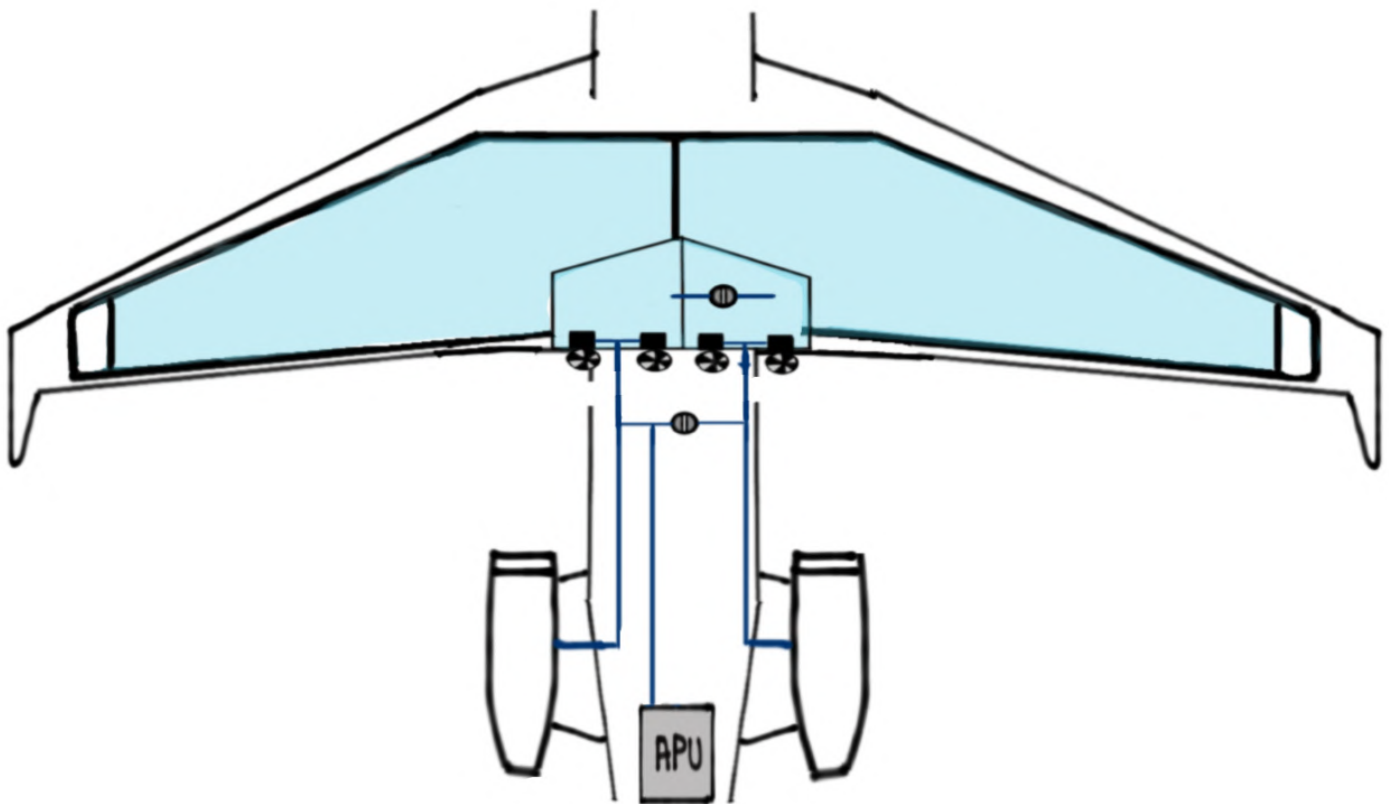


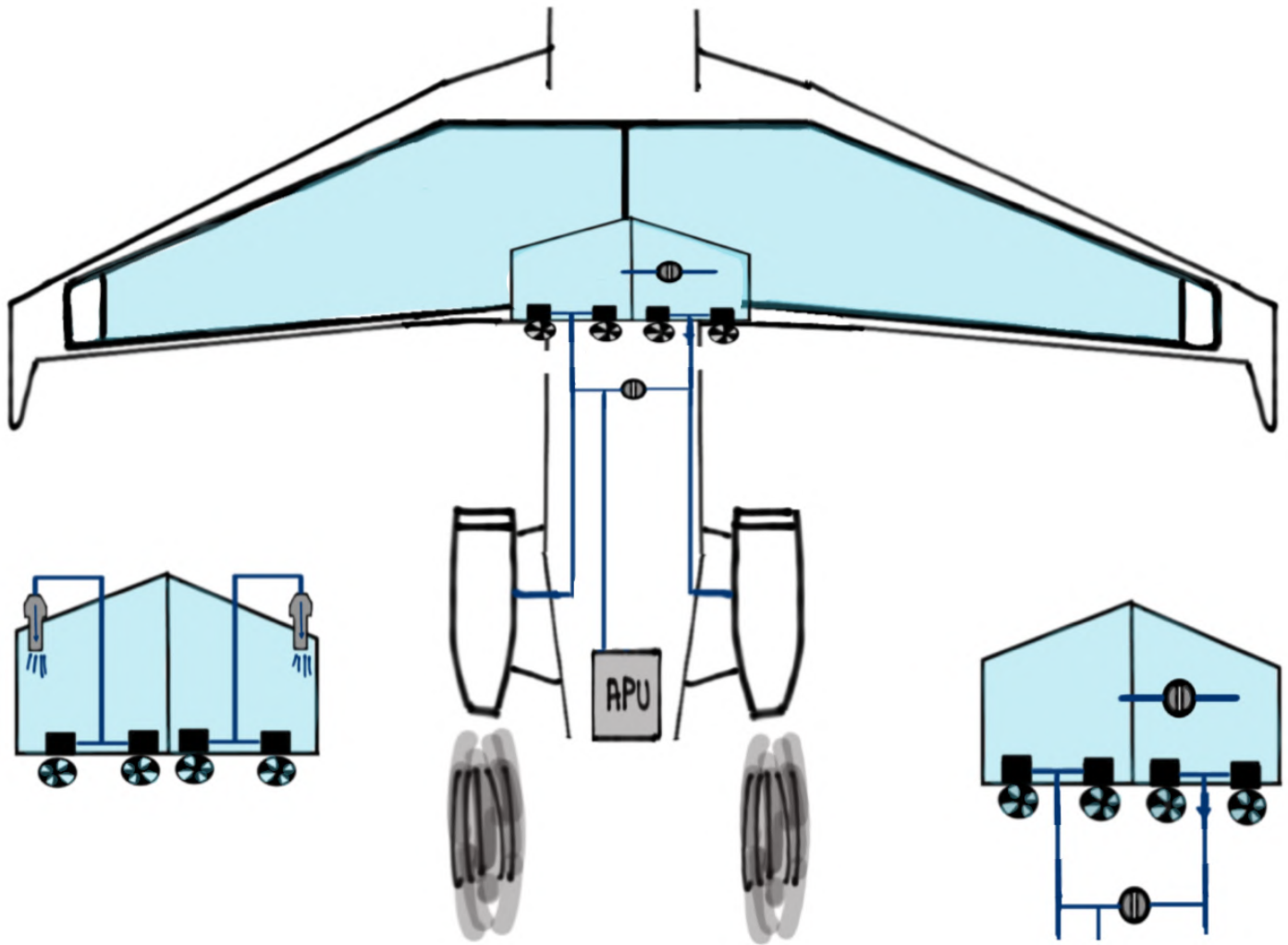
G450

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

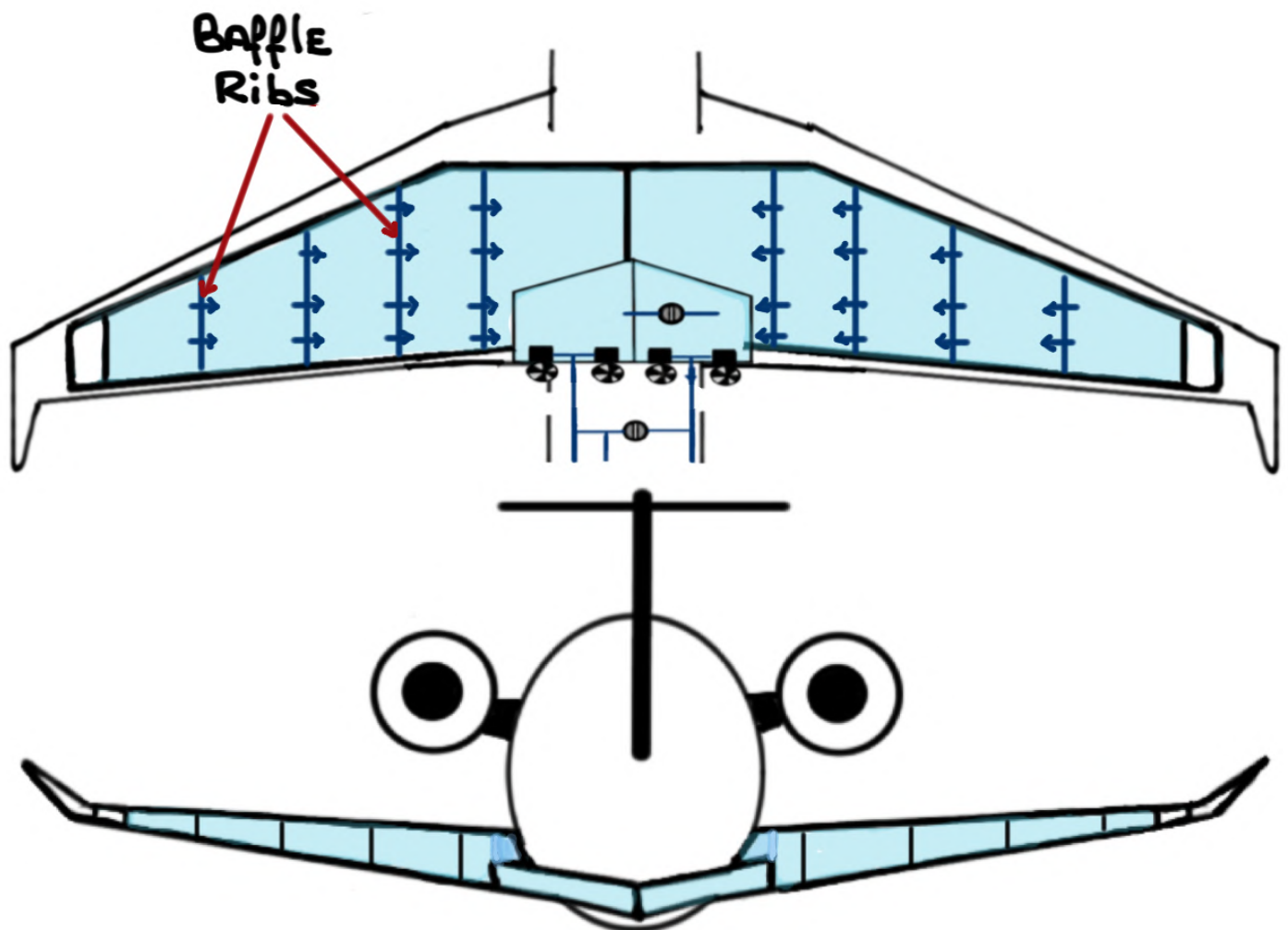
- Refueling:

