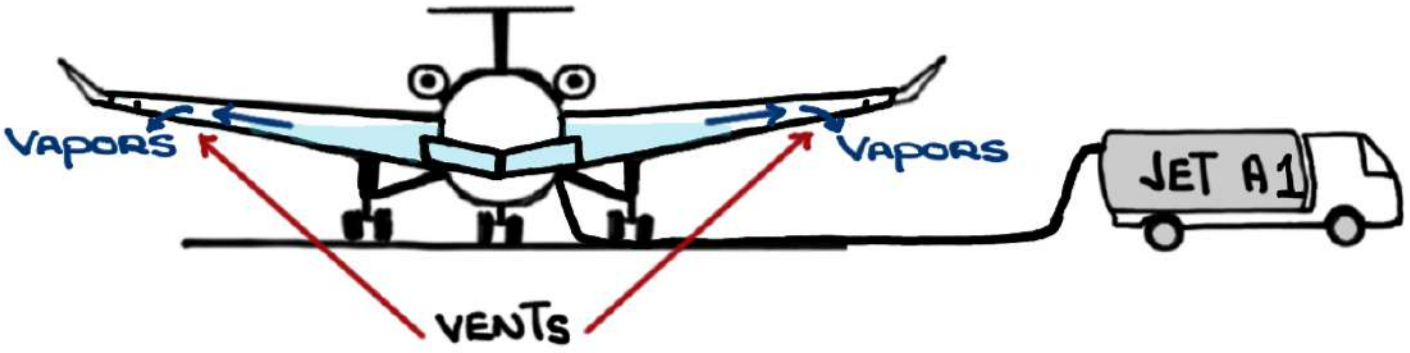
- The Plenum should be drained of any fuel prior to takeoff

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

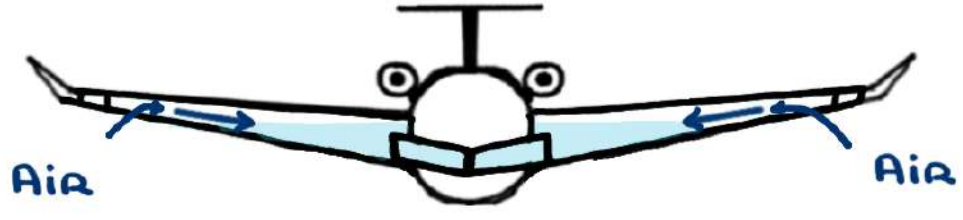
- The fuel vent system is fully automatic and does not require electrical power

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

Prevents wing rupture (positive pressure)



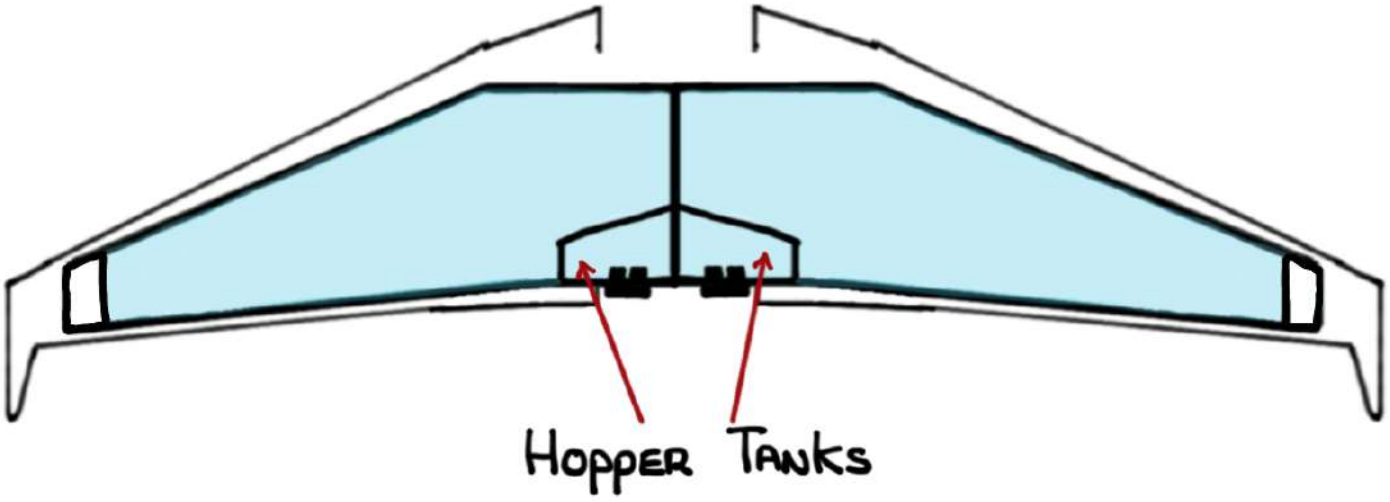
- The fuel vent system allows air to enter the fuel tanks as fuel is consumed during flight

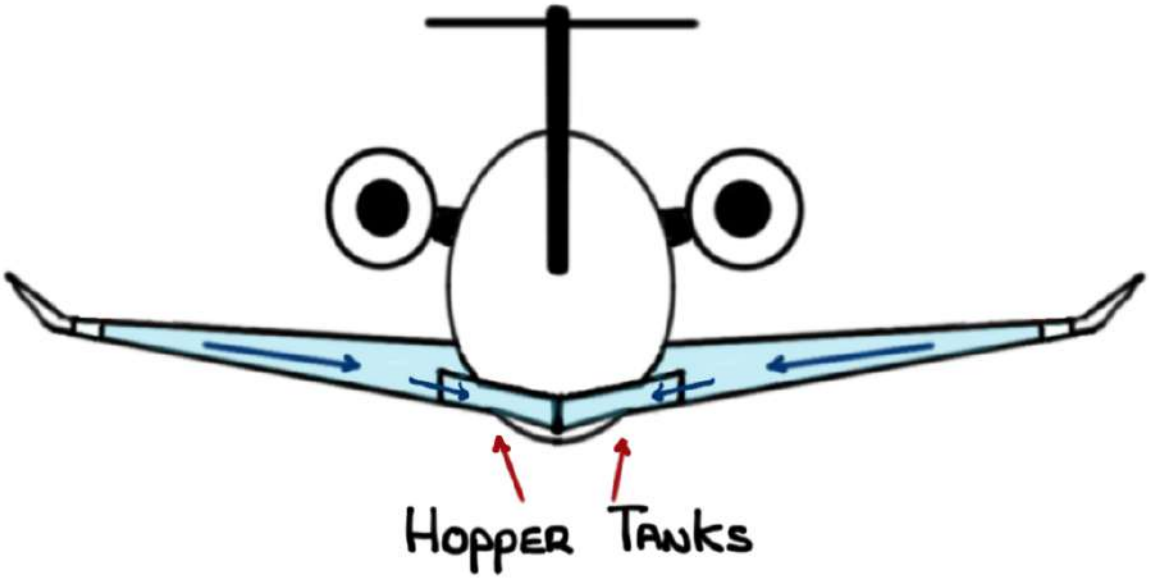


Prevents wing collapse (Negative pressure)

- 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



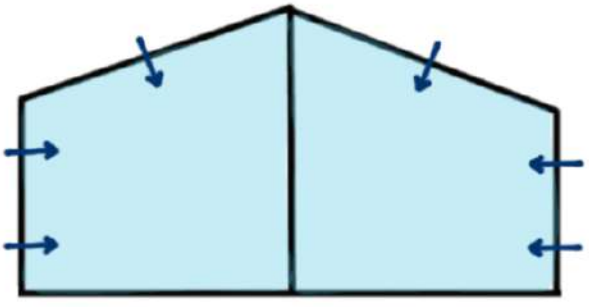


- It is from the Hopper Tanks that fuel is drawn to feed the engines and APU

- 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

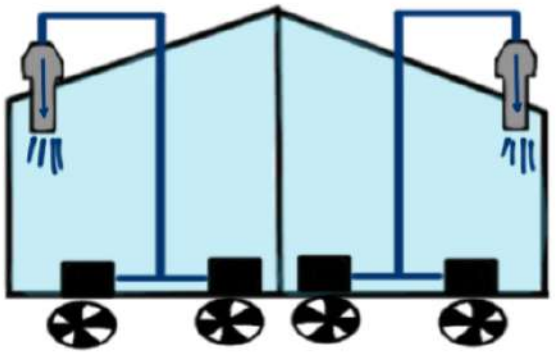


ONE WAY flow

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

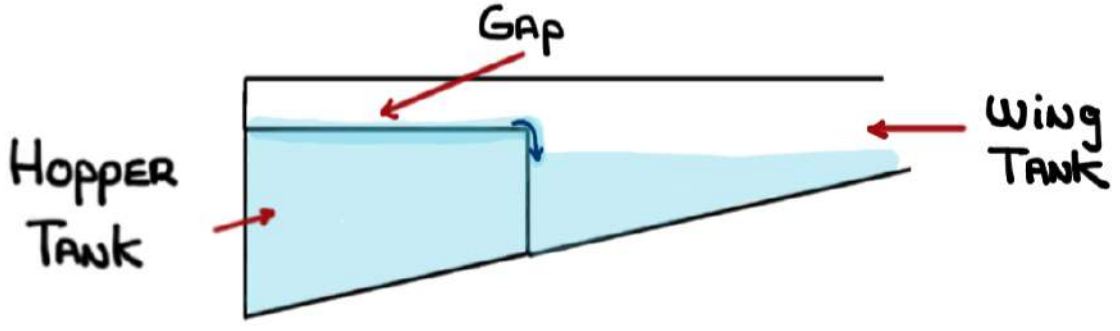
- Deliver steady flow of fuel from wing to Hopper
- Low pressure, high volume pumps
- 4,450 pounds per hour



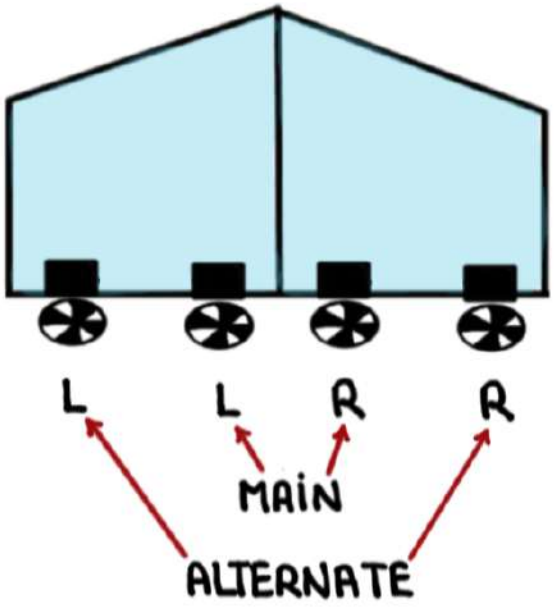
- Hopper Tanks capacity: 1,100 lbs X 2

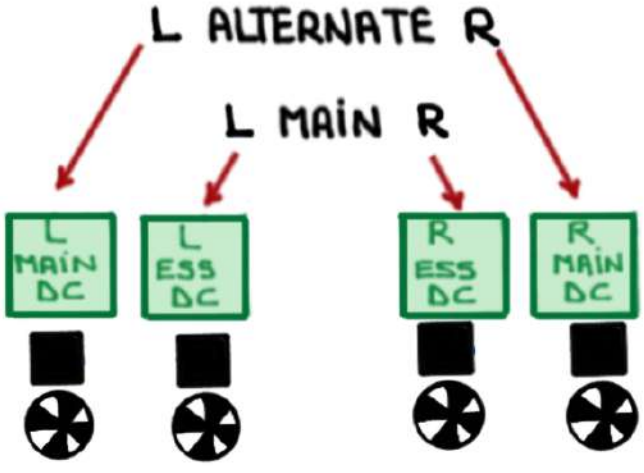
- L-R fuel level low : < 650 lbs

- 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 (25psi) fuel to the engines and APU





