PREPAR3D GUIDE
PMDG 747-400

BY CHUCK
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PLATFORM: PREPAR3D V 4.2

Special thanks to Paul "Goldwolf" Whittingham for creating the guide icons.

The **Boeing 747,** nicknamed “The Queen of the Skies”, is an American wide-body commercial jet airliner and cargo aircraft, often referred to by its original nickname, "Jumbo Jet". Its distinctive "hump" upper deck along the forward part of the aircraft has made it one of the most recognizable aircraft, and it was the first wide-body airplane produced. Manufactured by Boeing's Commercial Airplane unit in the United States, the 747 was originally envisioned to have 150 percent greater capacity than the Boeing 707, a common large commercial aircraft of the 1960s. First flown commercially in 1970, the 747 held the passenger capacity record for 37 years.

In 1963 Boeing was among a group of plane makers that were competing for a military contract to build a very large transport: the CX-HLS. One of the main requirements for the military transport design was for a nose loading cargo door with clear access to the main deck. The Boeing design featured a bubble atop the fuselage forward of the wing leading edge. The contract went to Lockheed and General Electric to build what was to become the C5 Galaxy. During this time, commercial aviation was growing at a rapid pace. The jet age was finding its feet with the very popular Boeing 707 and Douglas DC8 being the workhorses of the day. Juan Trippe of Pan Am, one of Boeings biggest customers, approached Boeing to press them look at building an aircraft twice the size of the 707 and DC8.

Trippe advocated that a larger aircraft would be the solution to the congestion at airports, reducing the number of relatively smaller aircraft required to move the same amount of people. In 1965 Boeing put together a design team to work on the new airliner which was already given the Boeing 747 designation. The proposal Boeing had put forward for the military transport, the CX-HLS, was taken as a start point. Some features were retained, but others such as the high wing design were discarded. The design also had to be future proof. At this time in aviation, it was felt that supersonic travel had every chance of becoming the norm, so Boeing had to take an each way bet. The design team for the Boeing 747 had to come up with an aircraft that met the requirements of airlines who wanted mass passenger movement, but at the same time had the ability to be an effective freighter.

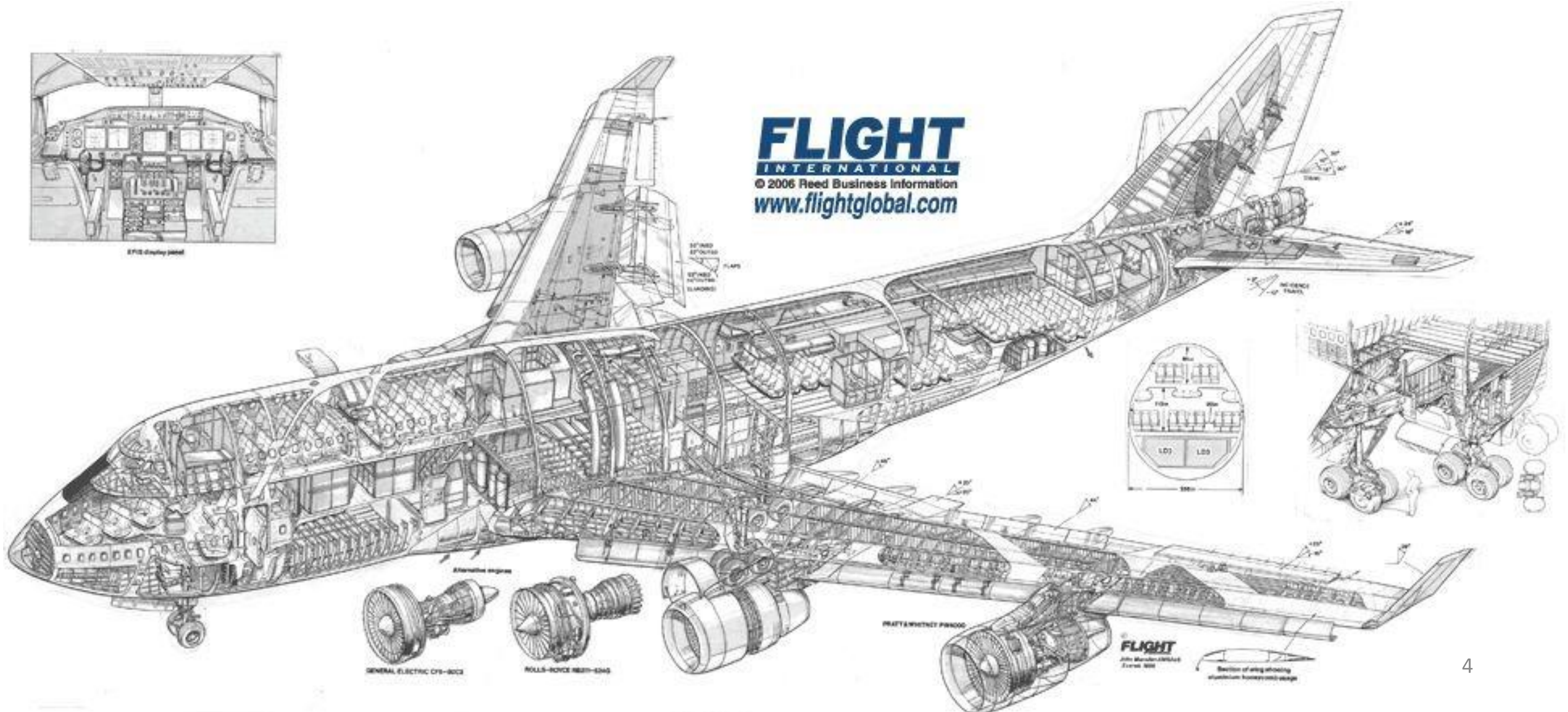
One of main enablers that made such a larger aircraft possible was the advent of high bypass turbofan engines. General Electric had applied the principal to the C5 Galaxy project. The high bypass turbofan delivered twice the power of turbojets which were in use at the time, and used one third less fuel. Pratt and Whitney were also working on this concept and in 1966 Pan AM, Boeing and Pratt and Whitney agreed to develop the JT9D as the powerhouse for the 747. However, the variants simulated by PMDG are more modern and include the Rolls-Royce RB211-524, General Electric CF6-80C2B1F and Pratt & Whitney PW4056 turbofan engines.