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

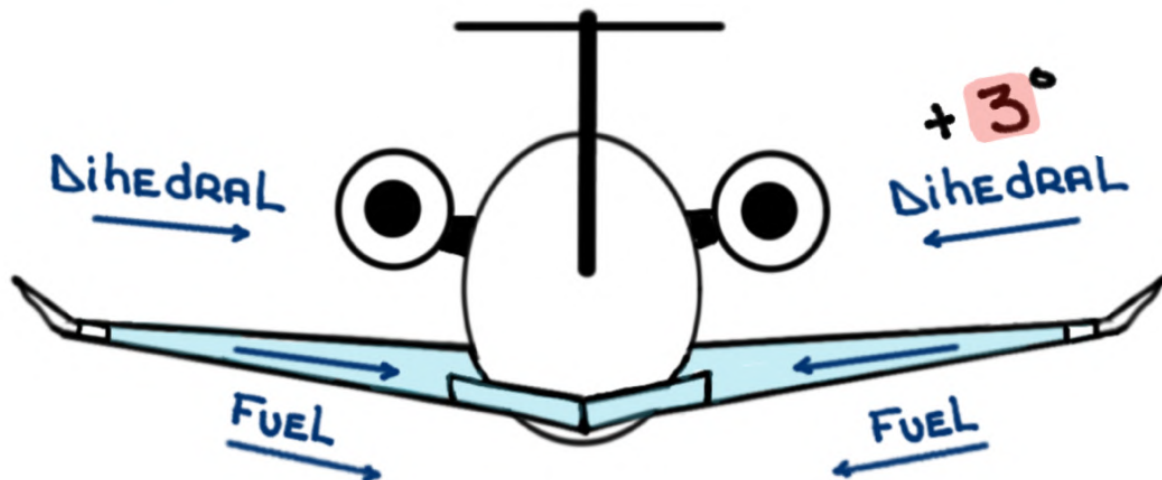
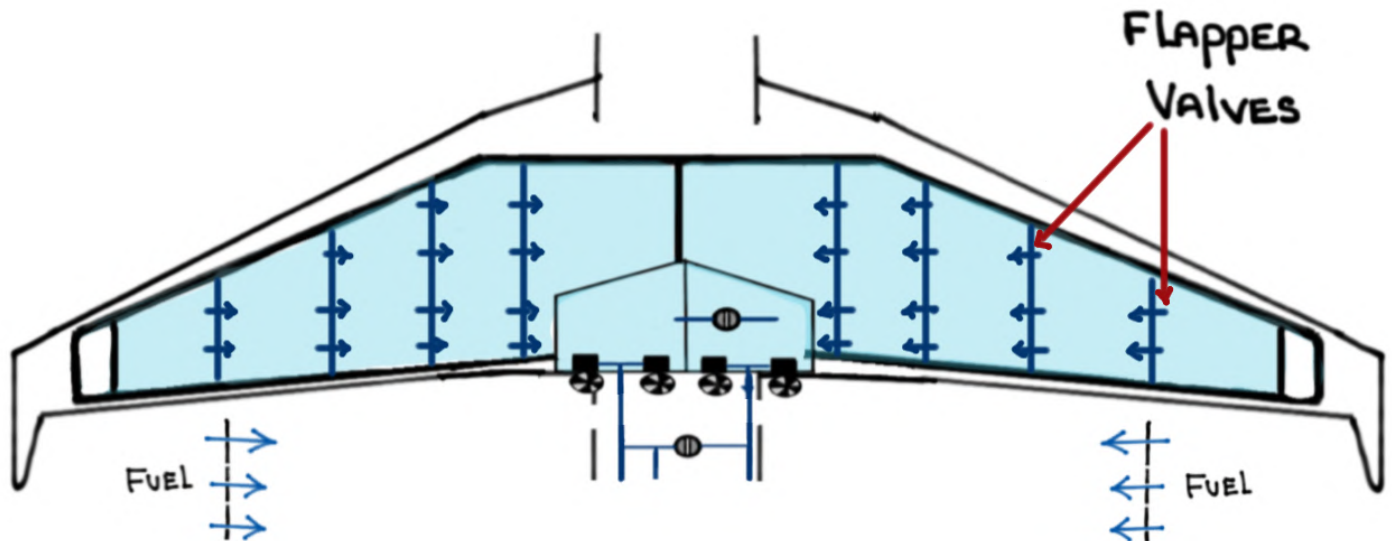
② Overwing gravity refueling

- There are five (5) compartments in each tank

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



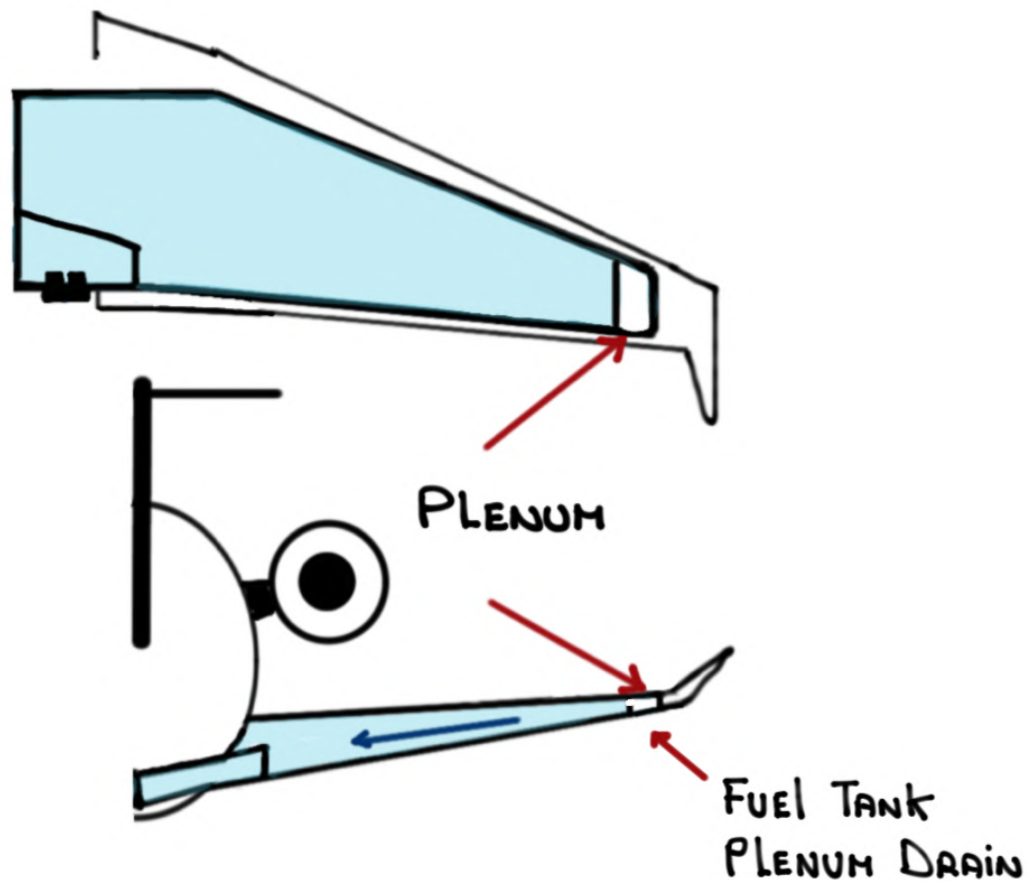
- FLAPPER VALVES AT THE bottom of each baffle rib allow fuel To TRAVEL in one direction FROM COMPARTMENT To COMPARTMENT AND TOWARDS THE FUEL HOPPERS



- Any fuel below The flapper valves MOVES TOWARDS The FUEL 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

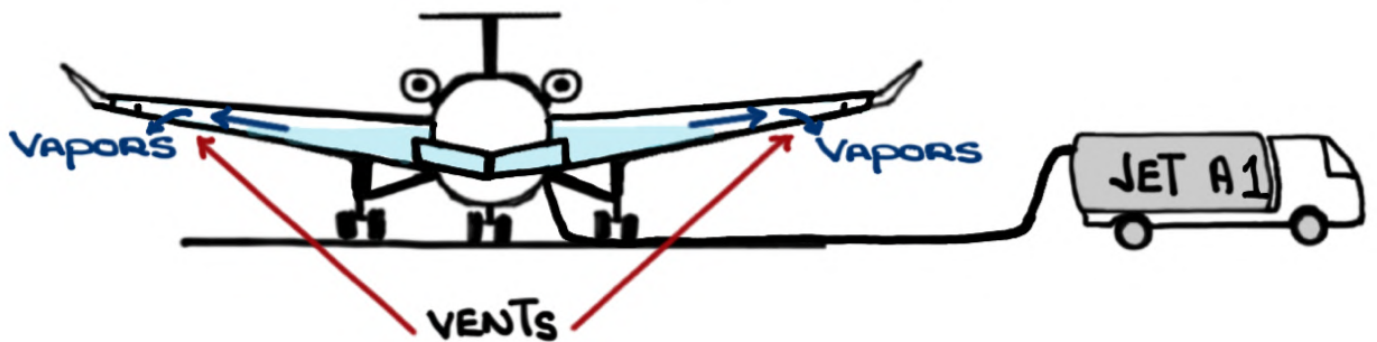
- The PLENUM also allows for a two (2) percent fuel expansion



- 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)



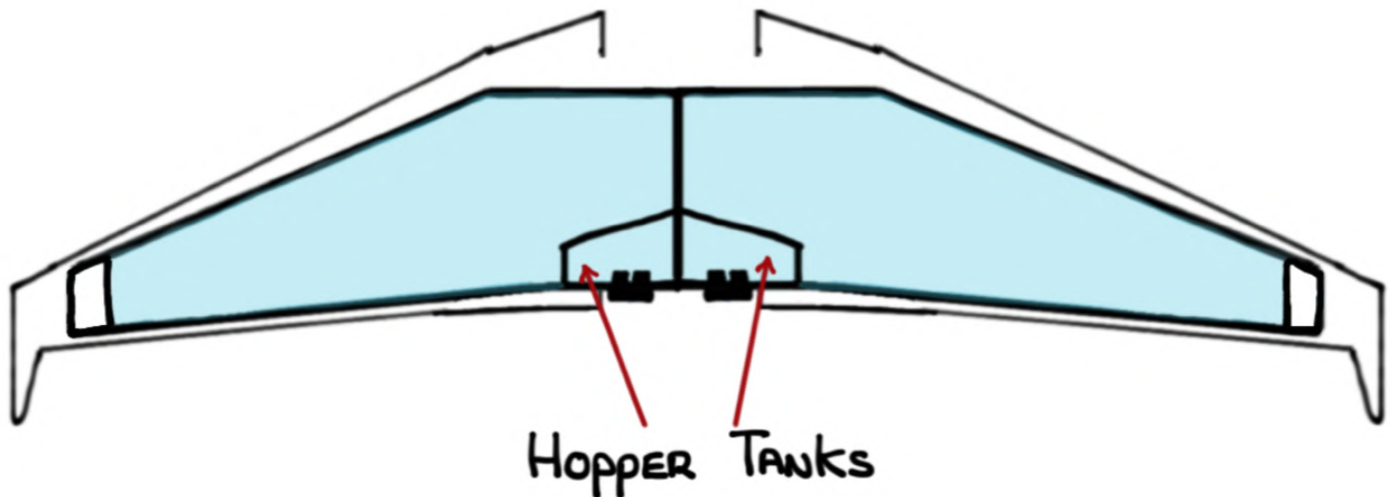
- The fuel VENT SYSTEM ALLOWS AIR TO ENTER THE FUEL TANKS AS FUEL IS CONSUMED DURING FLIGHT



PREVENTS wing COLLAPSE (NEGATIVE PRESSURE)

- The Hopper Tanks ARE SEGREGATED TANKS within The wing Tanks

- They ARE located ADJECENT TO THE CENTERLINE rib AT THE LOWEST point within The wing TANK

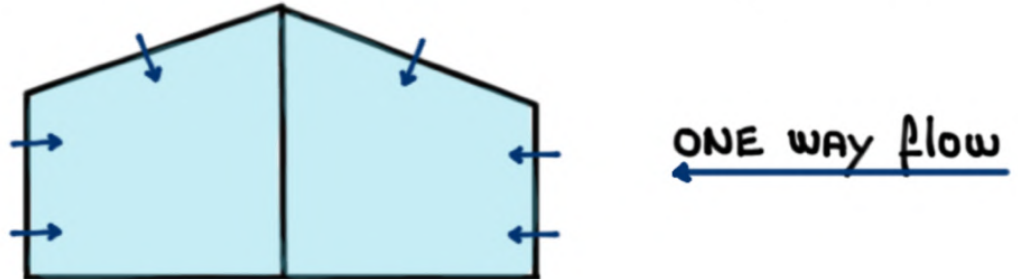


- IT IS FROM THE HOPPER TANKS THAT FUEL IS DRAWN TO FEED THE ENGINES AND APU

- The Hopper Tanks ARE KEPT full via:

① FLAPPER-TYPE VALVES (GRAVITY)

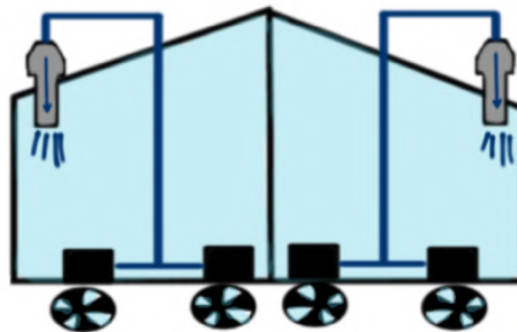
- THREE (3) flapper valves PER Hopper
- Allow GRAVITY flow of fuel FROM wing TO Hopper