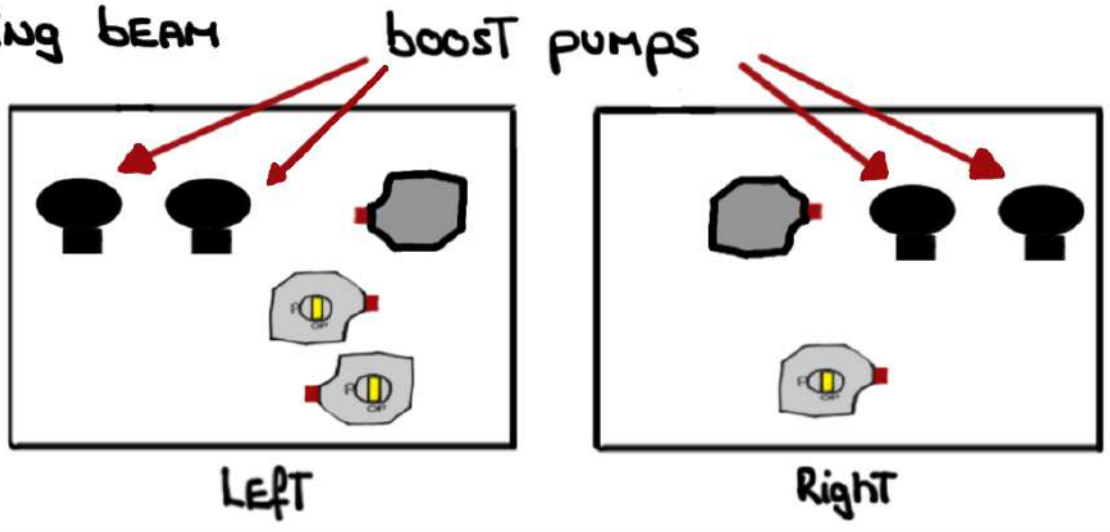
- Two (2) boost pumps per Hopper
- Boost pumps are identical and interchangeable
- Located in the wheel well and attached to the aft portion of the Hopper
- Two (2) Main powered by respective

- Two (2) Alternate powered by respective
- Without Boost pump pressure the engines will:

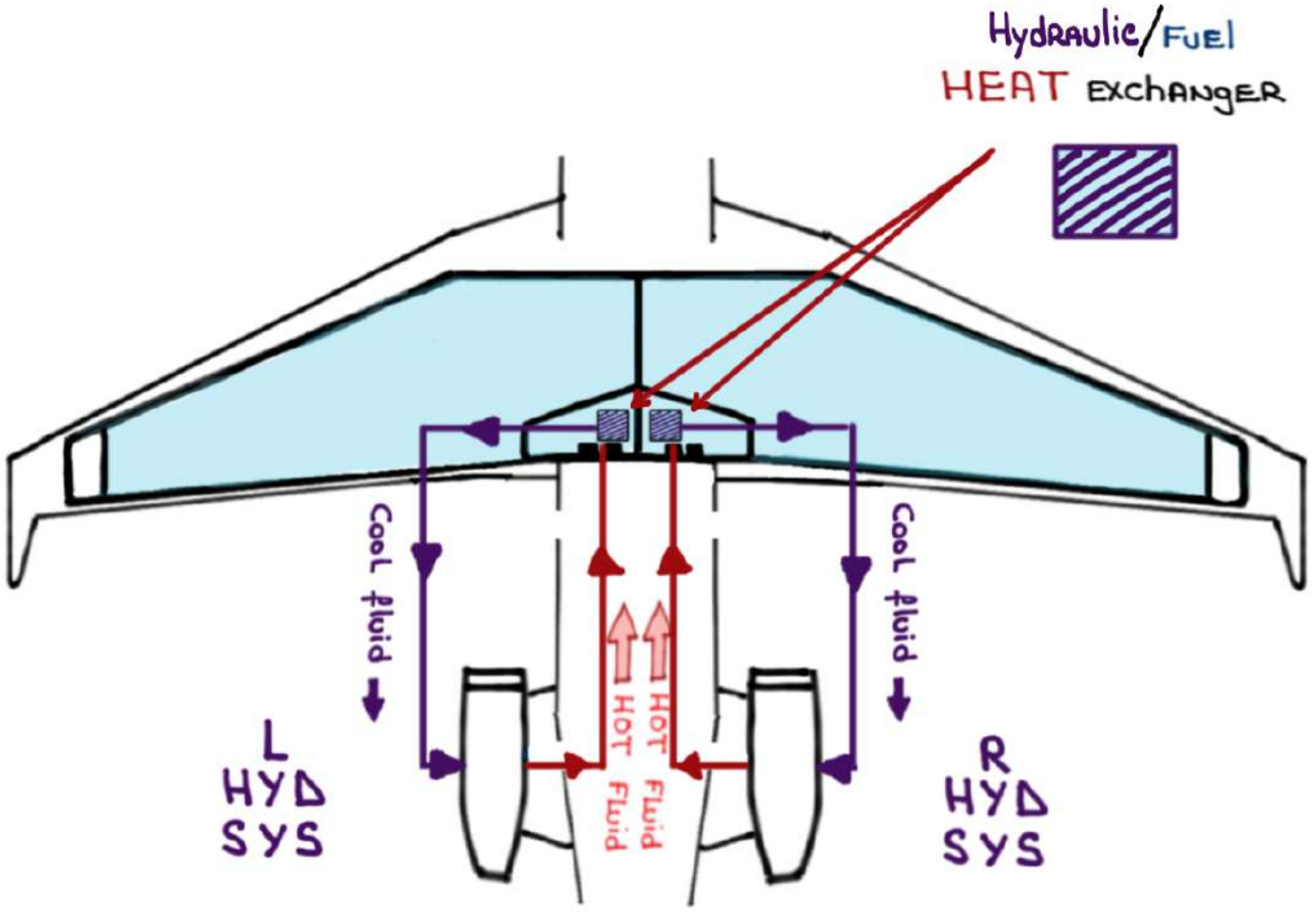
  ① < 20,000' = suction feed

  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



- The Hopper Tanks contain the Hydraulic fluid-to-fuel <u>Heat Exchangers</u>



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

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

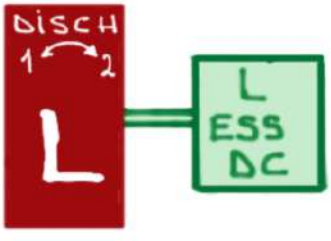
Fuel Shutoff Valves

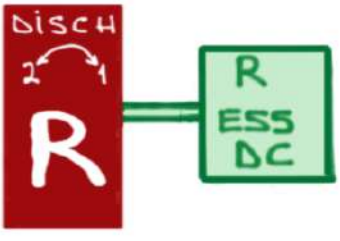
- There are three (3) fuel shutoff valves (SOV)

  ① Left Engine
  ② Right Engine
  ③ APU

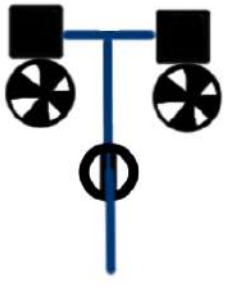
- Located in the wheel well and attached to the aft portion of the Hopper

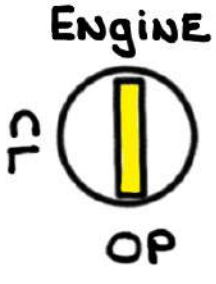
- Main engine SOV is operated by the respective **FIRE** handle in the cockpit and powered by its respective DC ESS bus



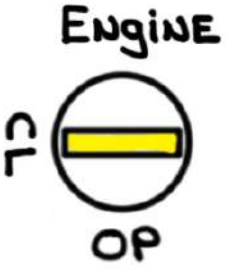


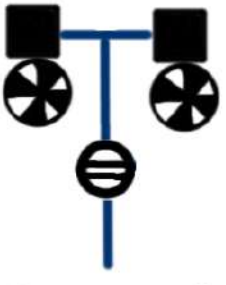
- Main engine SOV position indicator - wheel well





(Open)

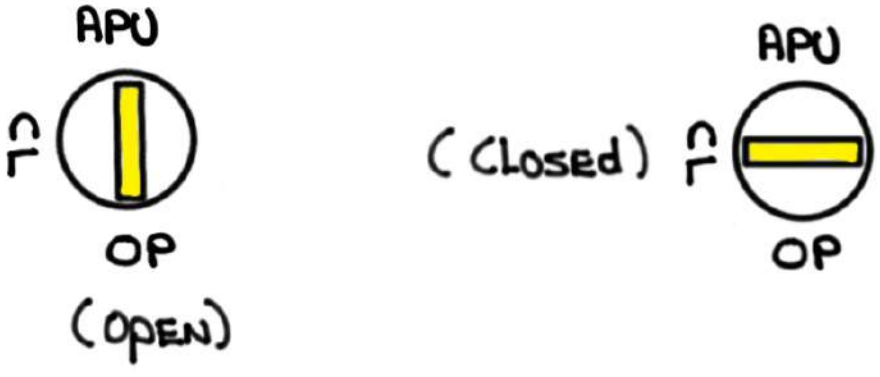




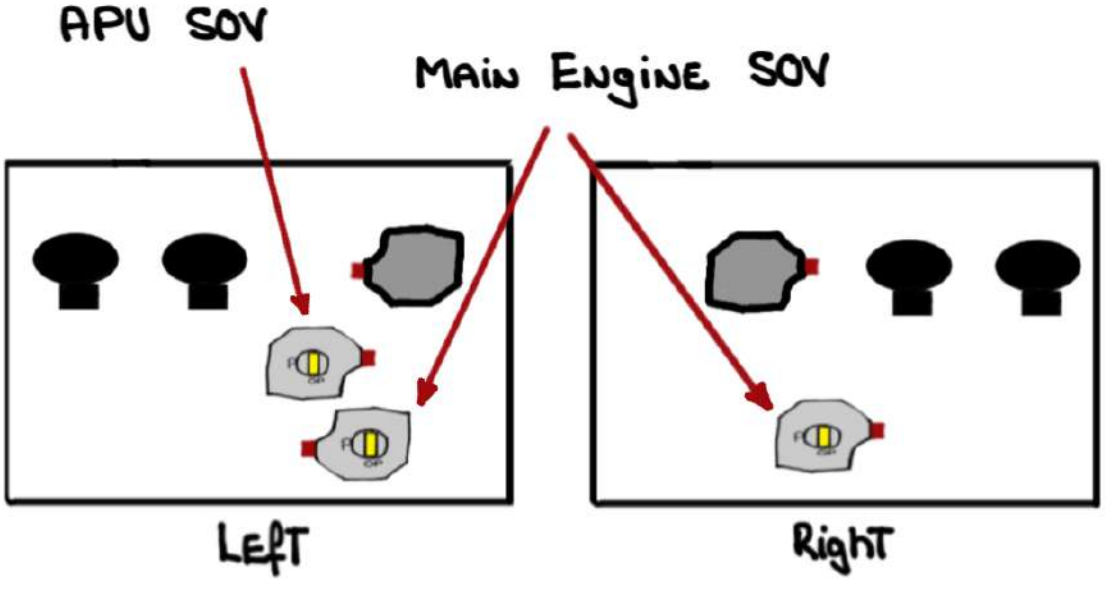
(Closed)

- APU SOV is controlled by the APU Electronic Control Unit (ECU)

- APU SOV position indicator - wheel well (Left)