747-400F (Cargo Version)

747 Prototype (1968)

The four-engine 747 uses a double-deck configuration for part of its length and is available in passenger, freighter and other versions. Boeing designed the 747's hump-like upper deck to serve as a first–class lounge or extra seating, and to allow the aircraft to be easily converted to a cargo carrier by removing seats and installing a front cargo door. The 747-400, the most common variant in service, has a high-subsonic cruise speed of Mach 0.85–0.855 (up to 570 mph or 920 km/h) with an intercontinental range of 7,260 nautical miles (8,350 statute miles or 13,450 km). The 747-400 can accommodate 416 passengers in a typical three-class layout, 524 passengers in a typical two-class layout, or 660 passengers in a high–density one-class configuration.

Boeing expected supersonic airliners—the development of which was announced in the early 1960s—to render the 747 and other subsonic airliners obsolete, while the demand for subsonic cargo aircraft would remain robust well into the future. Though the 747 was expected to become obsolete after 400 were sold, it exceeded critics' expectations with production surpassing 1,000 in 1993. By June 2018, 1,545 aircraft had been built.



The 747 is just an incredible aircraft to fly. It feels heavy and does definitely *not* turn on a dime. The 747 requires careful planning during approaches. The engines are big and powerful, but keep in mind that their response time is longer than you might think.

As Chuck Jodry said on AVSIM in his review of the PMDG 747: "As you line up the 747 for takeoff, the thrill of flight slowly intensifies as you apply takeoff power and watch as this majestic aircraft gradually thunders down the runway before gracefully lifting off into the skies above. With outstanding sound quality and cockpit shaking effects, you can't help but for a brief moment to feel that you're a real 747 captain. Although a large aircraft of this nature will typically fly on autopilot after the landing gear is retracted, the QOTS II is an aircraft that encourages the user to fly by hand due to its smooth and outstanding flying characteristics. Even with the autopilot turned on; this aircraft gracefully handles adverse weather and is always smooth when responding to any autopilot input by the pilot."

TUTORIAL STRUCTURE

Before you even step foot in your virtual cockpit, you need to know where you are, where you are going, how you will get there, what you need to get there. This document is structured like a short tutorial flight.