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

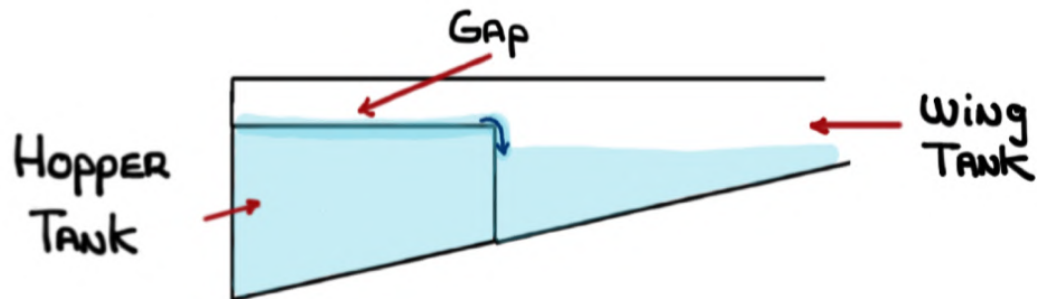
- DELIVER STEADY flow of fuel FROM wing TO Hopper
- LOW PRESSURE, high volume pumps
- 4,450 pounds PER hour



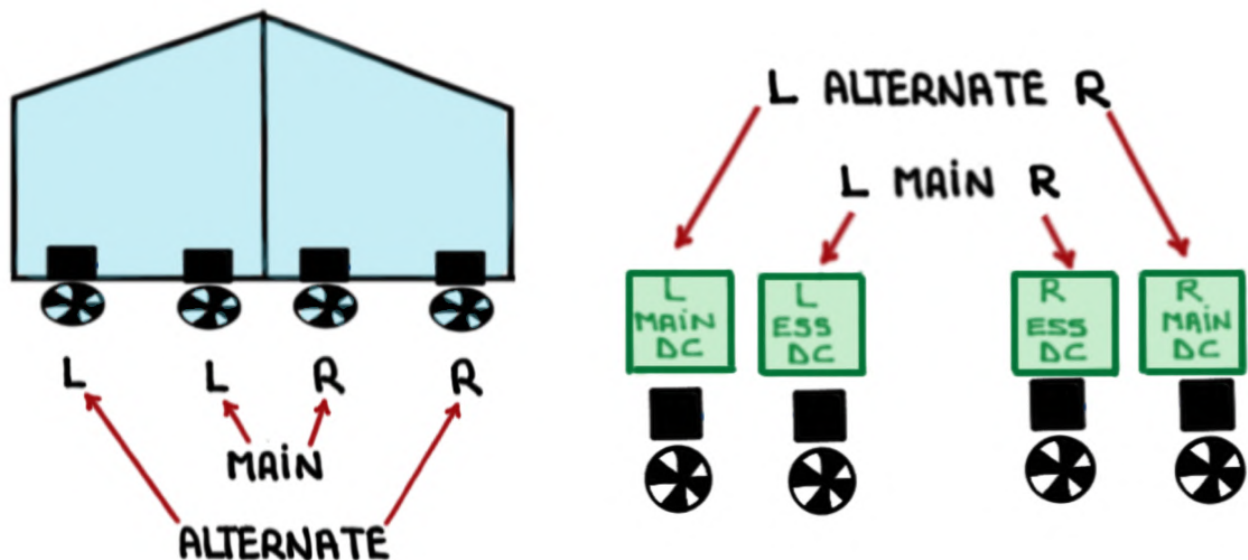
- The Hopper Tanks have a fuel capacity of:

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

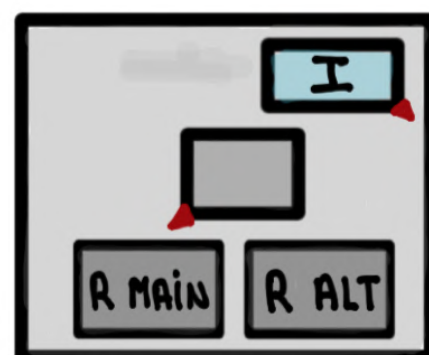
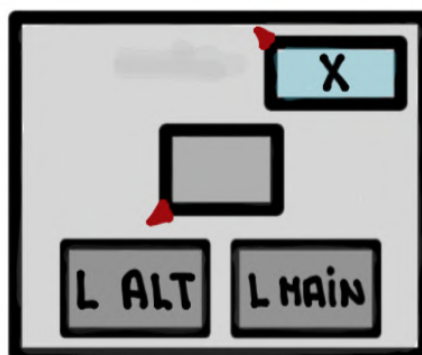


- Two (2) MAIN powered by RESPECTIVE
- Two (2) ALTERNATE powered by RESPECTIVE
- Without Boost pump pressure The engines will:

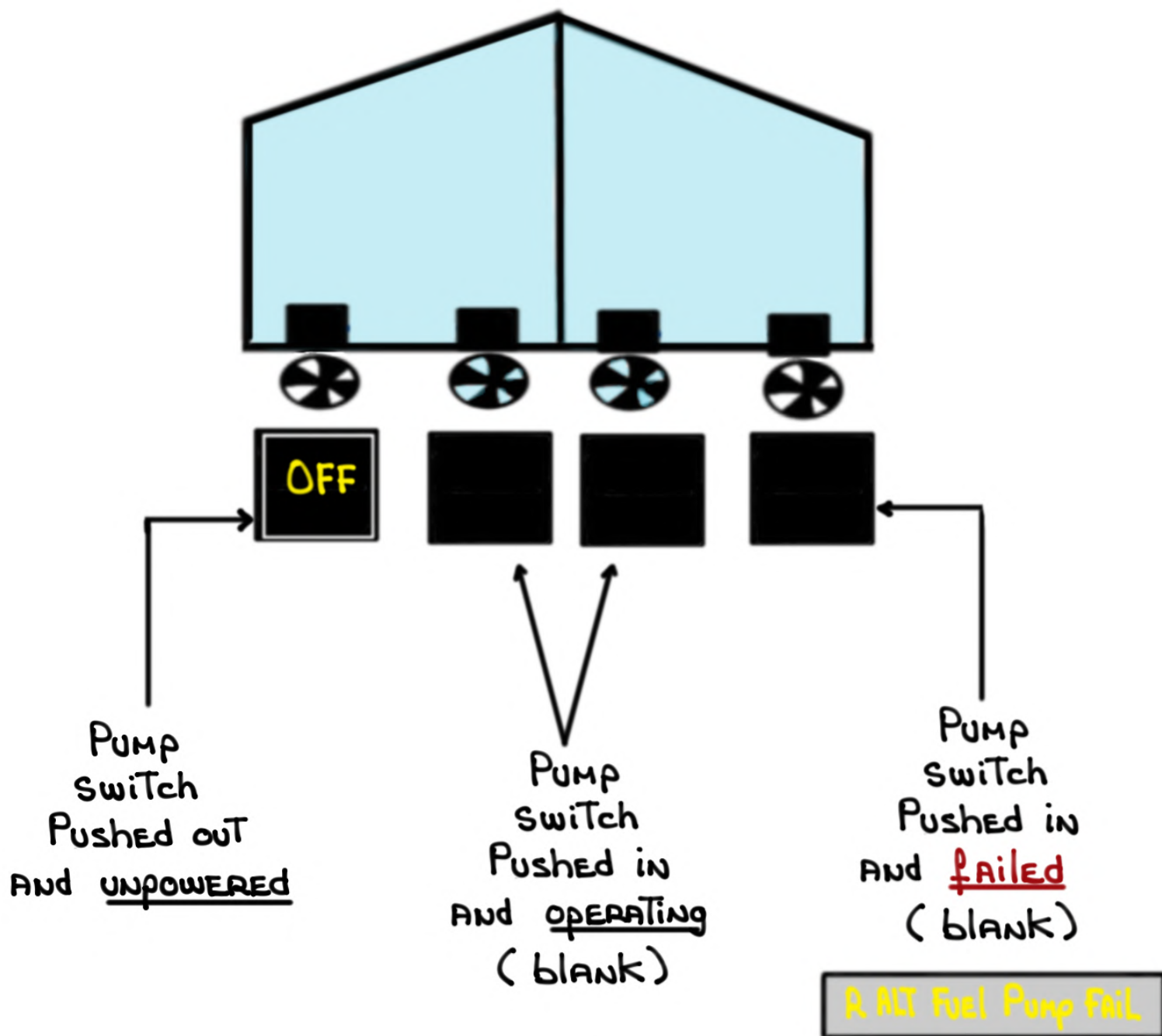
① < 20,000' = suction feed

② ≥ 20,000' = RUN ERRATICALLY AND FLAMEOUT

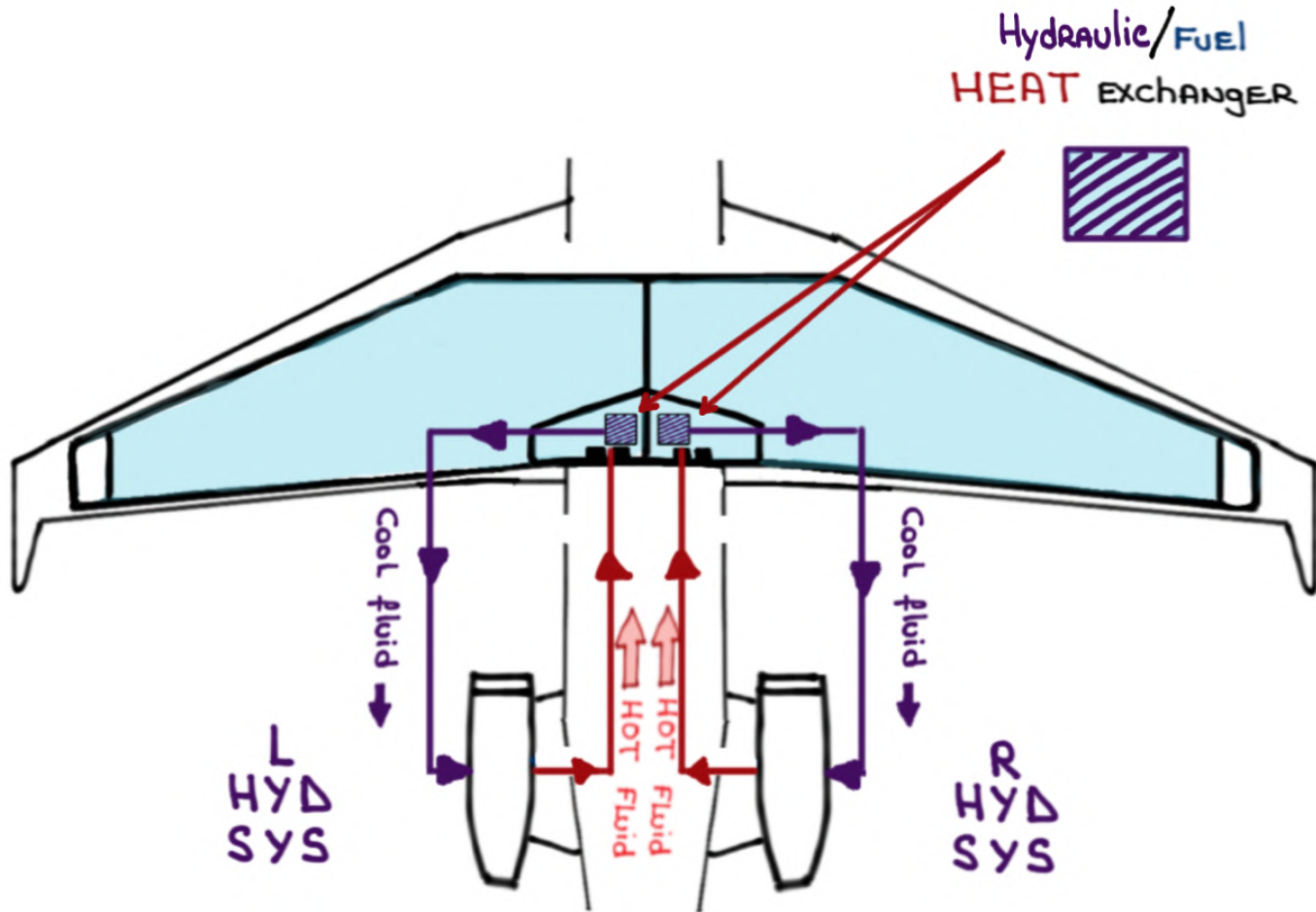
- Each boost pump draws < 25 amps
- All operable boost pumps MUST BE SELECTED ON for all PHASES of flight UNLESS fuel balancing is in PROGRESS OR AS DIRECTED by THE CHECKLIST
- REAR wing BEAM



- Boost pump switch (indications)



- The Hopper Tanks contain The **Hydraulic fluid -To- FUEL** HEAT EXCHANGERS

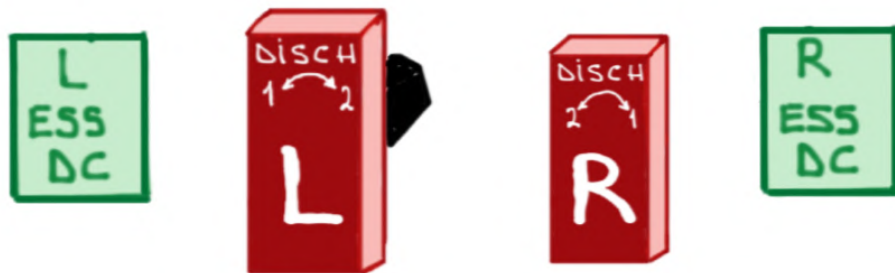


The HEAT EXCHANGER unit is inside The **ONSIDE** fuel Hopper. **HOT** hydraulic fluid flows continuously Through The HEAT EXCHANGER without pilot input