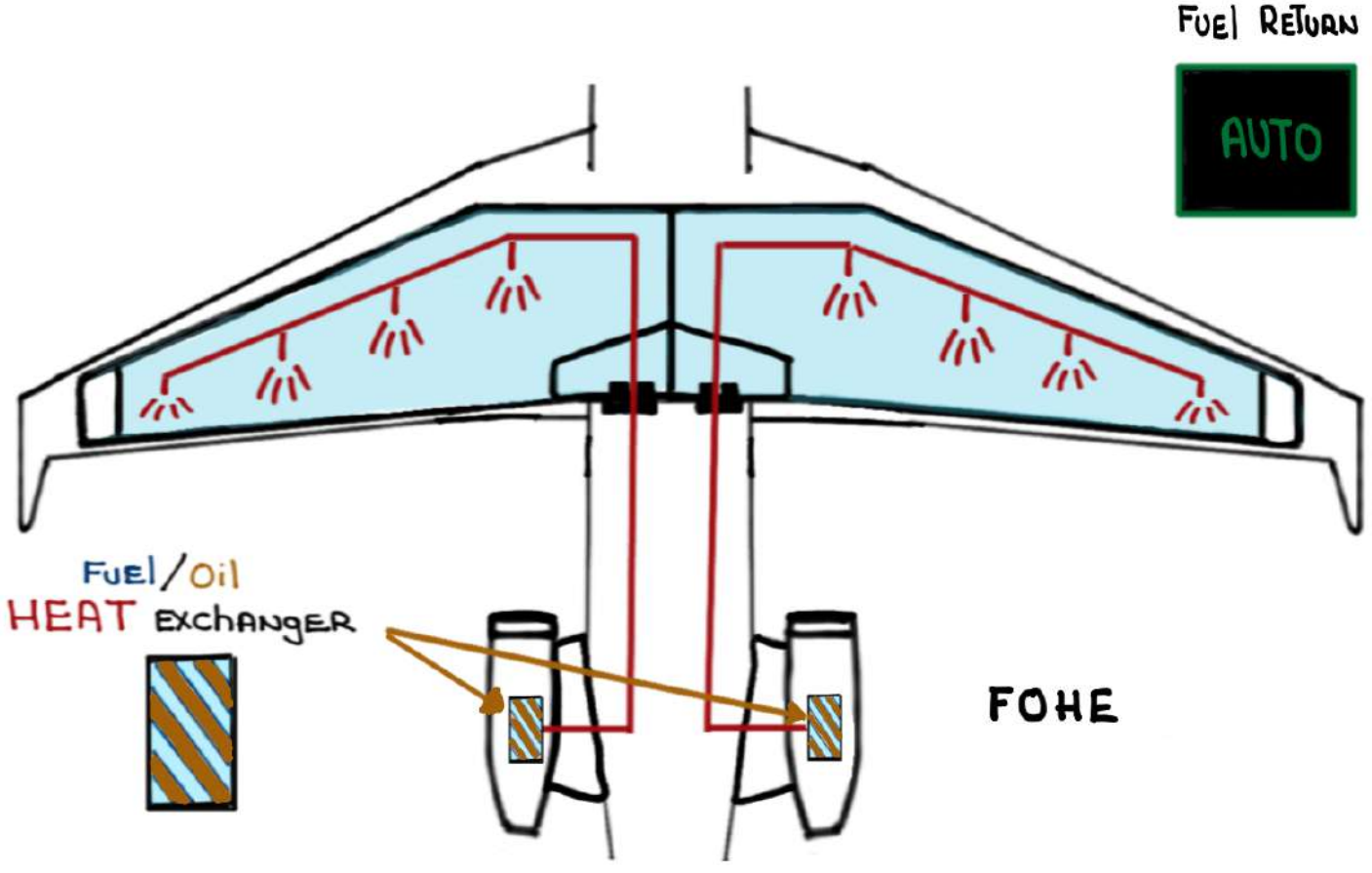


- Rear wing beam

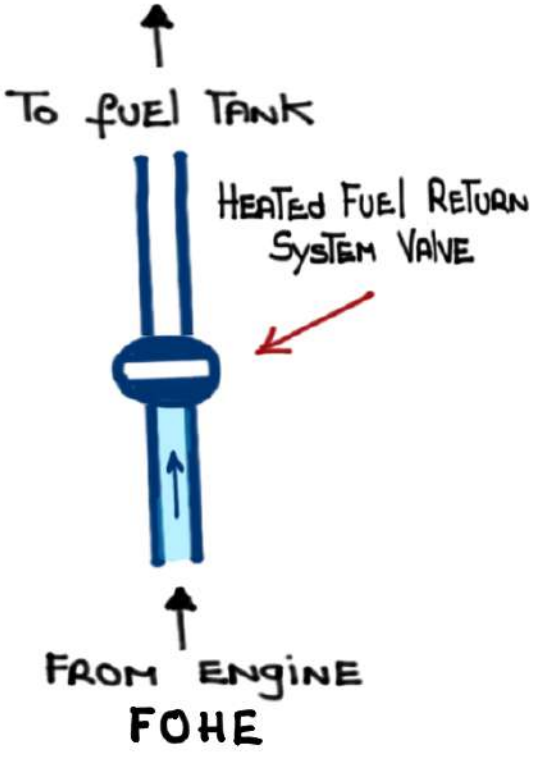


Heated Fuel Return System (HFRS)

- The HFRS prevents fuel tank temperatures from getting too cold during long range, high altitude flights
  - The HFRS sends fuel heated by the Fuel Oil Heat Exchanger (FOHE) into the wing tanks
  - The FOHE cools down **HOT** engine oil and warms up **COLD** fuel



- Controlled by FADEC
- AUTO ON: 0°C AUTO OFF: 10°C
- Three (3) gallons of heated fuel @ 50°C per minute
- HFRS is inhibited under the following conditions:
  - a) Fuel Tank Temperature > 10°C
  - b) Crossflow Valve open
  - c) Engine Thrust Lever setting at high power
  - d) HFRS switch selected **OFF**
  - e) Engine **FIRE** handle pulled/not stowed
  - f) Low fuel pressure/quantity
  - g) FADEC HFRS inhibit **ON**
  - h) Engine fuel filter blocked
  - i) Abnormal engine indication

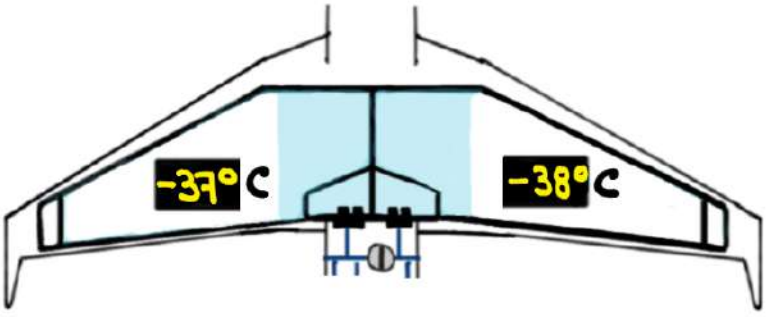


- Fuel Tank Temperature:

- **AMBER**

  < -37°C > 54°C

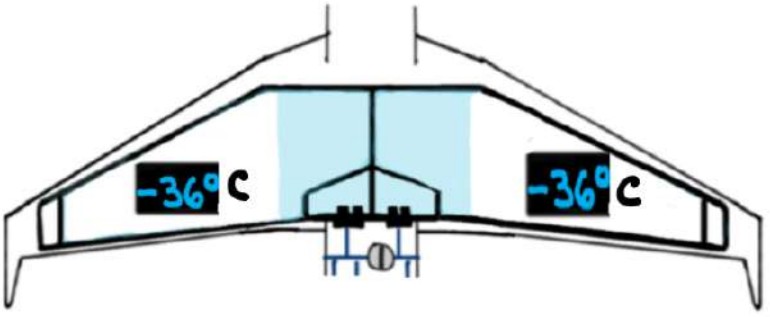
  Fuel Tank Temperature



- **Cyan**

  -36° or -35° C

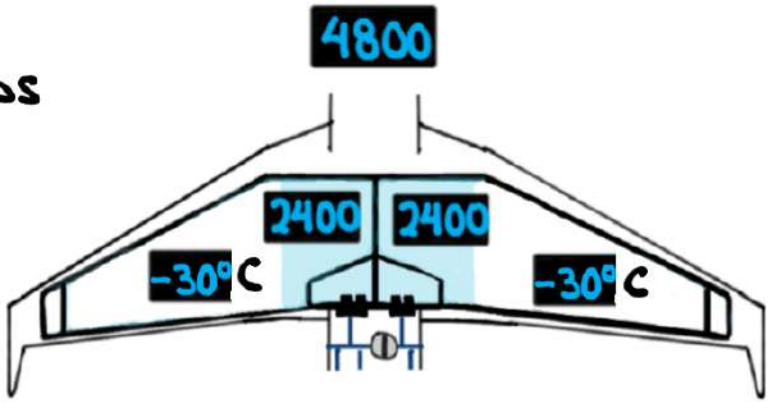
  Fuel Tank Temperature



- **Cyan**

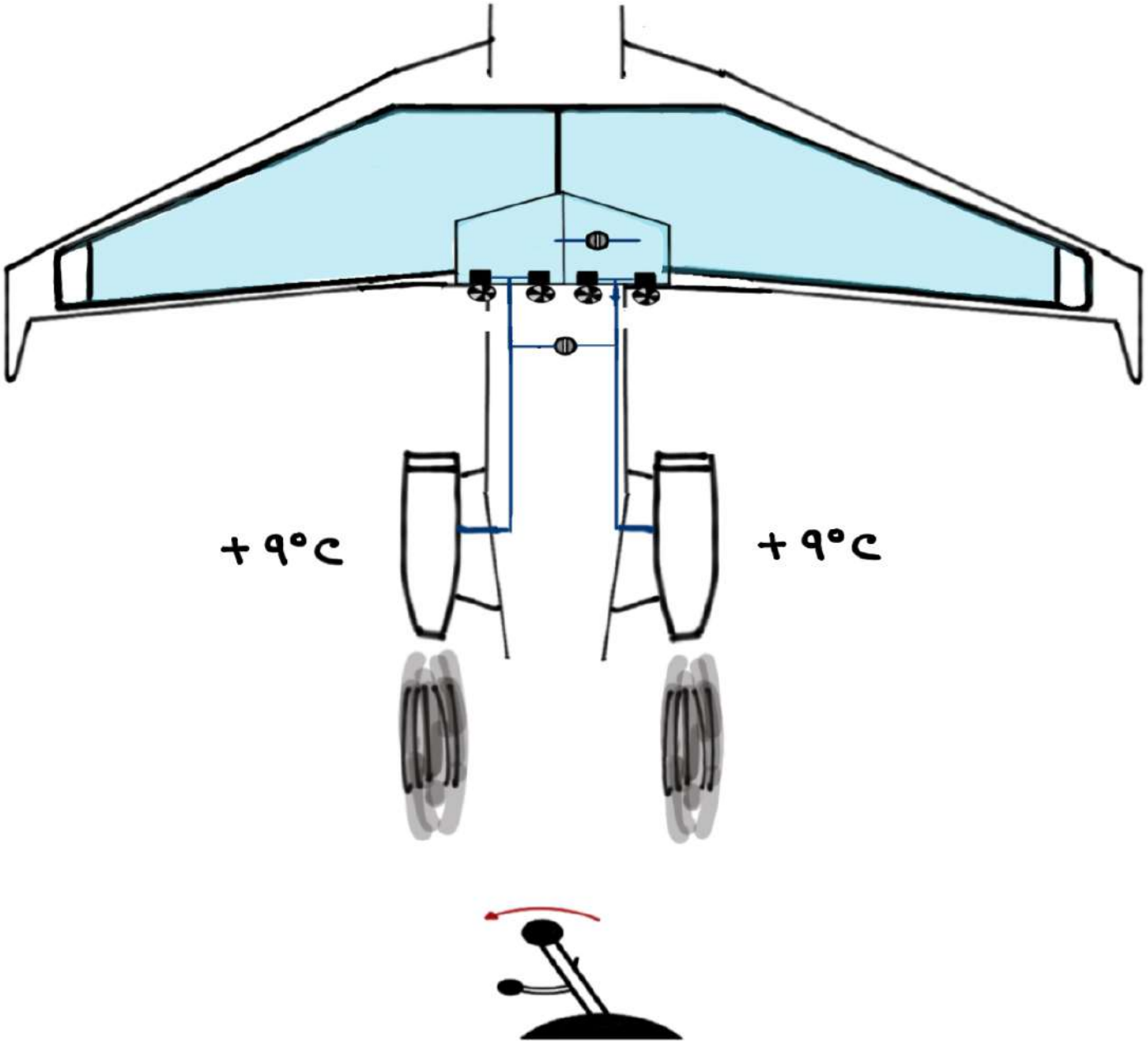
  -30° C with < 5,000 lbs

  Fuel Tank Temperature



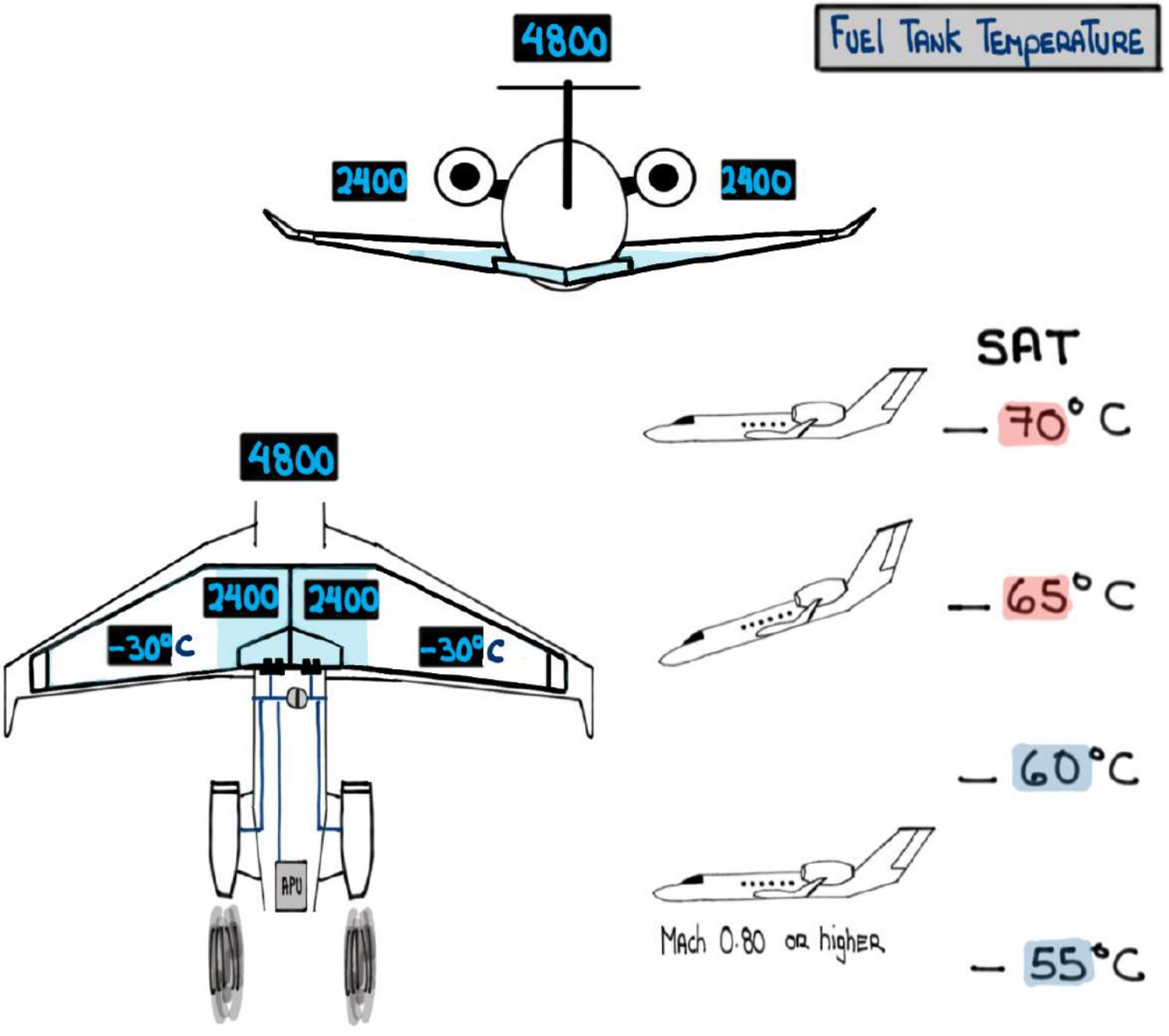
- Engine Fuel Temperature:

Minimum engine fuel temperature for Takeoff power:



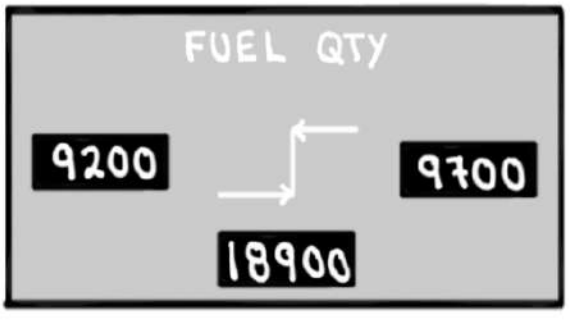
- If inflight with a fuel Tank Temperature of -30°C and <5,000 lbs Total remaining:

- Descend To an altitude where The SAT is -60°C or warmer and maintain a speed of M.080 or greater

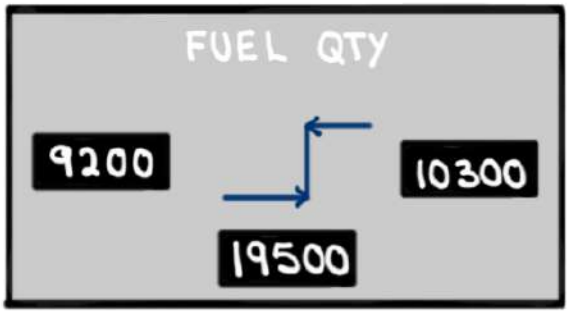


Fuel Imbalance

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

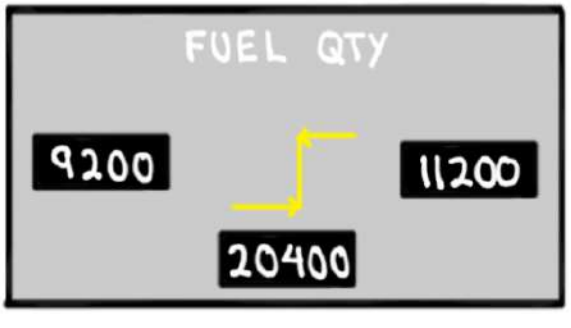


500 lbs imbalance



1,000 lbs imbalance in flight

FUEL IMBALANCE CAS message



- 1,000 lbs imbalance GROUND
- 2,000 lbs imbalance Inflight

FUEL IMBALANCE CAS message

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

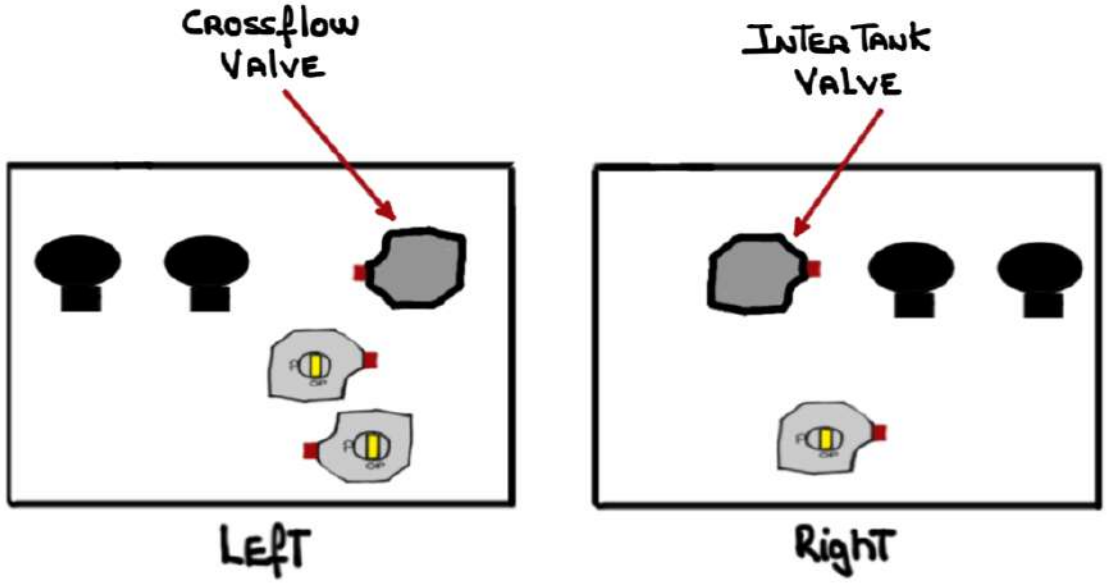
① InterTank Valve:

- When OPEN it allows fuel to gravity flow between the right and left fuel tanks via the Hoppers
- Approximately ½ 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

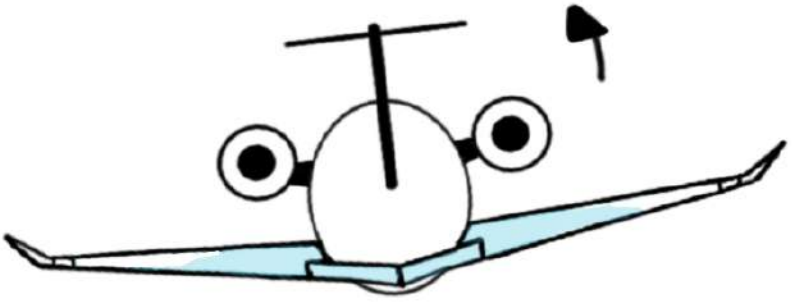
- Rear wing beam



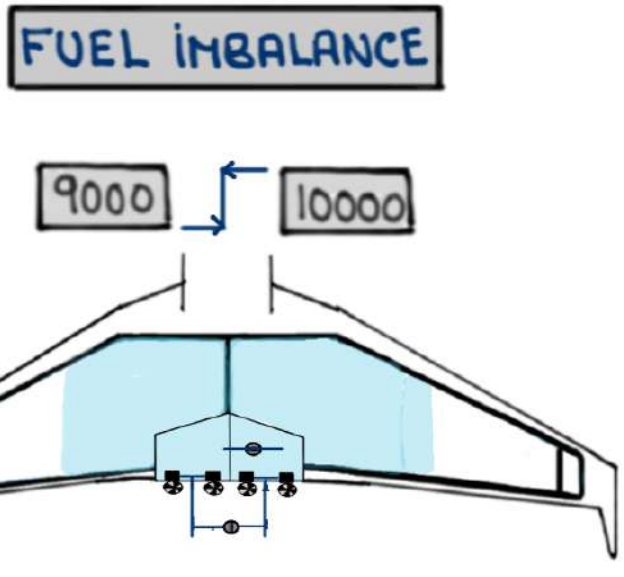
Method 1: Inter Tank

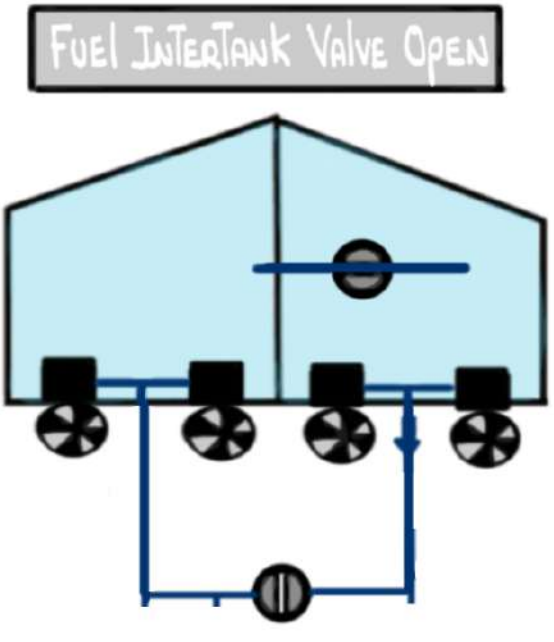
① Autopilot ON, Level flight

② Manually adjust Rudder Trim towards the heavy wing



③ Open Inter Tank valve and monitor fuel progress





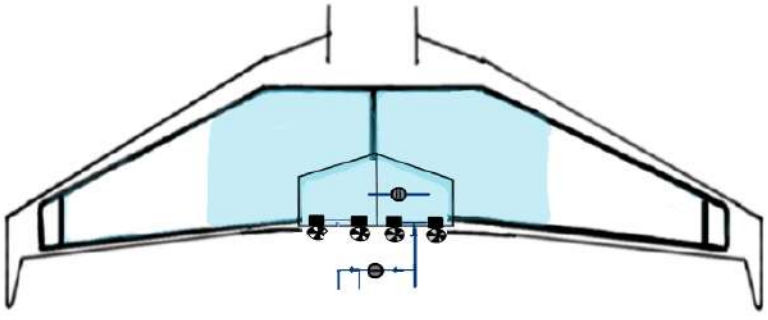
④ Close Inter Tank valve when within 200 lbs or so