The flight tutorial is structured as follows:

- Familiarize yourself with the cockpit layout
- Plan your flight
    - Determine the flight route, fuel & cargo loads
    - Spawn the aircraft and set it in a Cold & Dark state
    - Provide aircraft with power
    - Program the FMC (Flight Management Computer)
- Start–up the aircraft and make it ready for flight
- Taxi
- Takeoff
- Climb and cruise
- Explore autopilot capabilities
- Descend, approach and land

BEST RESOURCES

DISCLAIMER: Do not use this guide for real life flying. I mean it.

PMDG 747 FCOM (Flight Crew Operations Manual)

PMDG Documentation Downloads Section
https://www.precisionmanuals.com/pages/downloads/docs.html

747-441 Operations Manual
http://landrover.narod.ru/gershon/AIRPLANTANK/747-400_operations_manual.pdf

Boeing 747-400F CBT (Computer Based Training)
https://www.youtube.com/watch?v=jIuOOzSinhE&list=PLpNS2WzxM5y3ib-zSVe4nxTZoPD1DKUZA

Jet A1 747 Pilot – PMDG 747 Tutorial (Three Parts) (Youtube)
Part 1: https://www.youtube.com/watch?v=hcH1vfjH5Eo
Part 2: https://youtu.be/1UTzyfI2BUg?list=PLDez55ieLLnMZ_qgQIBlqgmKNE7XQQrUI
Part 3: https://youtu.be/zJDh53IuSG8?list=PLDez55ieLLnMZ_qgQIBlqgmKNE7XQQrUI

747 Flight Deck (Jerome Meriweather)
http://meriweather.com/flightdeck/747/deck-747.html


FLOTATION CUSHION
PULL TO REMOVE


SPARE BULBS
SMOKE GOGGLES
FLOTATION CUSHION
PULL TO REMOVE


Front Flight Deck


Academic License
Utility Lamp
Oxygen Mask Test Switch
Audio Select Panel
Oxygen Mask
RESET
TEST
100%
PUSH
OXYGEN
MASK
SPKR
APP
MKR
VOR
INT