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

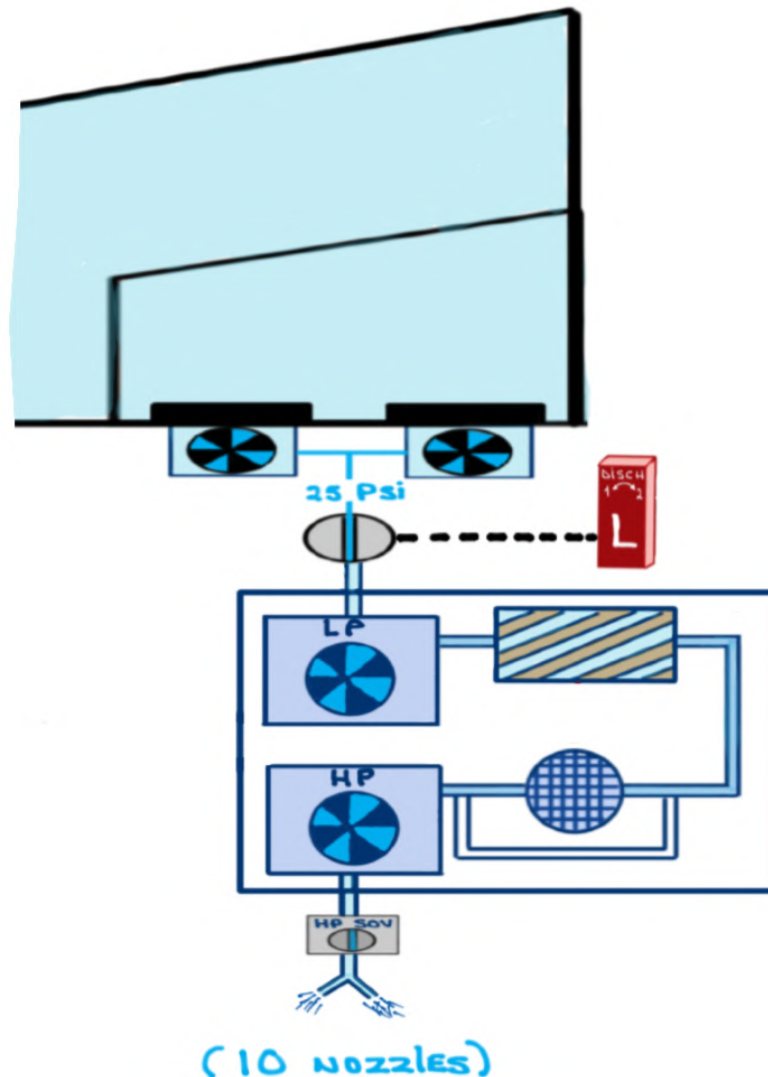


- SOV position indicator - wheel well

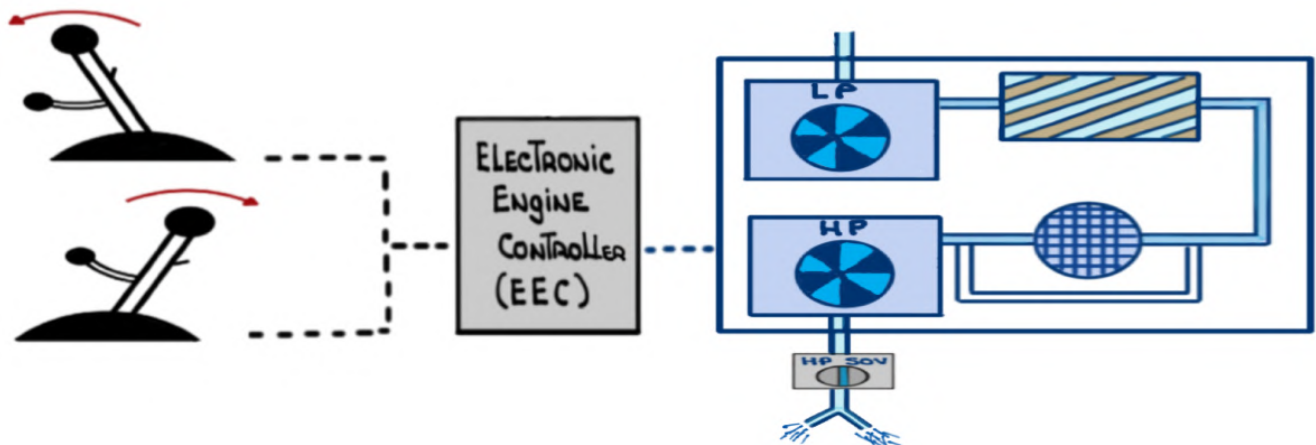


ENGINE FUEL SYSTEM

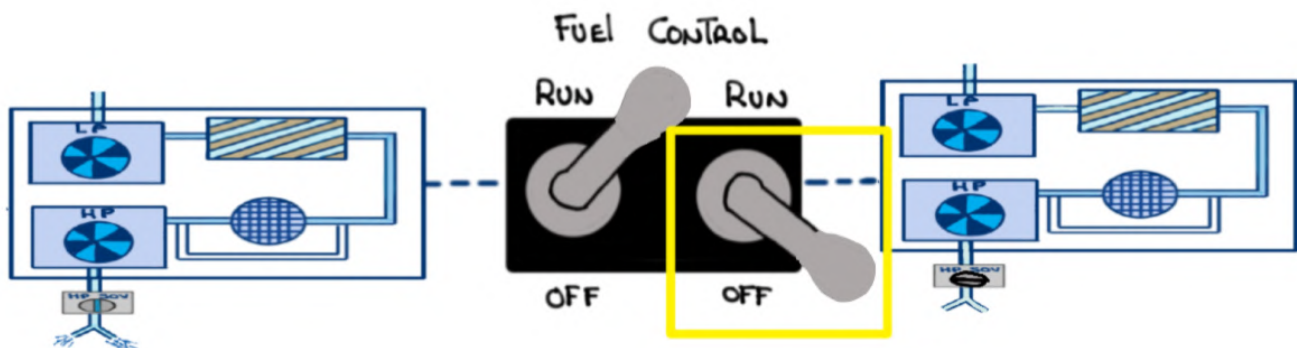
- METERED fuel from TANKS' boost pumps To NOZZLES
- Introduction of fuel is controlled by The EEC
- Low pressure fuel coming from The wings
- High pressure fuel coming from The FUEL METERING Unit (FNU)



- As Thrust Levers are advanced or retarded The EEC commands The FMU To modulate fuel To nozzles

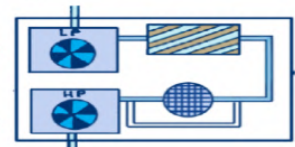


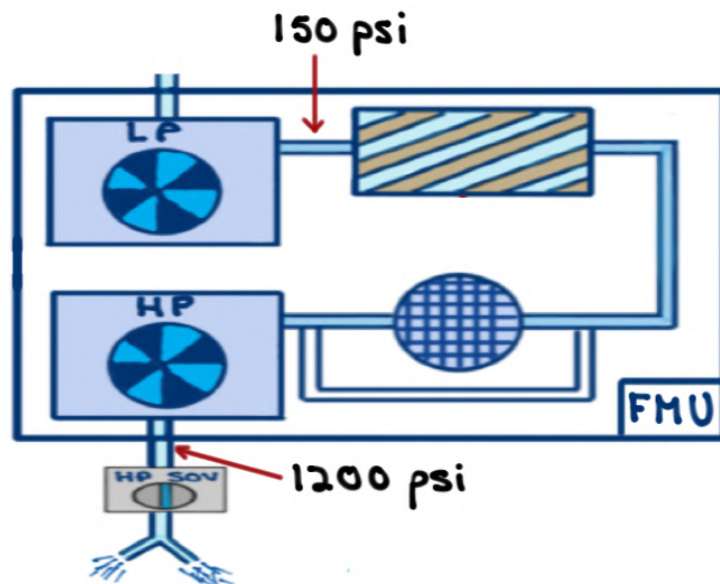
- Placing a fuel control switch To OFF closes FMU
All fuel is cutoff To The fuel nozzles AND The ENGINE shuts down




- The FMU CONTAINS Two (2) INTERNAL pumps :

- Low PRESSURE (LP) 1ST STAGE
- High PRESSURE (HP) 2ND STAGE

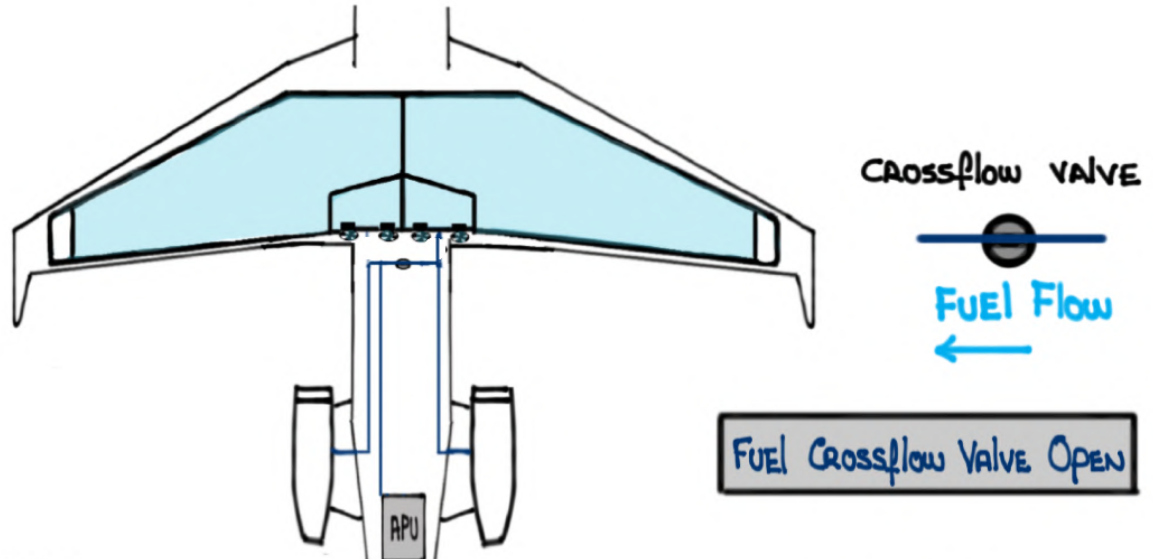




- The LP and HP pumps are driven by the engine accessory gearbox
- A fuel filter RECEIVES fuel from the 1st stage LP pump and REMOVES debris and contaminants
- A filter bypass valve ensures CONTINUAL fuel flow to the engine if filter is blocked
- Excess fuel is recirculated through the FUEL/OIL heat exchanger 

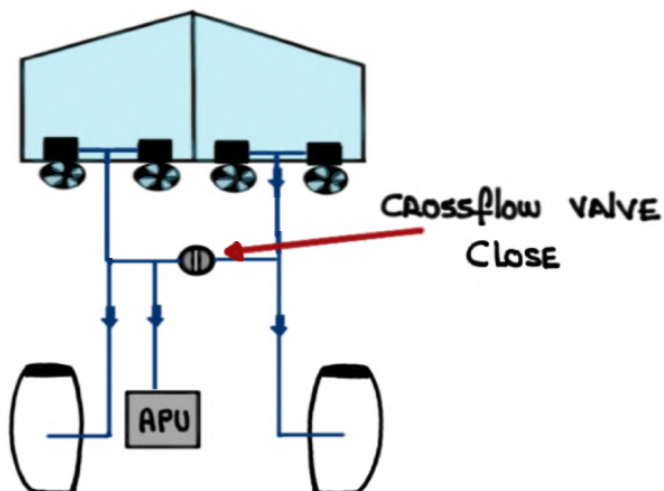
APU FUEL Supply

FUEL IS NORMALLY SUPPLIED FROM THE LEFT FUEL MANIFOLD BUT CAN ALSO BE SUPPLIED FROM THE RIGHT MANIFOLD BY TEMPORARILY OPENING THE CROSSFLOW VALVE