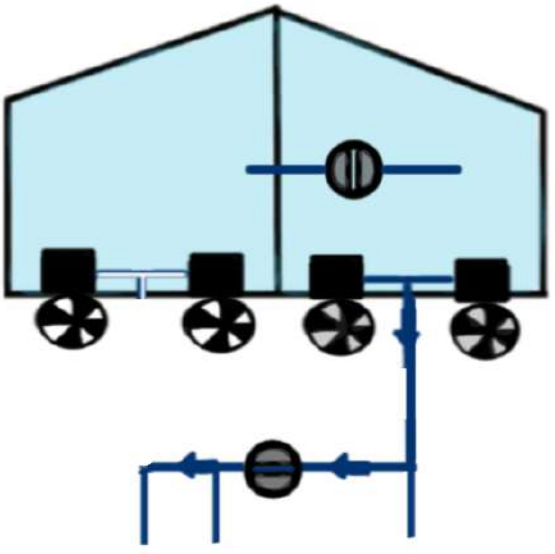
⑤ Retrim rudder

Method 2: Crossflow

① Open Crossflow valve

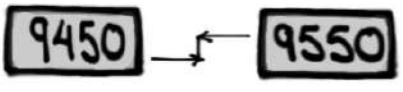
② Turn **OFF** boost pumps, one at a time, on light wing



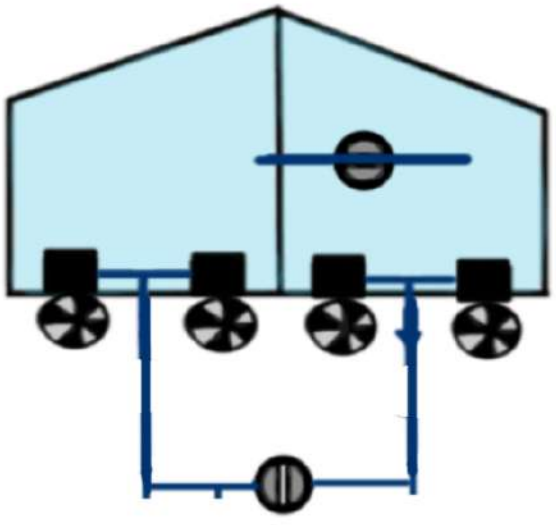


③ Turn **ON** boost pumps

④ Close Crossflow valve when desired balance is achieved



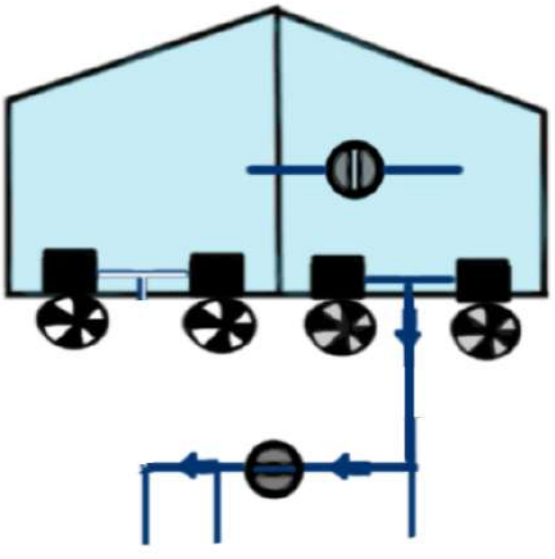
- The InterTank Valve and the Crossflow Valve have a five (5) minute timer



InterTank

> 00:05 minutes

Fuel InterTank Valve Open

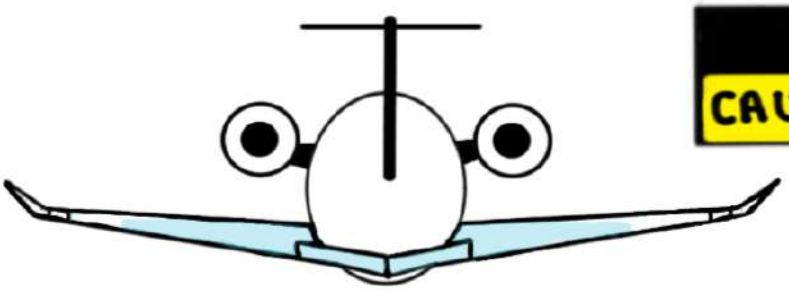


Crossflow

> 00:05 minutes

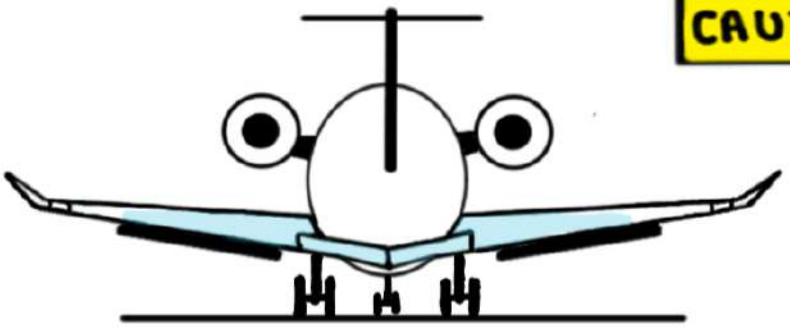
Fuel Crossflow Valve Open

- Maximum Fuel Imbalance



CAUT FUEL IMBALANCE CAUT

Inflight: 2,000 lbs.



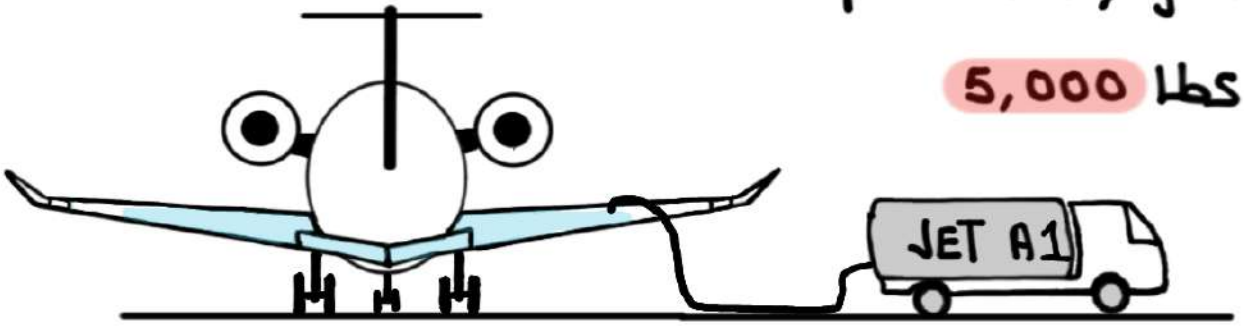
CAUT FUEL IMBALANCE CAUT

Takeoff: 1,000 lbs.

Refueling operations

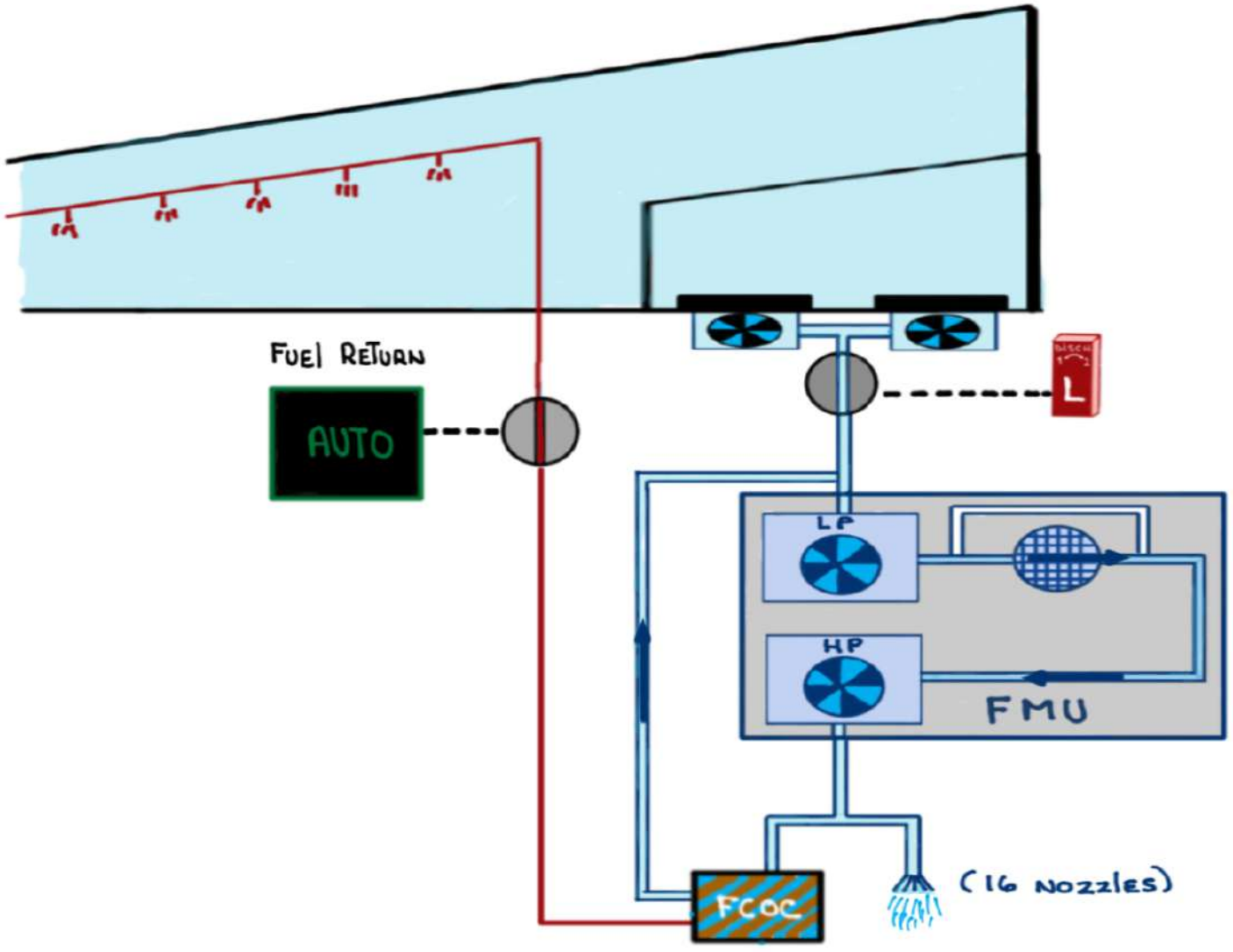
(pressure / gravity)