Academic License
Window Heater
Window Heater
Utility Lamp

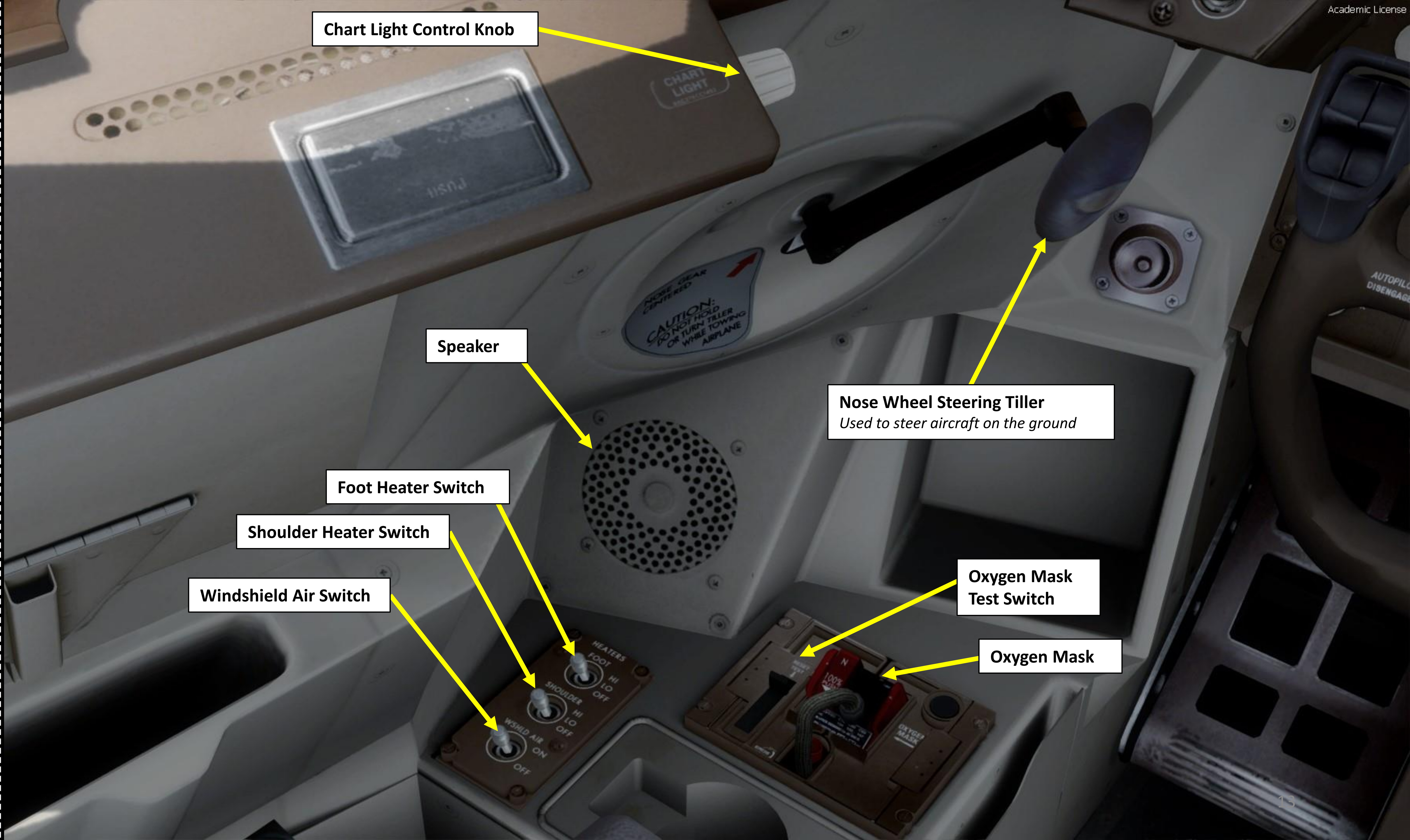
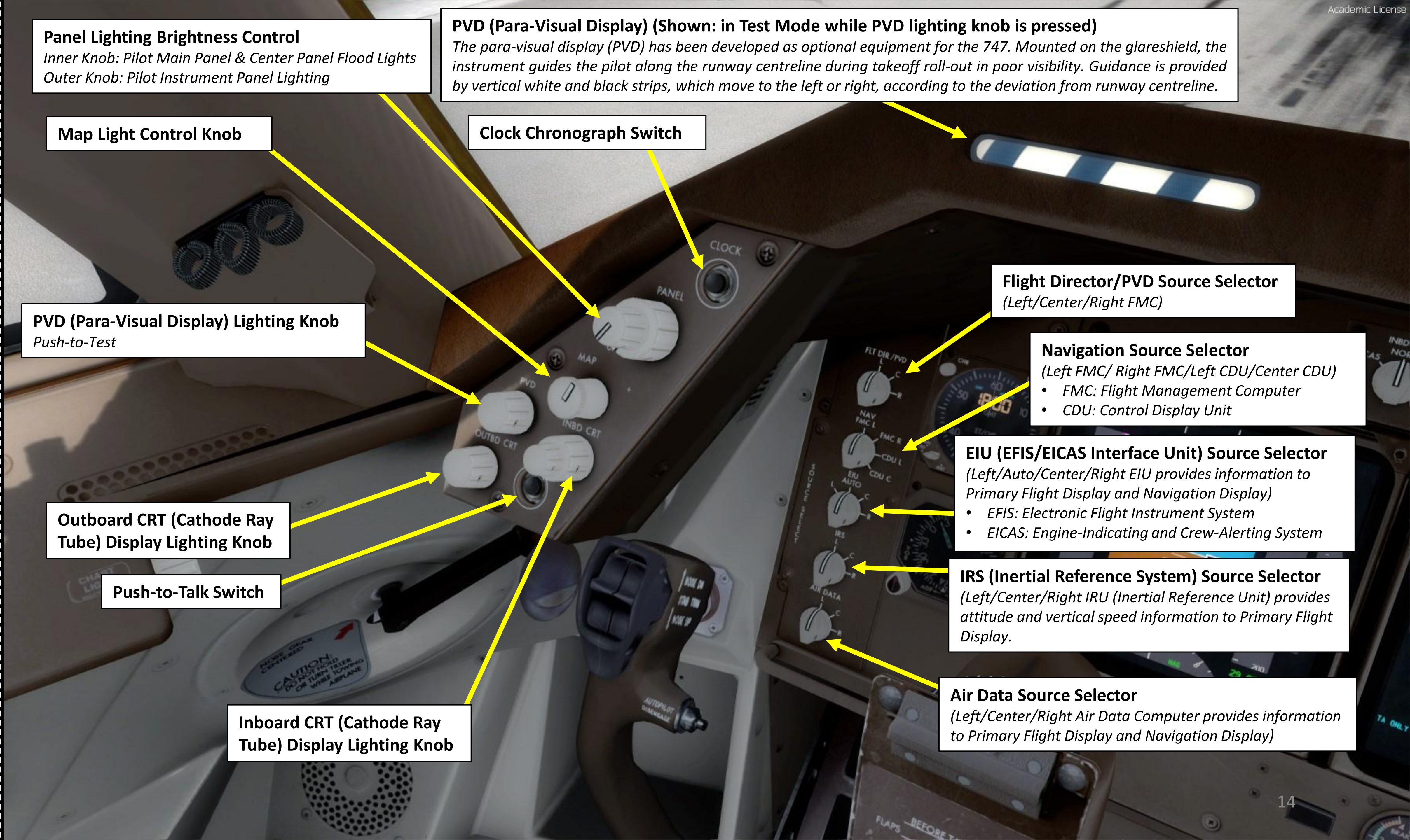