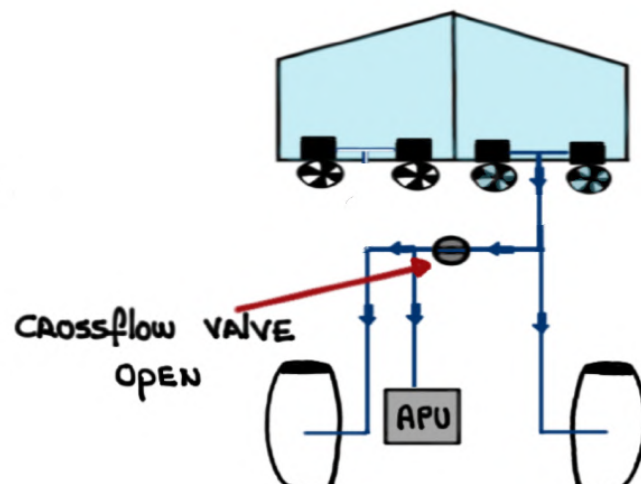


FUEL CROSSFLOW VALVE OPEN

L MANifold
To
APU



R MANifold
To
APU



- FUEL TANK TEMPERATURE:

If in flight, AND THE FUEL TANK TEMPERATURE is -40°C OR LESS:



DESCEND TO ALTITUDE WHERE SAT IS -60°C OR WARMER



Delay Takeoff

$< -37^{\circ}\text{C}$

FUEL TANK TEMPERATURE

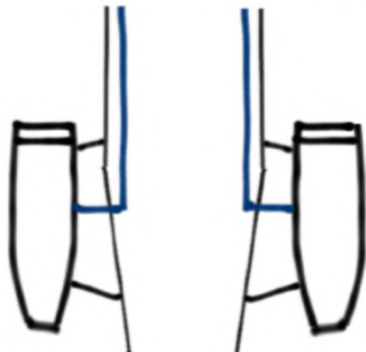
-35°C TO -36°C

FUEL TANK TEMPERATURE

$> +54^{\circ}\text{C}$

FUEL TANK TEMPERATURE

- ENGINE FUEL TEMPERATURE:



MAX: $+130^{\circ}\text{C}$ (15 MINUTES)

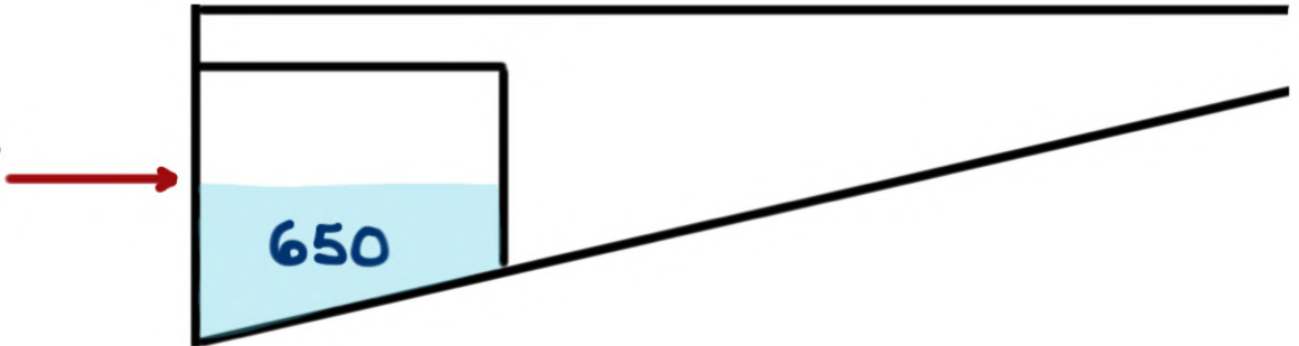
MAX: $+95^{\circ}\text{C}$

MIN: -40°C

- \leq 650 lbs REMAINING in EITHER OR BOTH hoppers



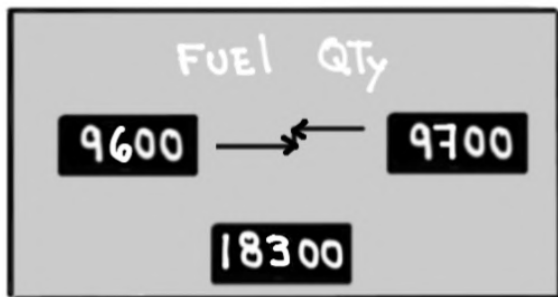
Hopper
TANK



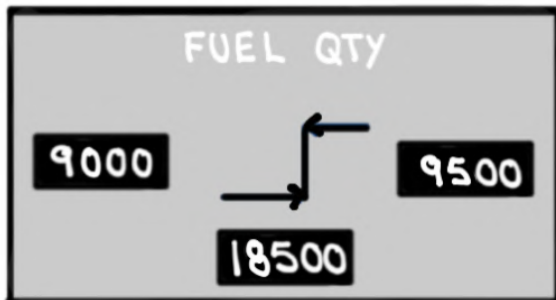
- PROCEED TO NEAREST AVAILABLE AIRPORT AND LAND
- AVOID EXTREME NOSE high/low ATTITUDES, EXCESSIVE FORWARD ACCELERATION AND UNCOORDINATED flight MANEUVERS
- DO NOT go-AROUND with $<$ 600 lbs in EITHER TANK
- DO NOT EXCEED 10° pitch up ATTITUDE

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

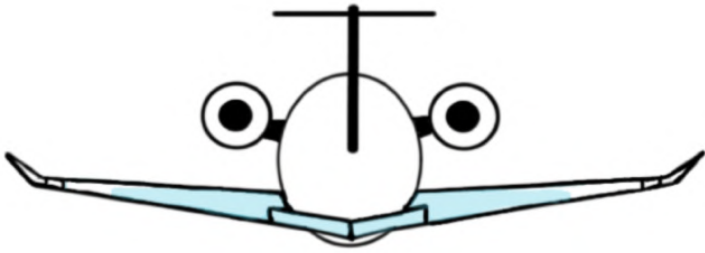


Full scale deflection AT 500 lbs imbalance



Full scale Turns AMBER AT 1000 lbs imbalance

MAXIMUM FUEL Imbalance



FUEL Imbalance

Inflight:

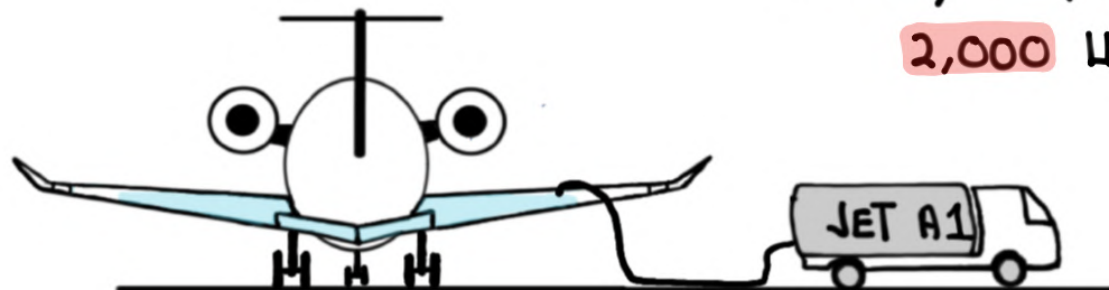
55,000 lbs or less:
 $\leq 2,000$ lbs

60,500 lbs or more:
 ≤ 400 lbs



FUEL Imbalance

Takeoff: $1,000$ lbs.



GRAVITY REFUELING
 $2,000$ lbs

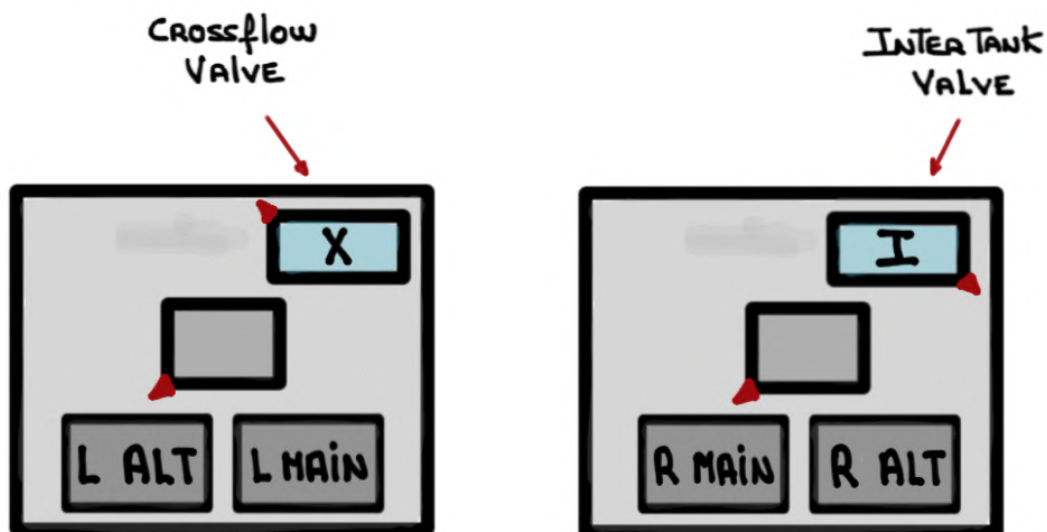
- IN THE EVENT OF A FUEL IMBALANCE CONDITION TWO METHODS ARE AVAILABLE TO BALANCE FUEL:

① INTERTANK VALVE:

- WHEN OPEN IT ALLOWS FUEL TO GRAVITY FLOW BETWEEN THE RIGHT AND LEFT FUEL TANKS VIA THE HOPPERS
- APPROXIMATELY $\frac{1}{2}$ ZOID DISPLACEMENT WHEN APPLYING RUDDER TRIM

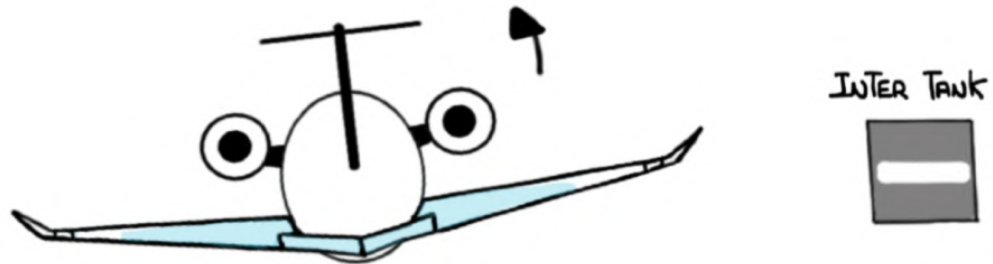
② CROSSFLOW VALVE:

- 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

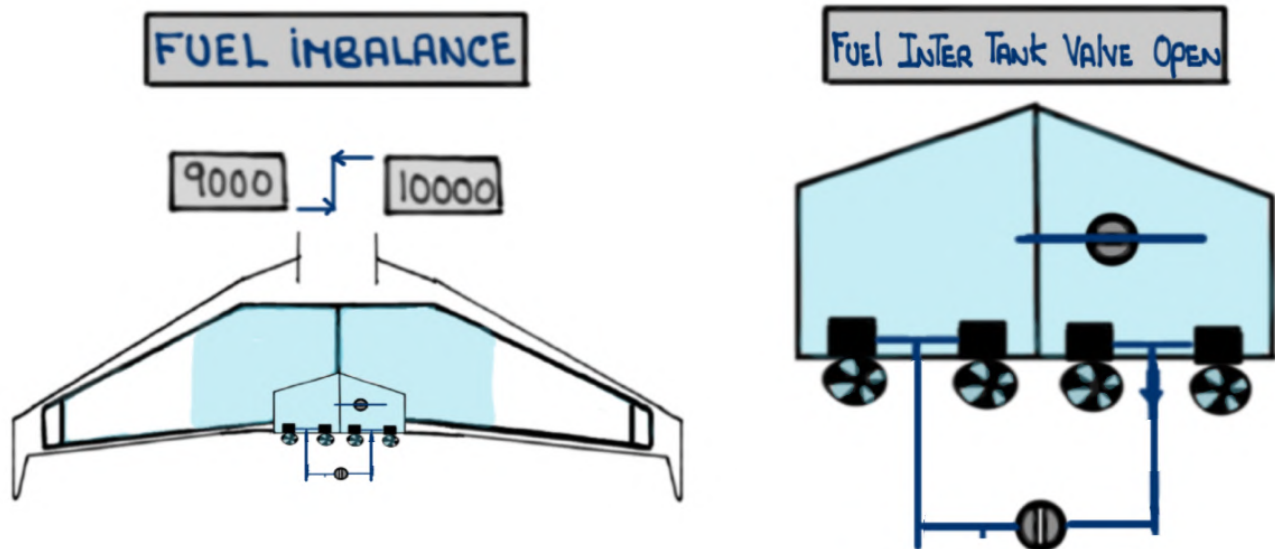


METHOD 1: INTER TANK

- 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



FUEL CROSSFLOW VALVE OPEN



X Flow

② TURN OFF boost pumps, ONE AT A TIME, ON lighter wing

FUEL IMBALANCE

9000



10000

L PUMPS

ALT

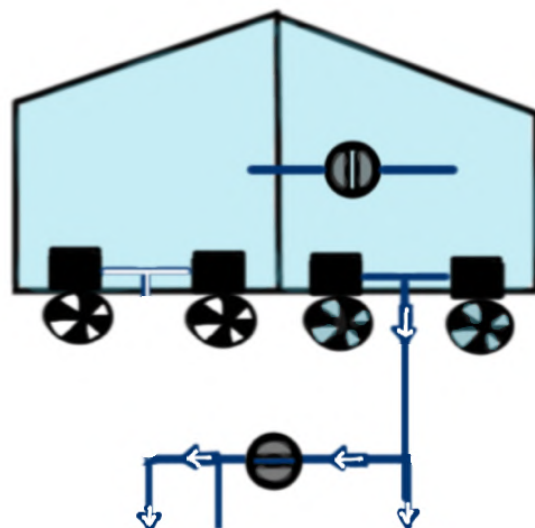
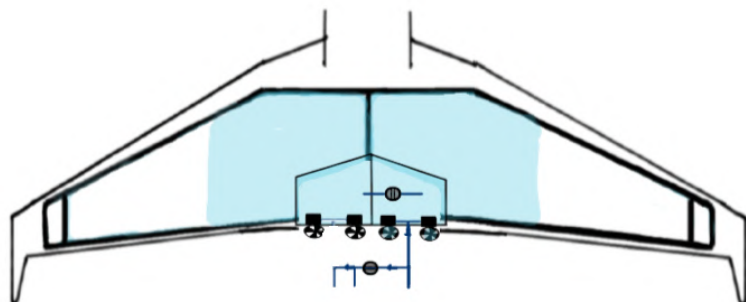
MAIN



R PUMPS

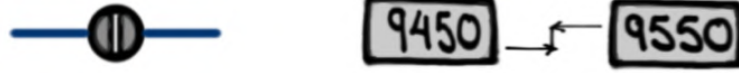
MAIN

ALT



③ TURN ON boost pumps

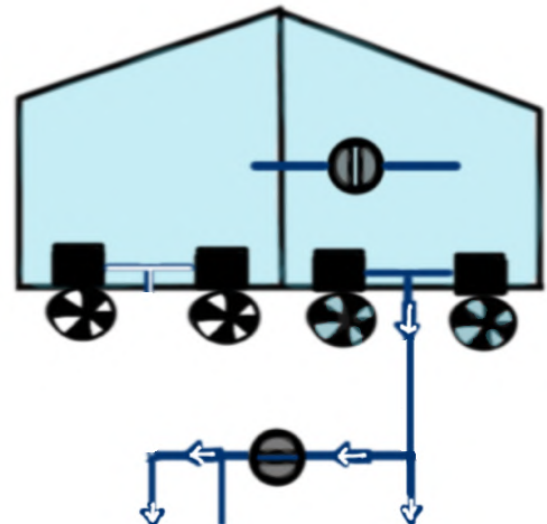
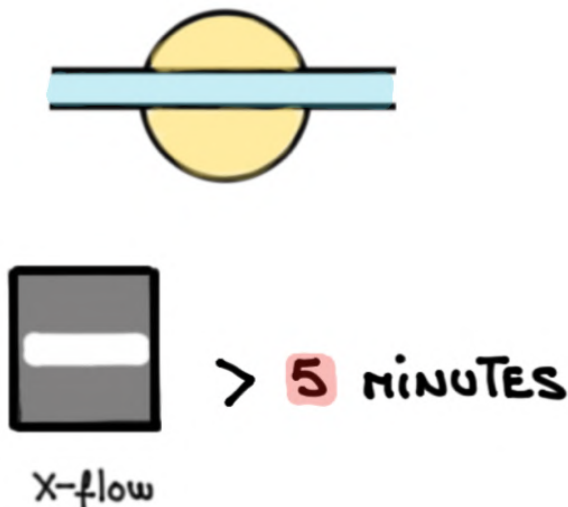
- ④ CLOSE CROSSflow VALVE when desired balance is achieved



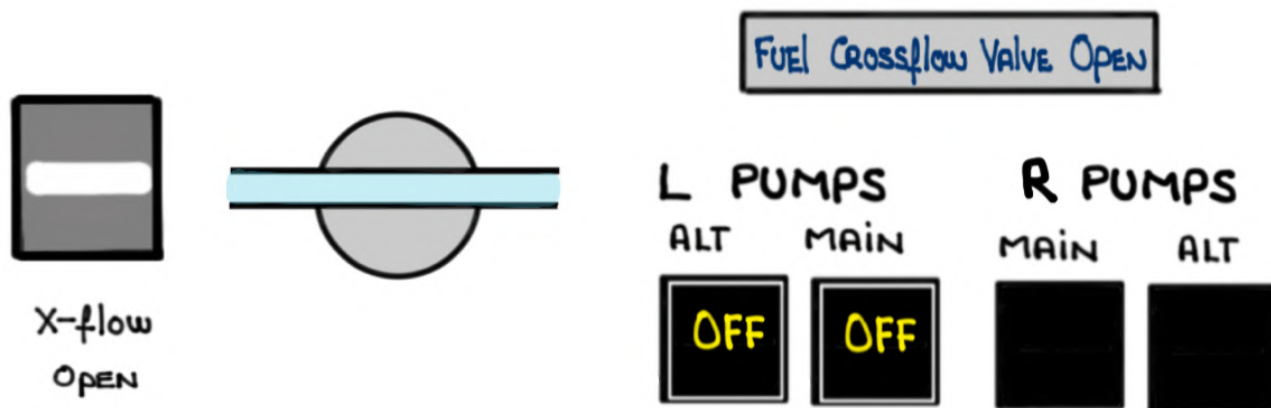
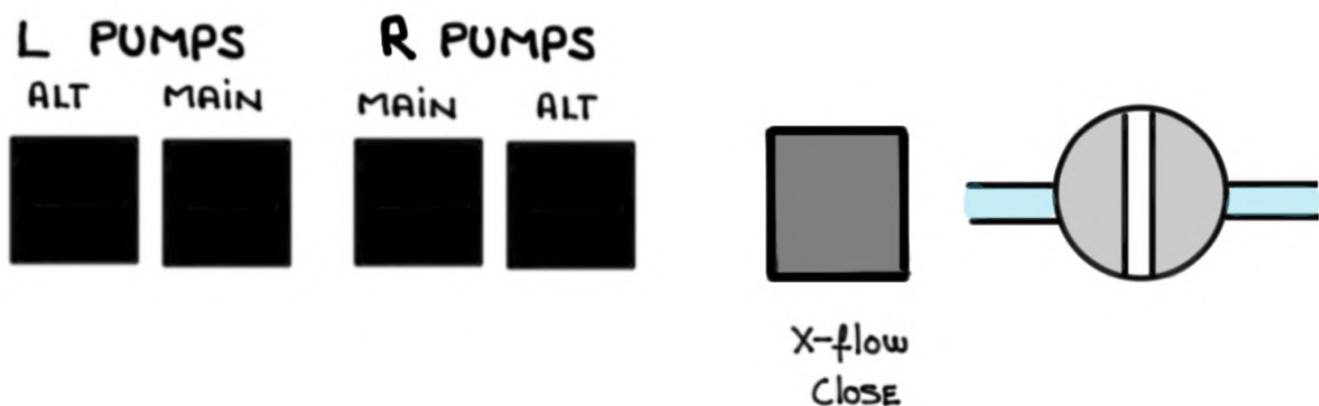
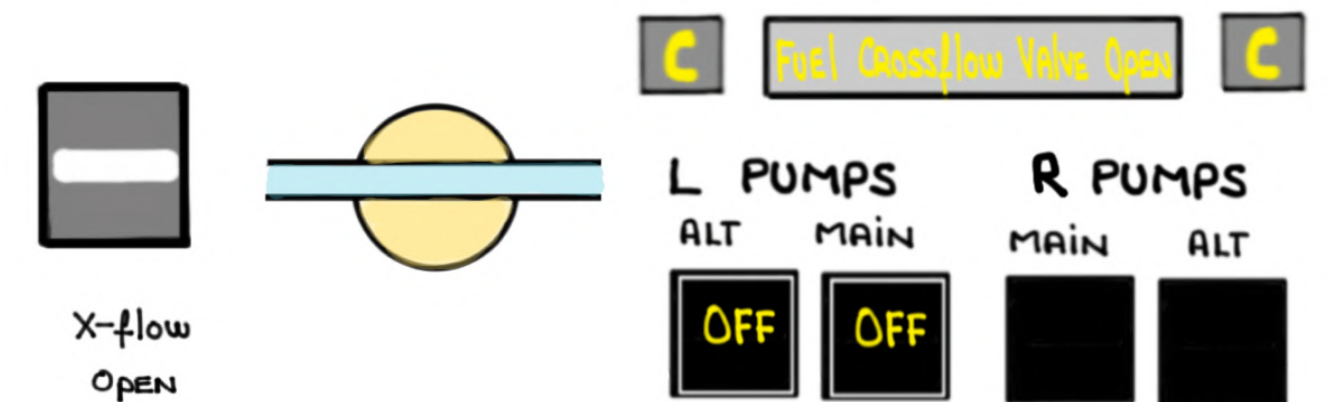
- The CROSSflow VALVE has a five (5) MINUTE TIMER TO ALERT THE CREW THAT it is still open. The CAS MESSAGE TURNS AMBER (CAUTION) AND A double-chime AURAL TONE will SOUND