5,000 lbs

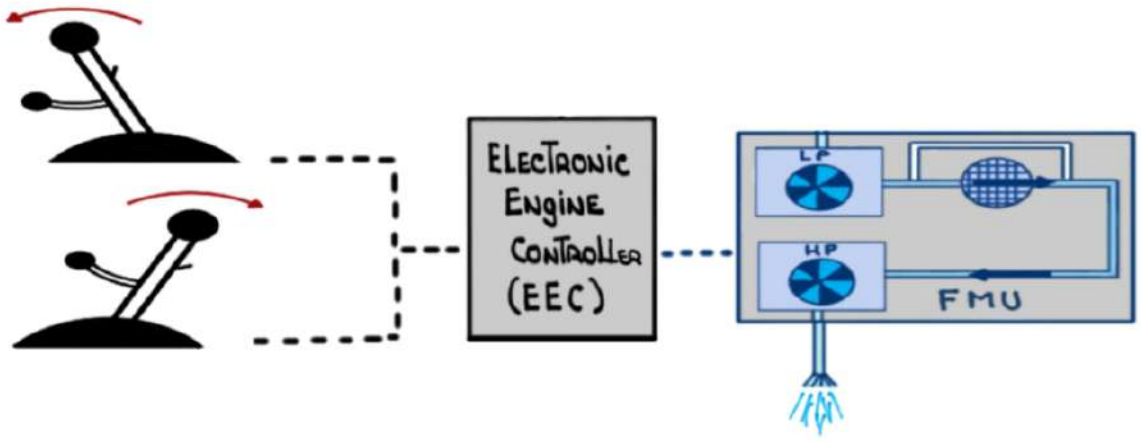


Engine Fuel System

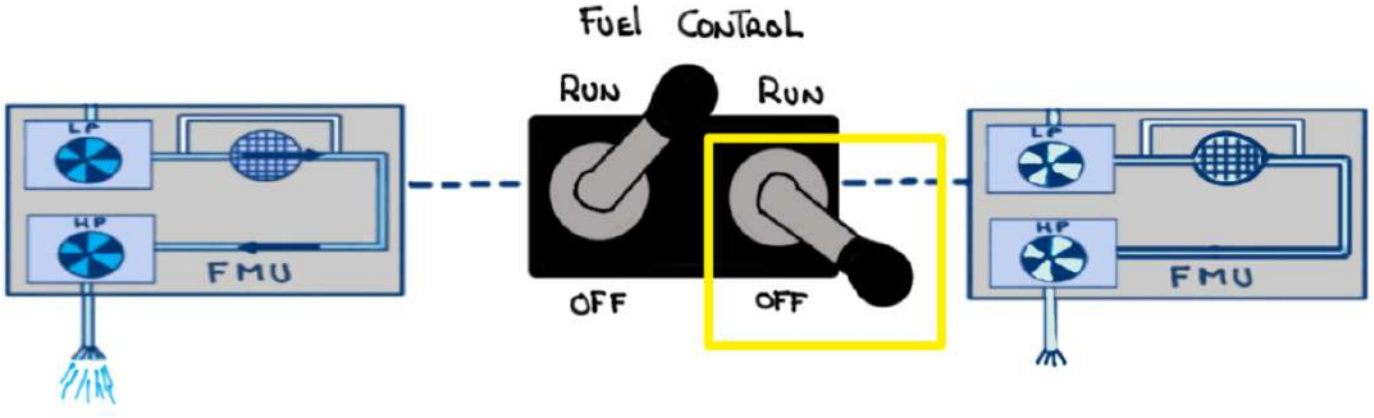
- Metered fuel from Tanks' boost pumps to nozzles
- Introduction of fuel is controlled by the EEC
- Low pressure fuel coming from the wings
- High pressure fuel coming from the Fuel Metering Unit (FMU)



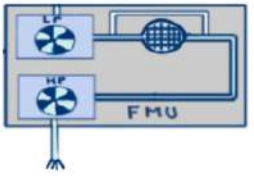
- As Thrust Levers are advanced or retarded the EEC commands the FMU to modulate fuel to nozzles

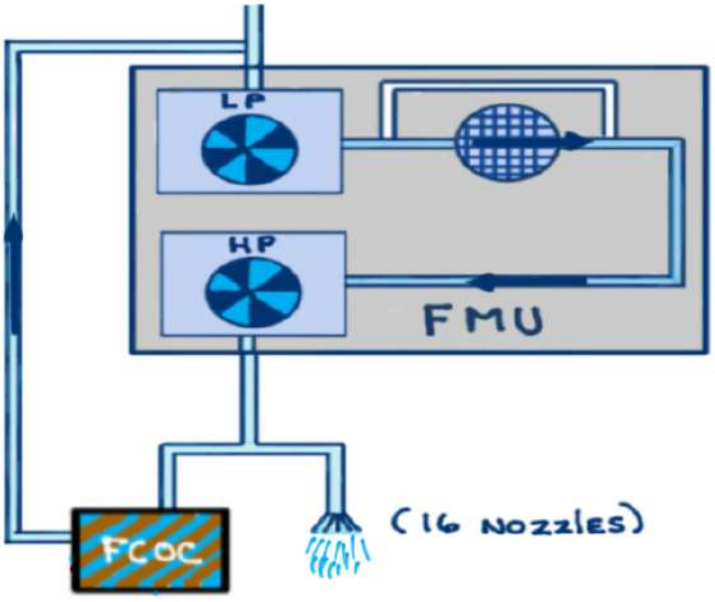


- Placing a fuel control switch to OFF closes FMU All fuel is cutoff to the fuel nozzles and the engine shuts down



- 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

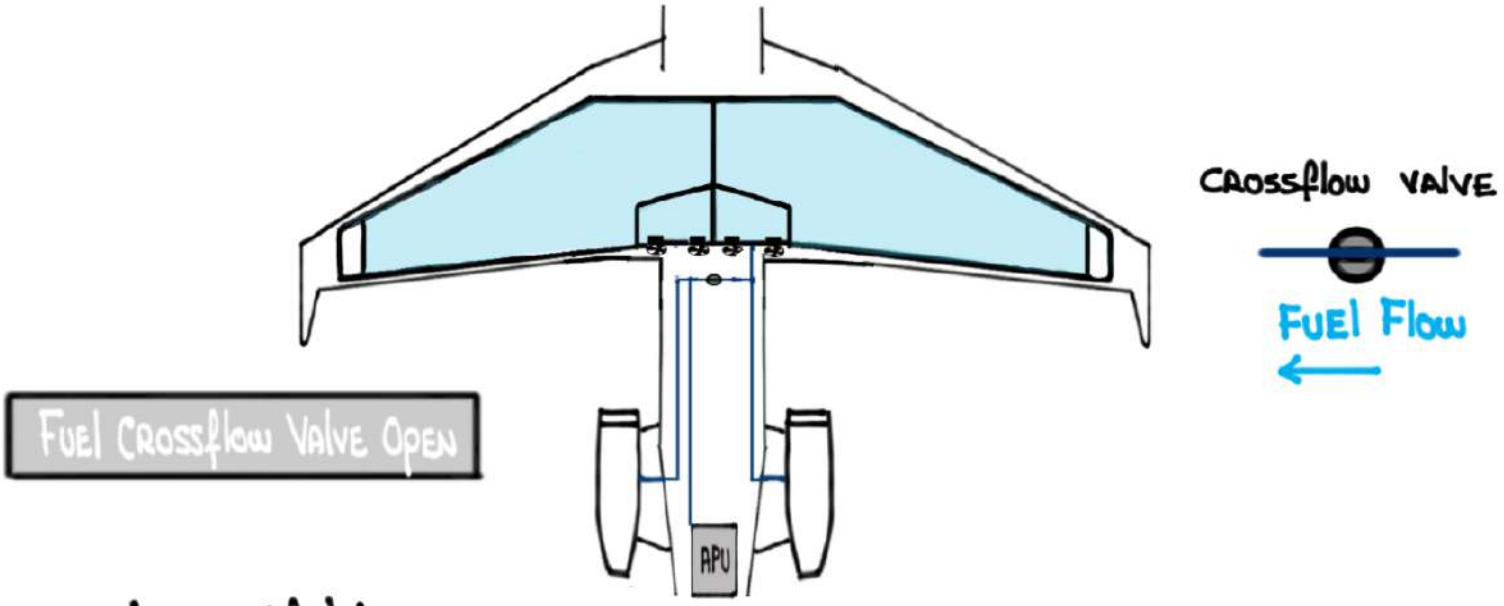
- A FUEL FILTER RECEIVES FUEL FROM THE 1ST STAGE LP PUMP AND REMOVES DEBRIS AND CONTAMINANTS

- 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 

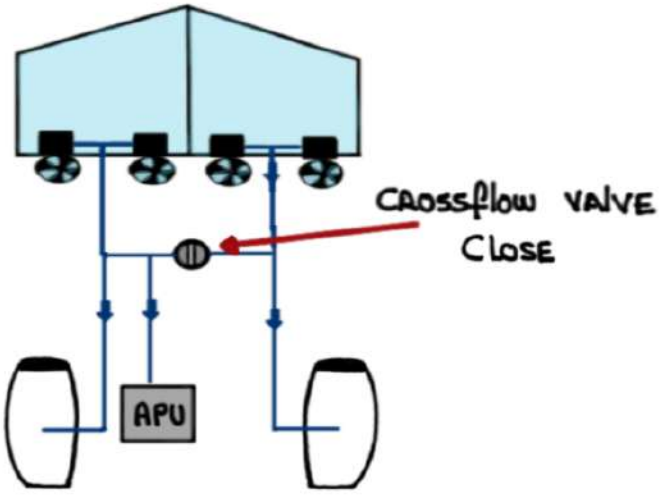
APU Fuel Supply

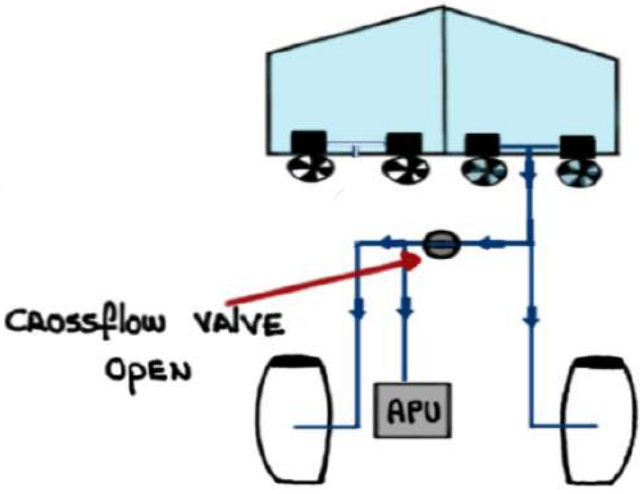
Fuel is normally supplied from the left fuel manifold but it can also be supplied from the right manifold by temporarily opening the crossflow valve



L manifold To APU

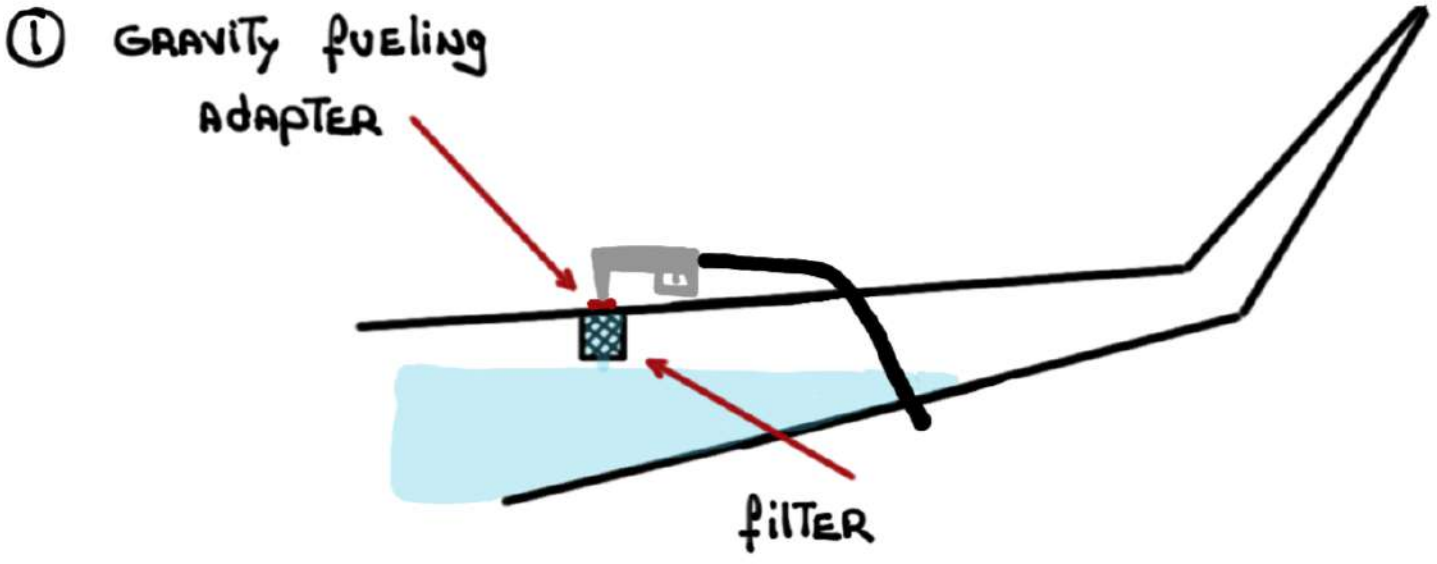
R manifold To APU

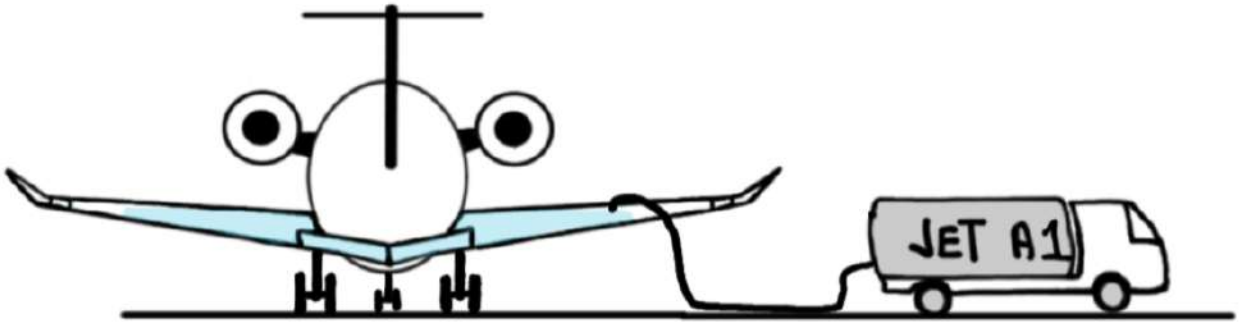




Fuel Filtration

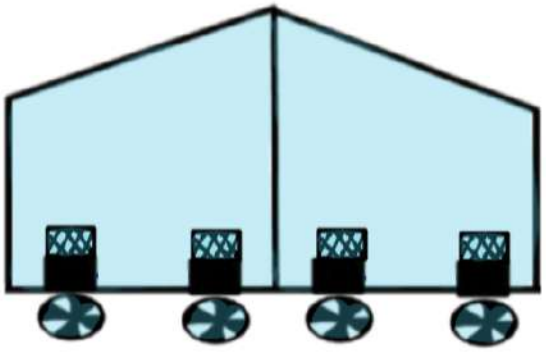
The fuel filtration system prevents contaminants from entering the wing tanks during overwing gravity refueling



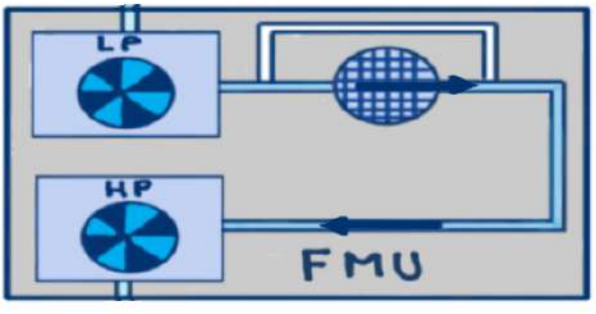


filTRATION is also ACCOMPLISHED AT:

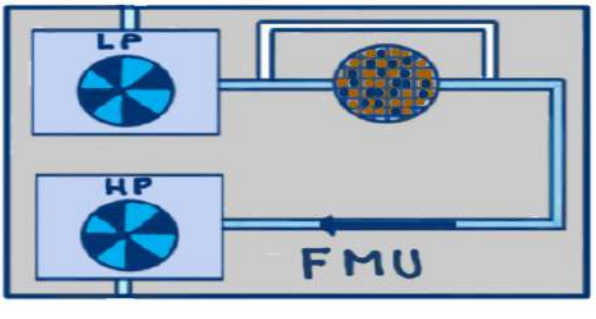
(2) THE INLETS of all FOUR (4) boost PUMPS



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



– IMPENDING blockage of indicATED LP filTER

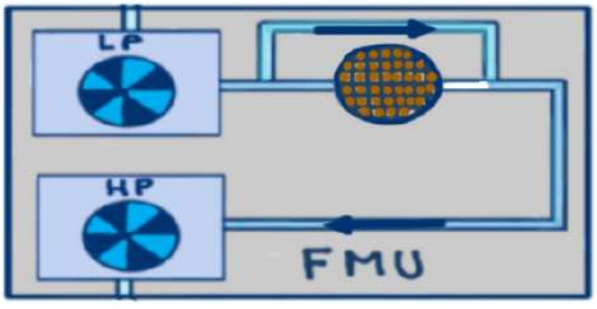


L-R FUEL FILTER

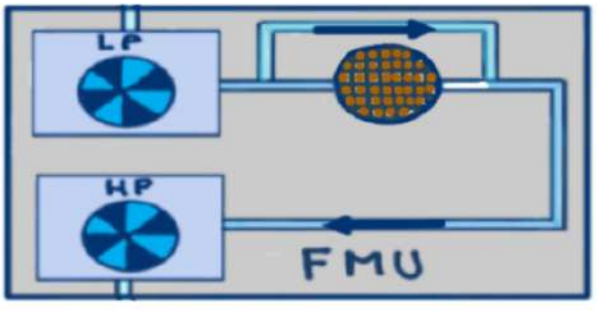
– fuel is bypassing indicated filter or impending blockage / bypassing of <u>both</u> LP filters