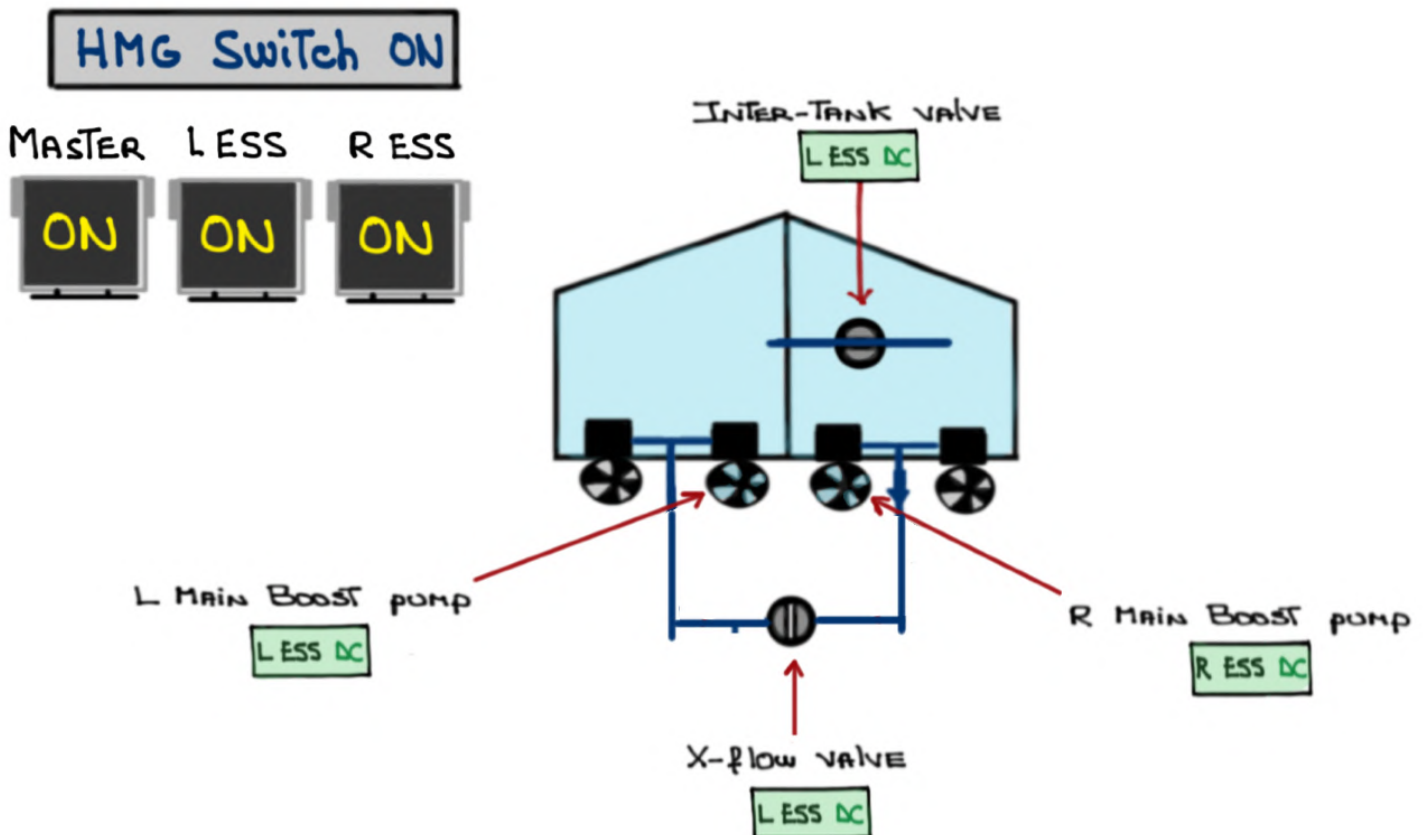
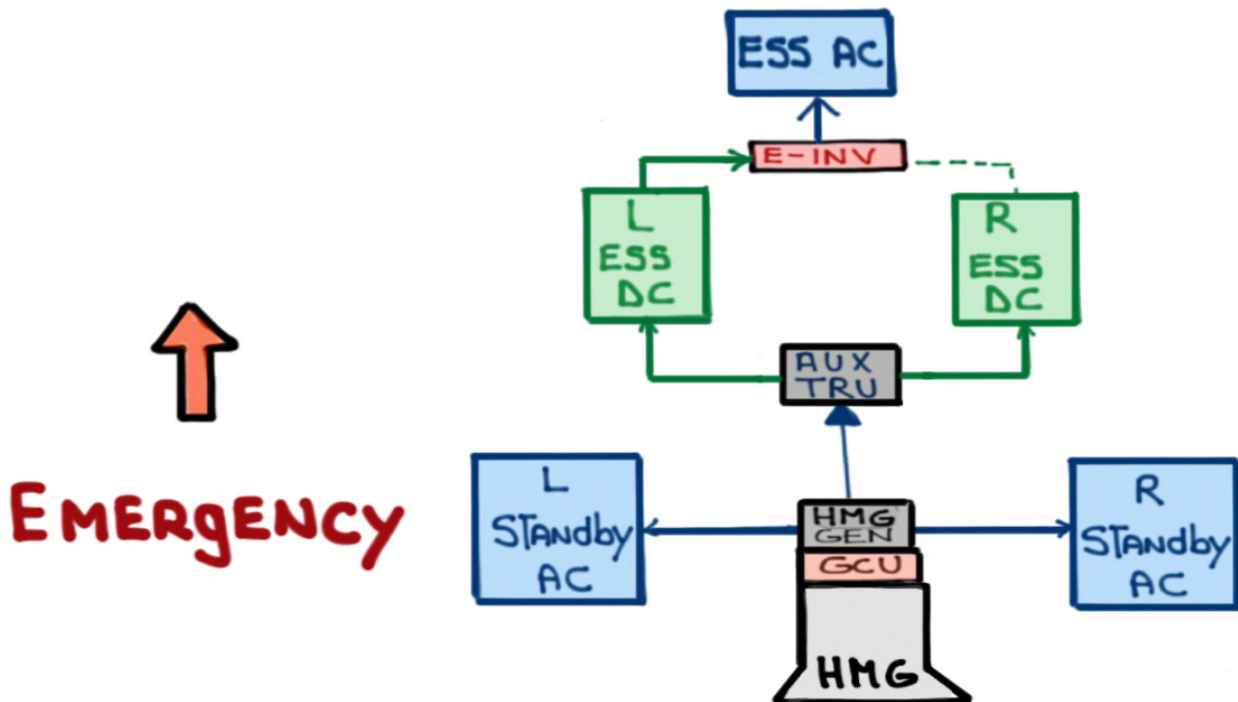
THE CROSSflow VALVE ON THE FUEL SYNOPSIS PAGE will ALSO TURN AMBER



AFTER REASSESSING THE STATUS OF THE FUEL IMBALANCE
RESET THE TIMER by cycling the crossflow valve
closed AND THEN, if REQUIRED, open it again



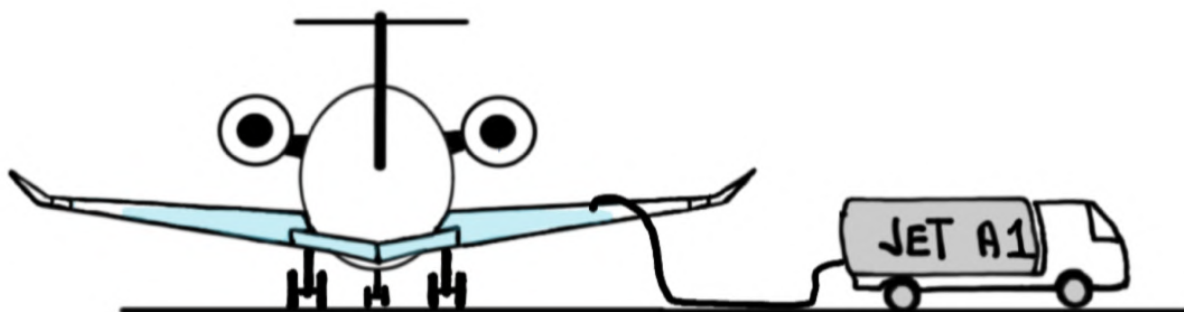
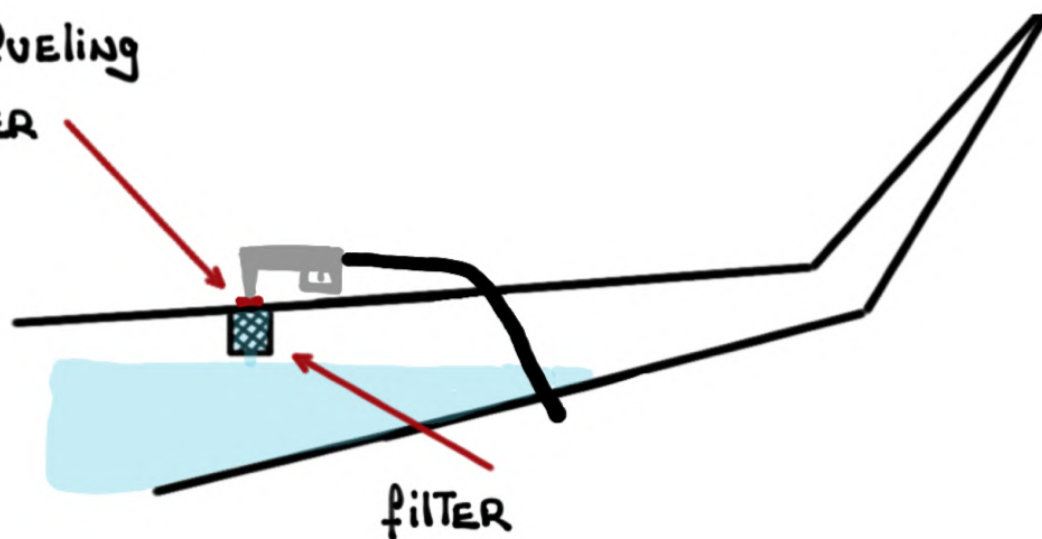
HMG OPERATIONS



FUEL FILTRATION

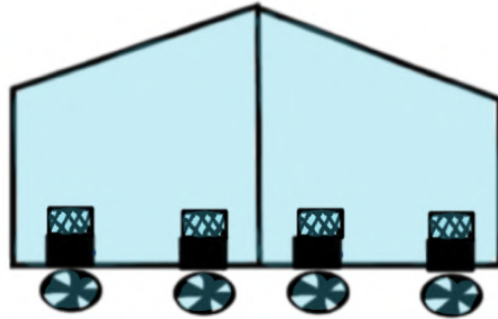
THE FUEL FILTRATION SYSTEM PREVENTS CONTAMINANTS FROM ENTERING THE WING TANKS DURING OVERWING GRAVITY REFUELING

① GRAVITY FUELING
ADAPTER

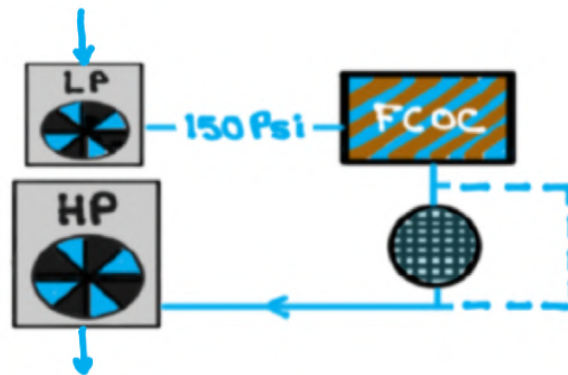


filtration is also accomplished at:

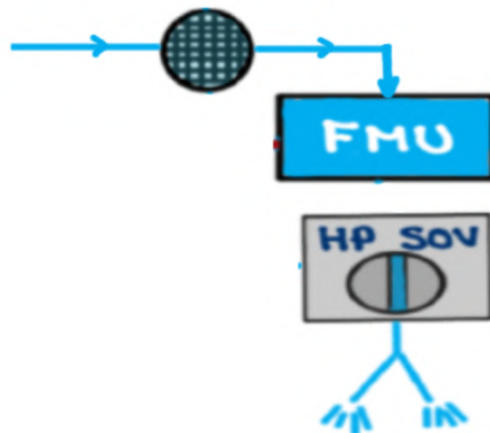
② The inlets of all four (4) boost pumps



③ Prior To The HP pump (LP filter)

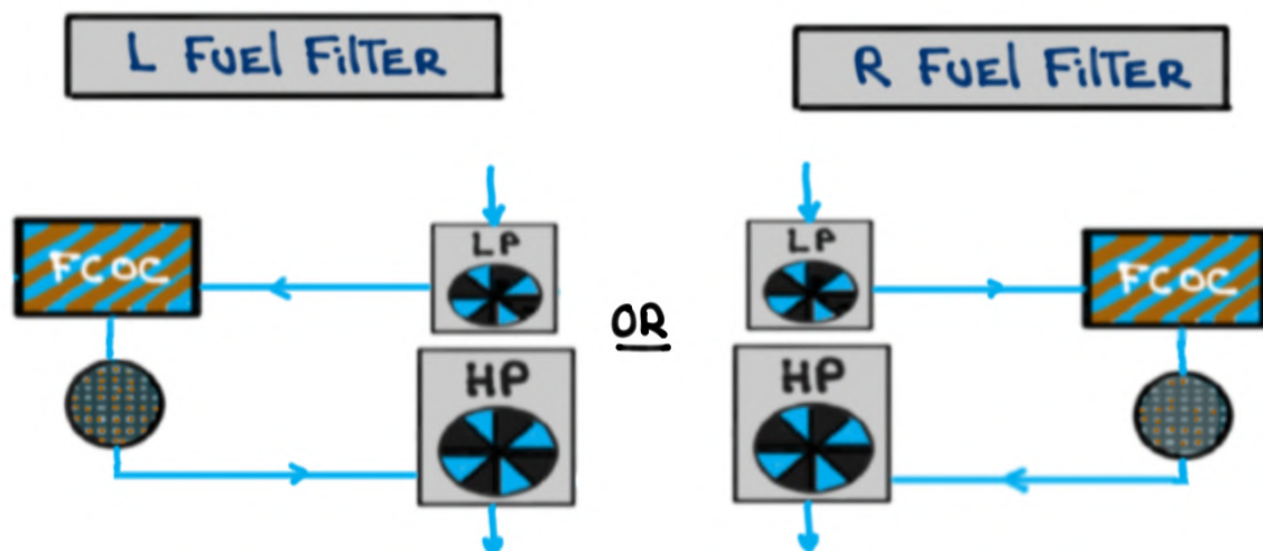


④ Prior To The FUEL METERING UNIT (FMU)