L-R Fuel Filter

Left engine

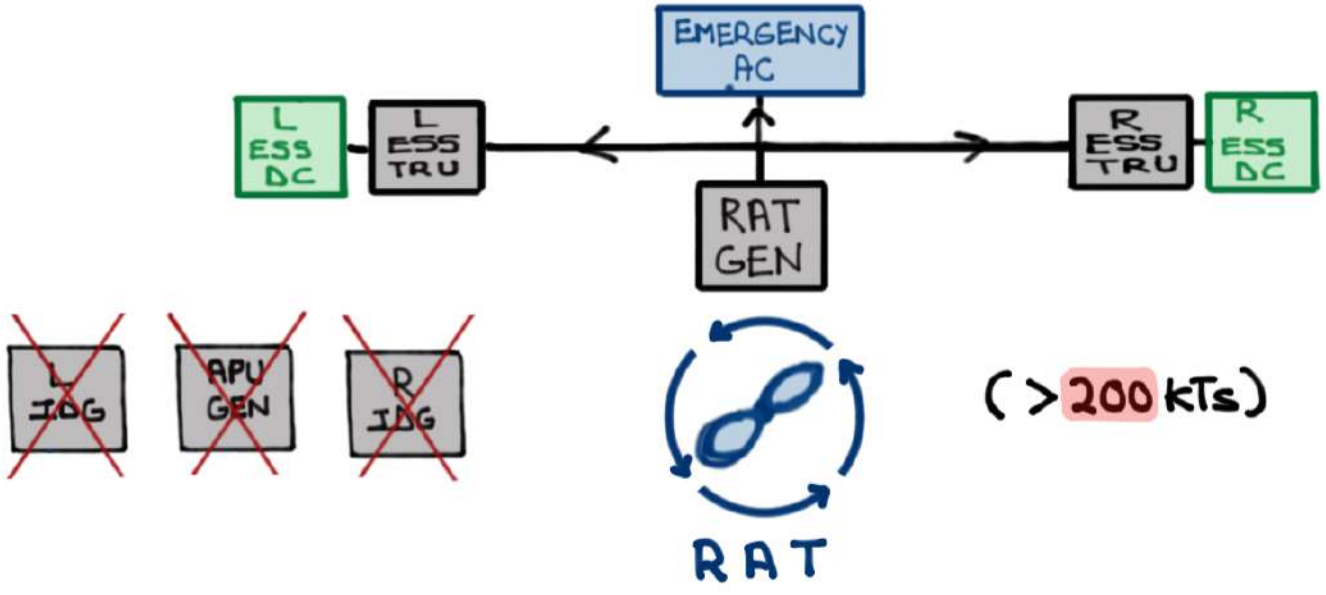


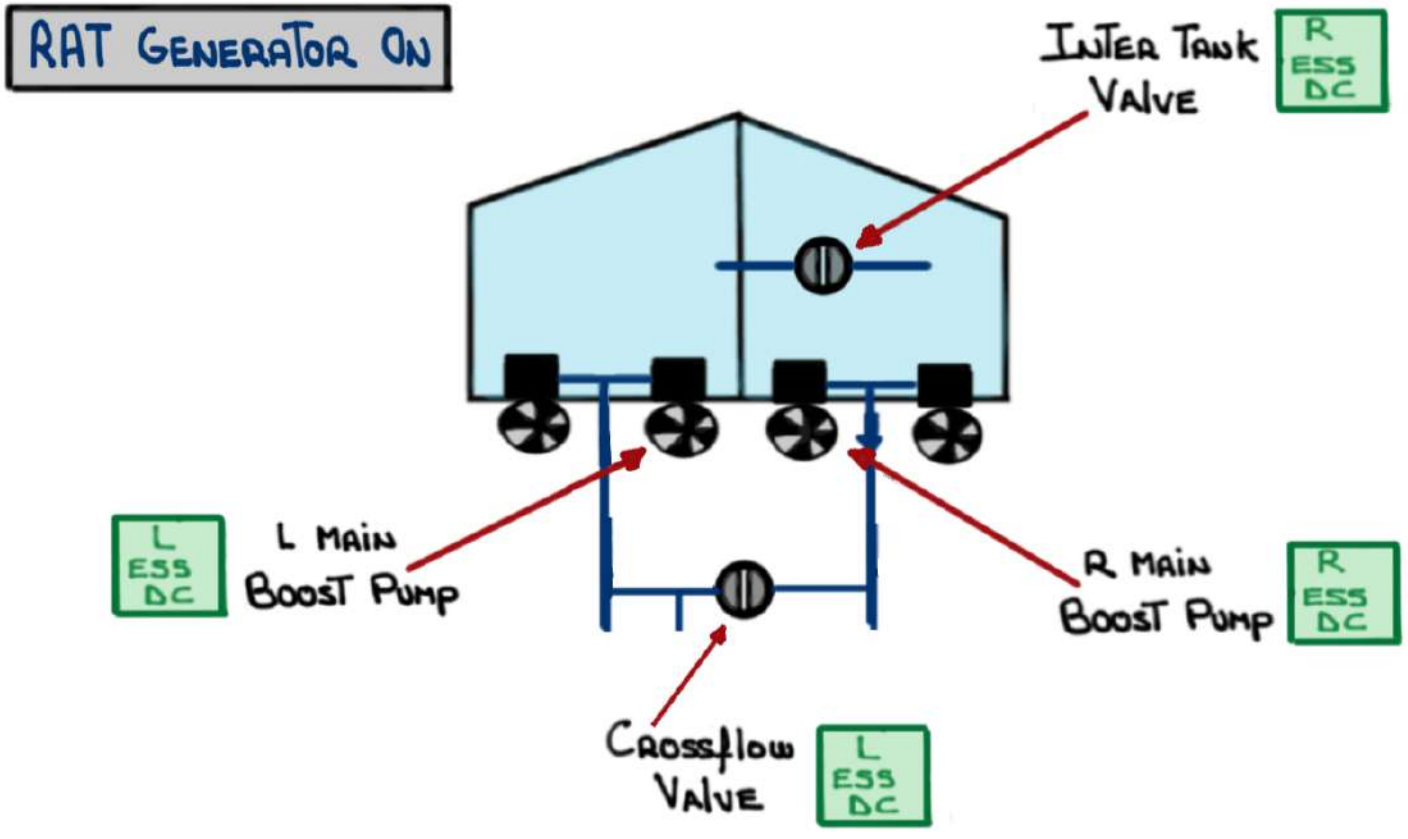
Right engine



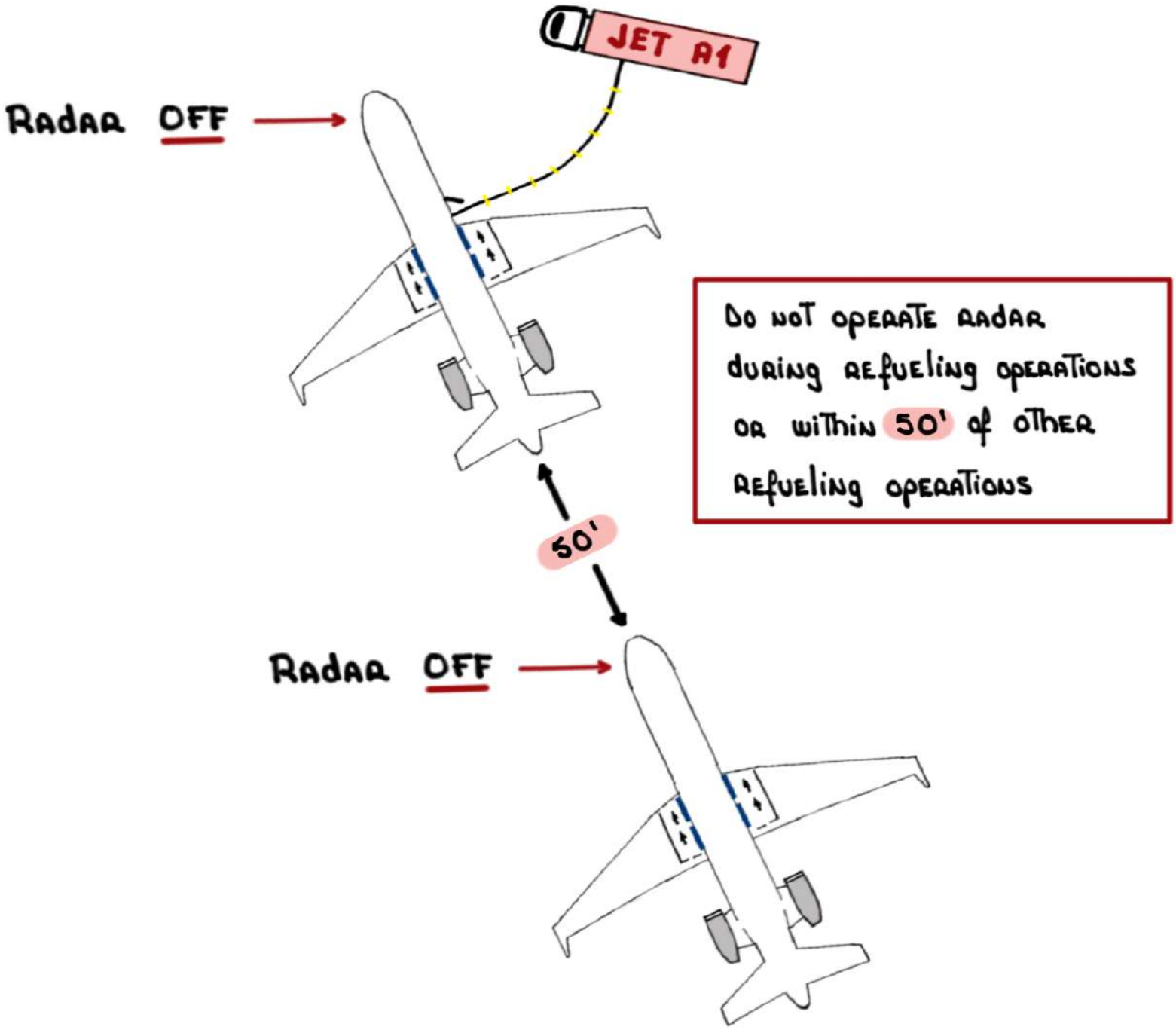
RAT Operations

When operating with the **RAT** the following fuel system components remain operative



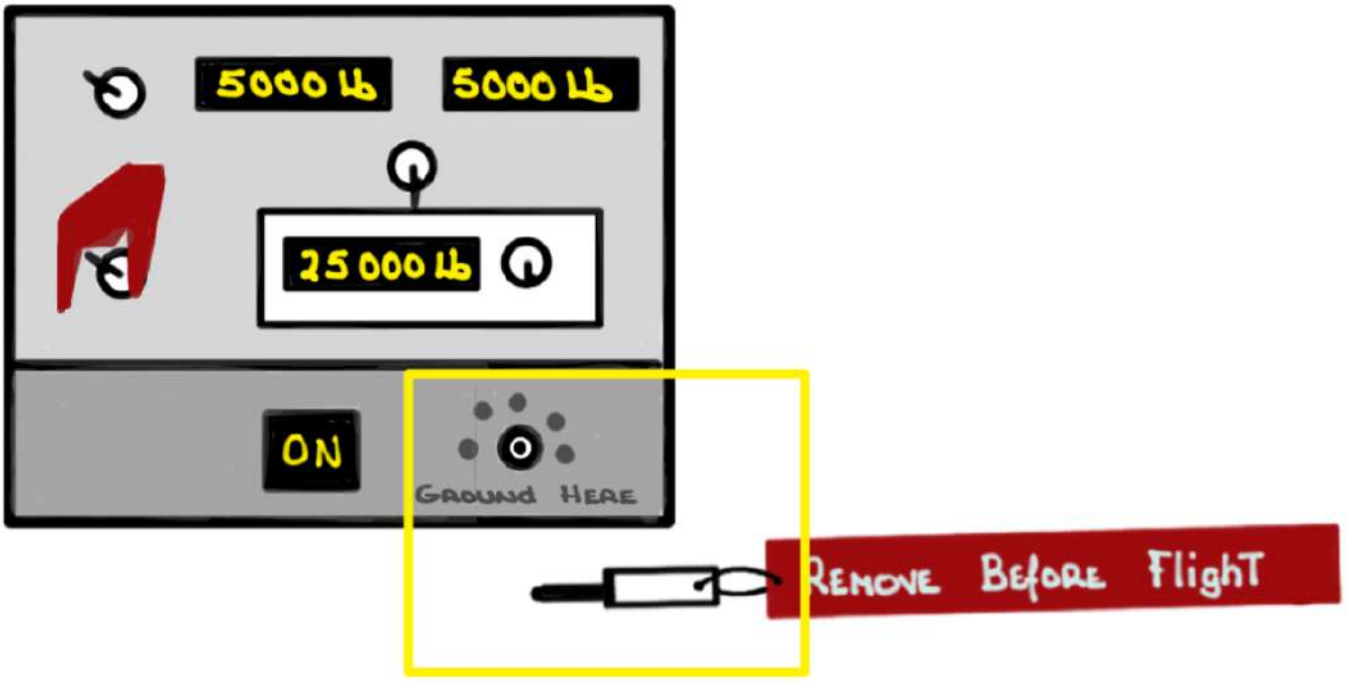


Fueling operations

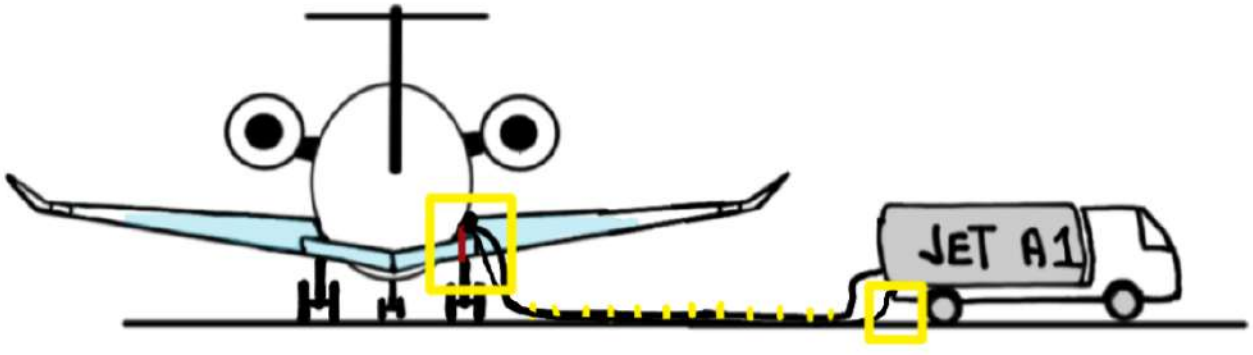


Do not operate radar during refueling operations or within 50' of other refueling operations

Before refueling, ensure airplane is bonded to the fuel source

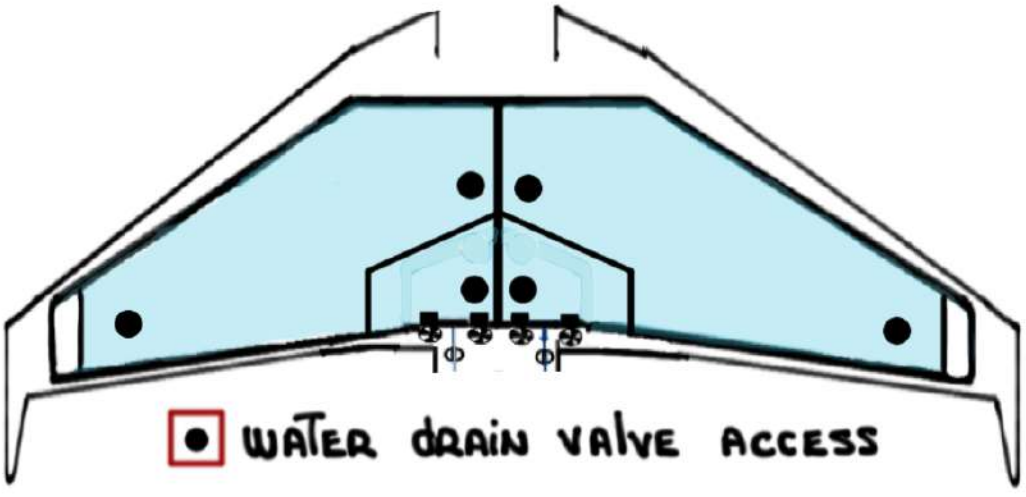


Grounding jack is located in the Ground Service Control Panel (GSCP)



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

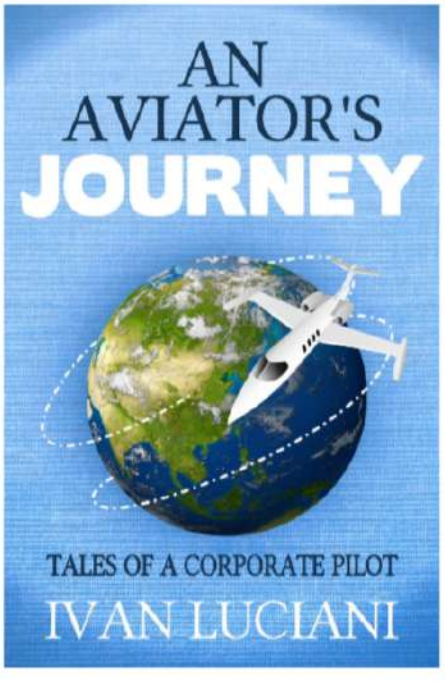


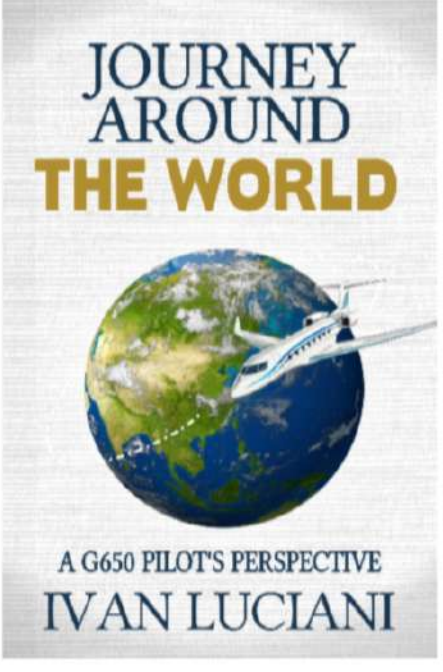
- Fuel quality check of fuel source prior to each refueling operation

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.luciani@gmail.com





Thank you!