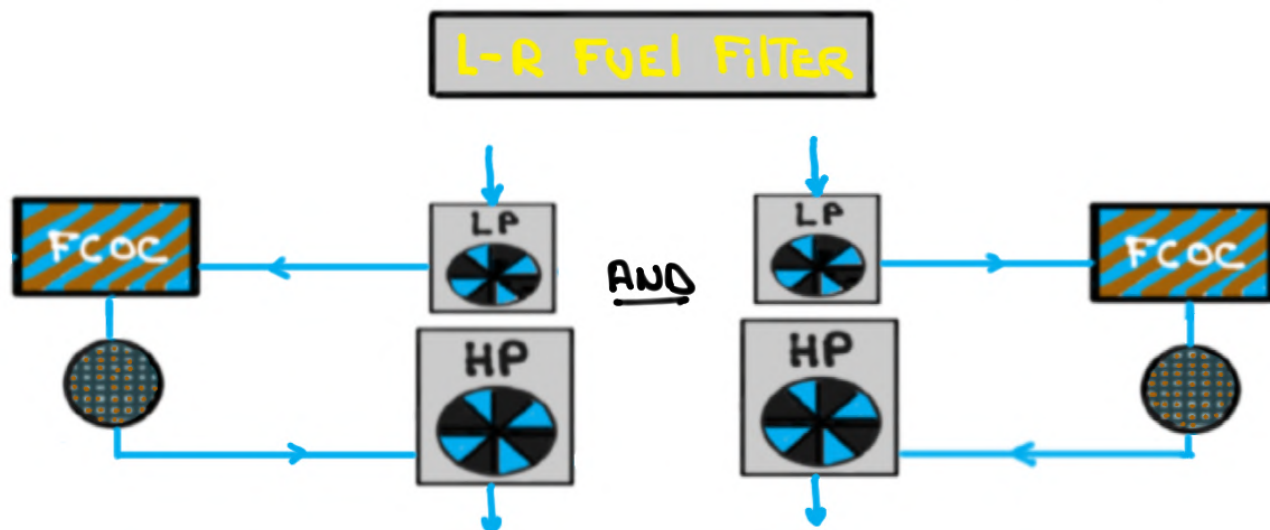
THERE IS NO BYPASS AROUND A FUEL FILTER IF IT BECOMES fully clogged

- IMPENDING FUEL FILTER BLOCKAGE IS INDICATED ENGINE



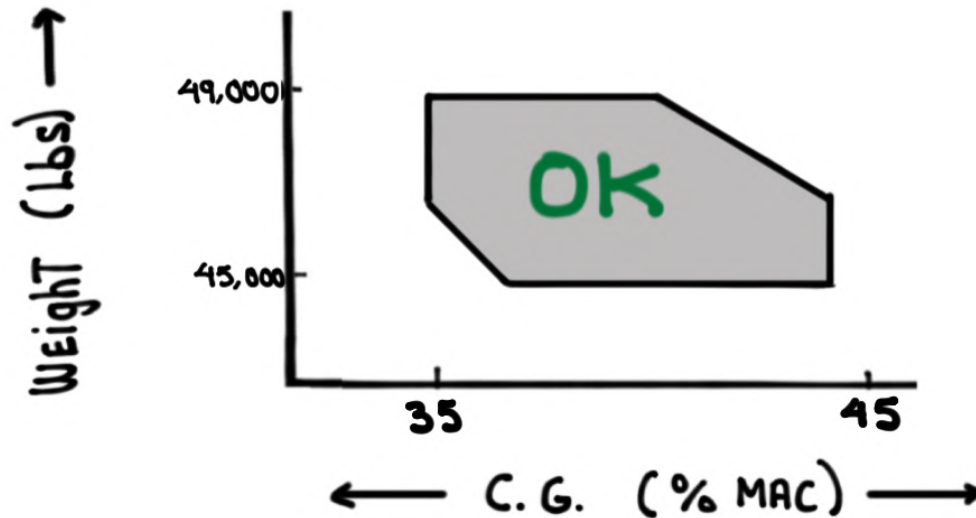
5 psi differential = Cyan CAS MESSAGE

- IMPENDING FUEL FILTER BLOCKAGE IN BOTH ENGINES



MAXIMUM ZERO FUEL WEIGHT: 49,000 lbs

ZFW C.G. ENVELOPE AFM 01-03-70

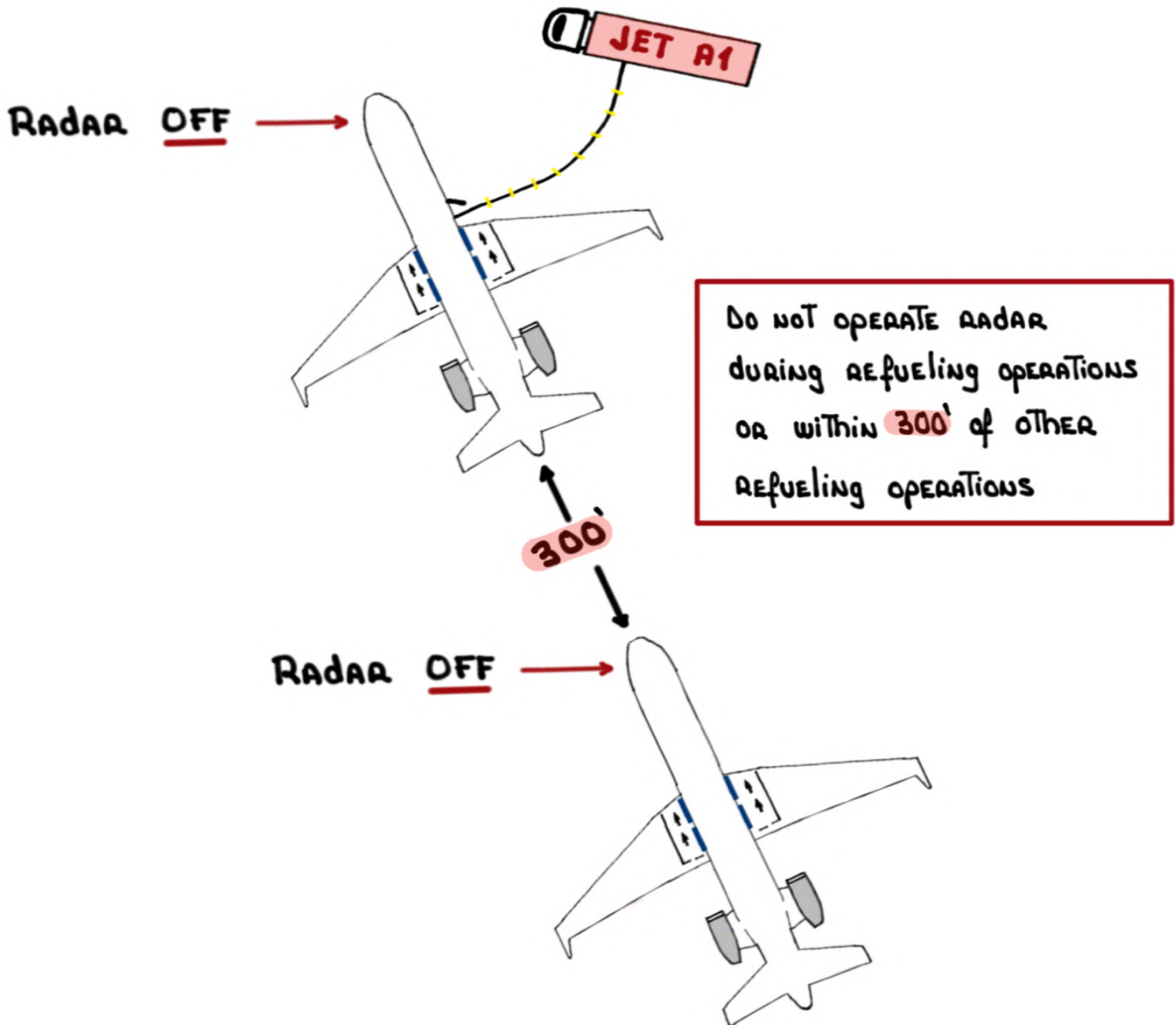


ZFW MUST BE WITHIN ZFW C.G. ENVELOPE

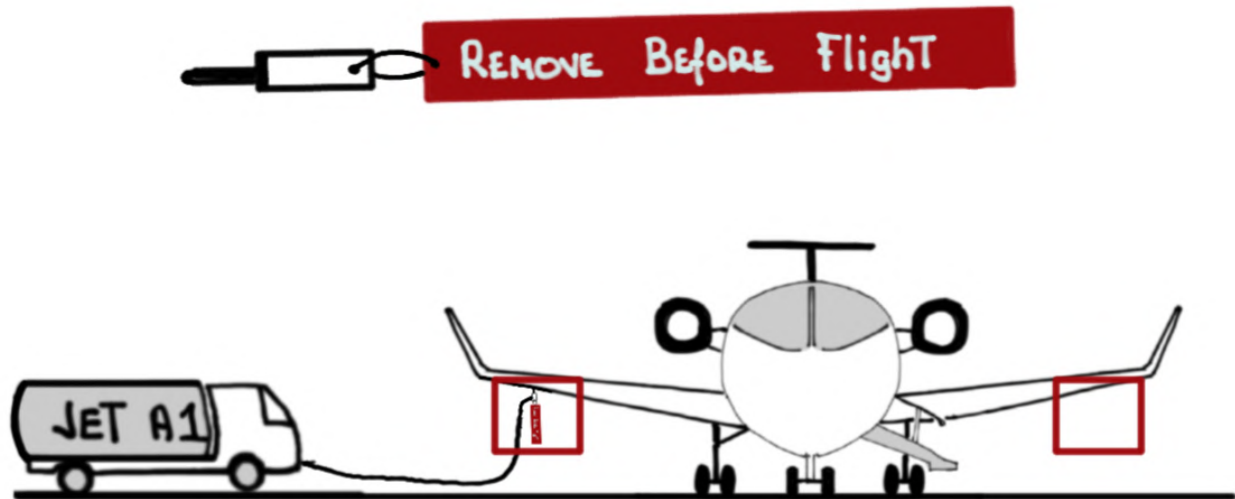
FUELED AIRPLANE C.G. WILL THEN REMAIN WITHIN
C.G. FOR:

- TAXI
- TAKEOFF
- INFLIGHT
- LANDING

FUELING OPERATIONS



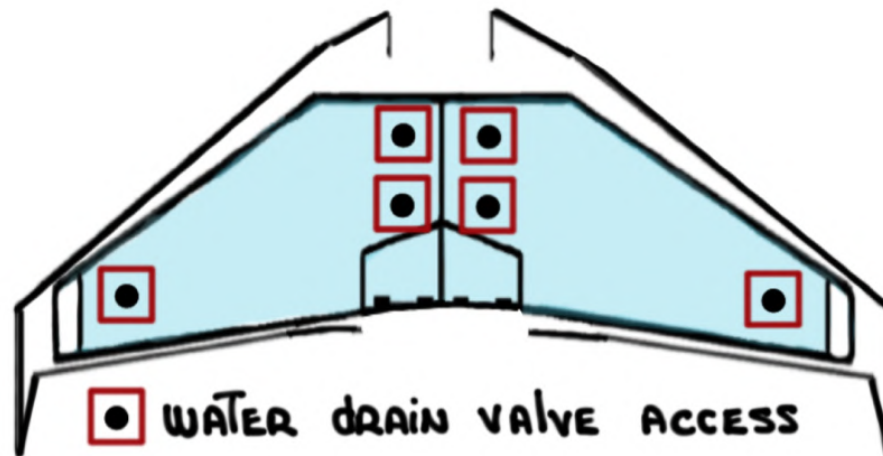
BEFORE REFUELING, ENSURE AIRPLANE IS BONDED
TO THE FUEL SOURCE



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

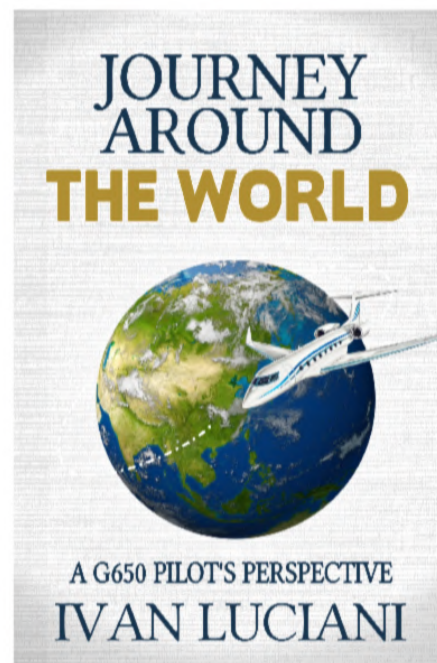
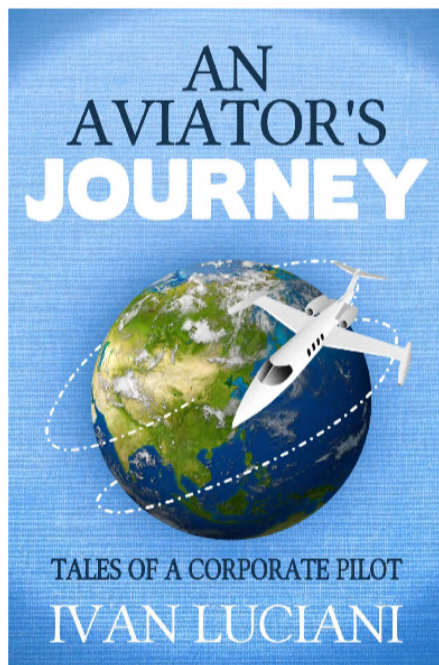


- FUEL quality check of FUEL SOURCE PRIOR TO EACH REFUELING OPERATION

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!