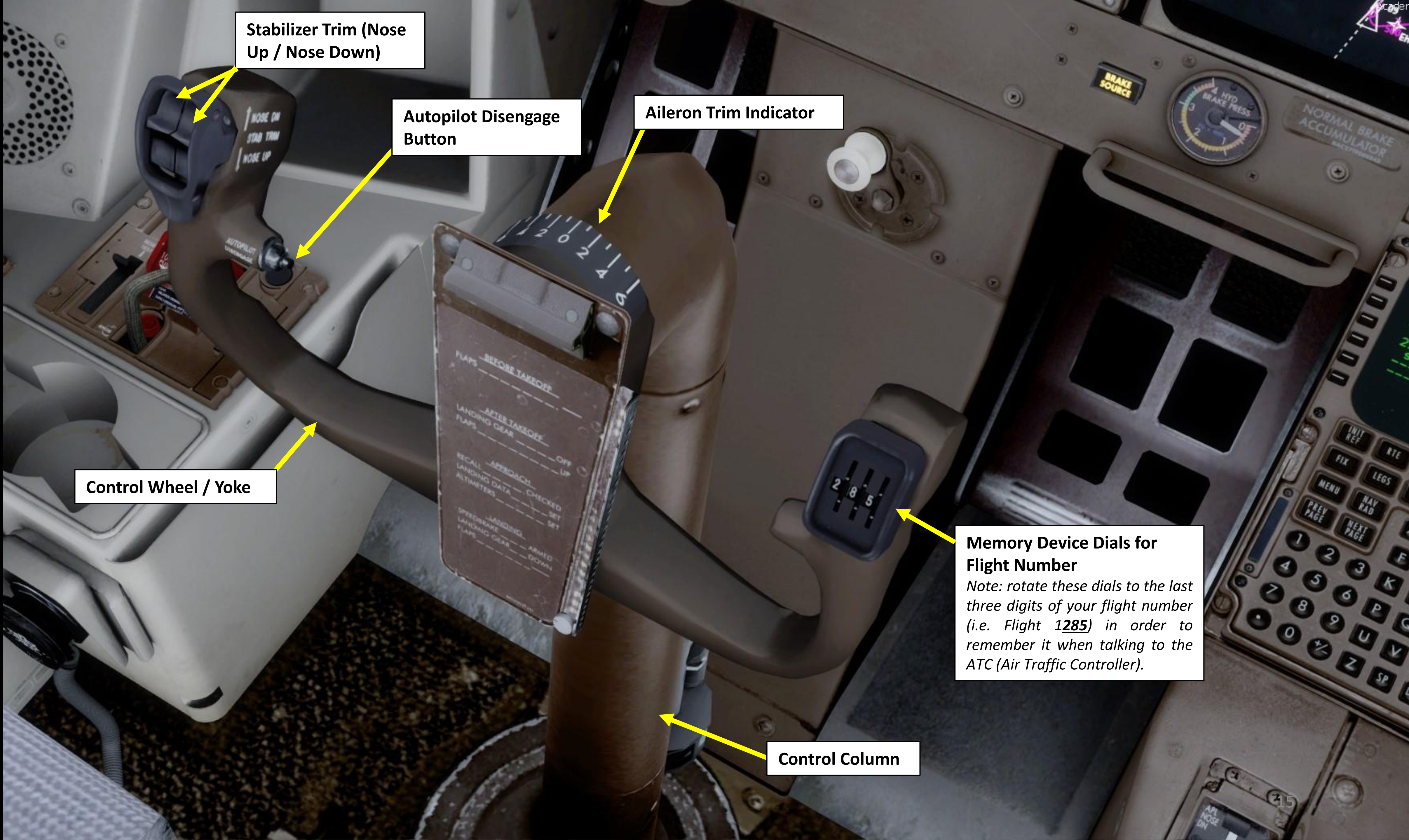
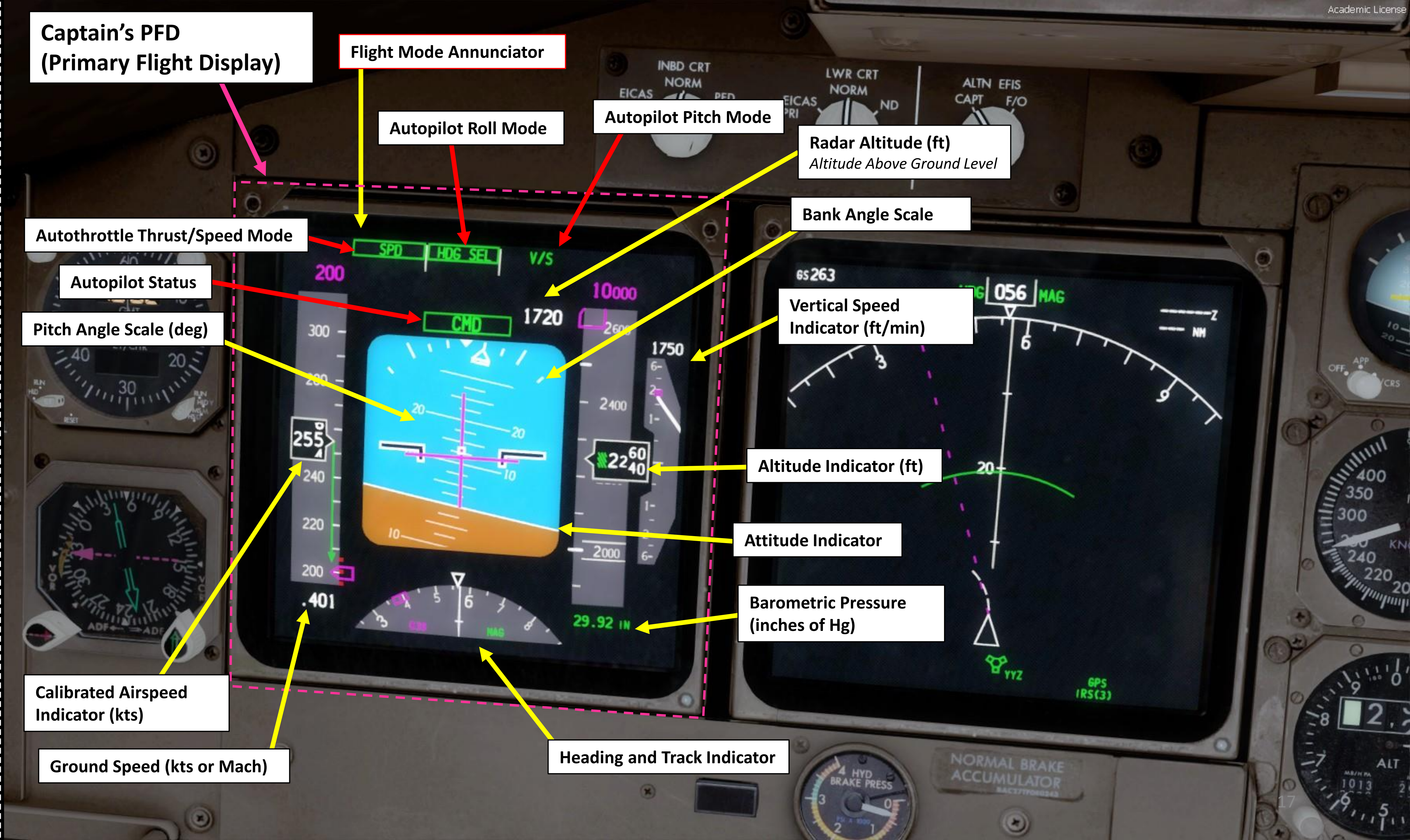


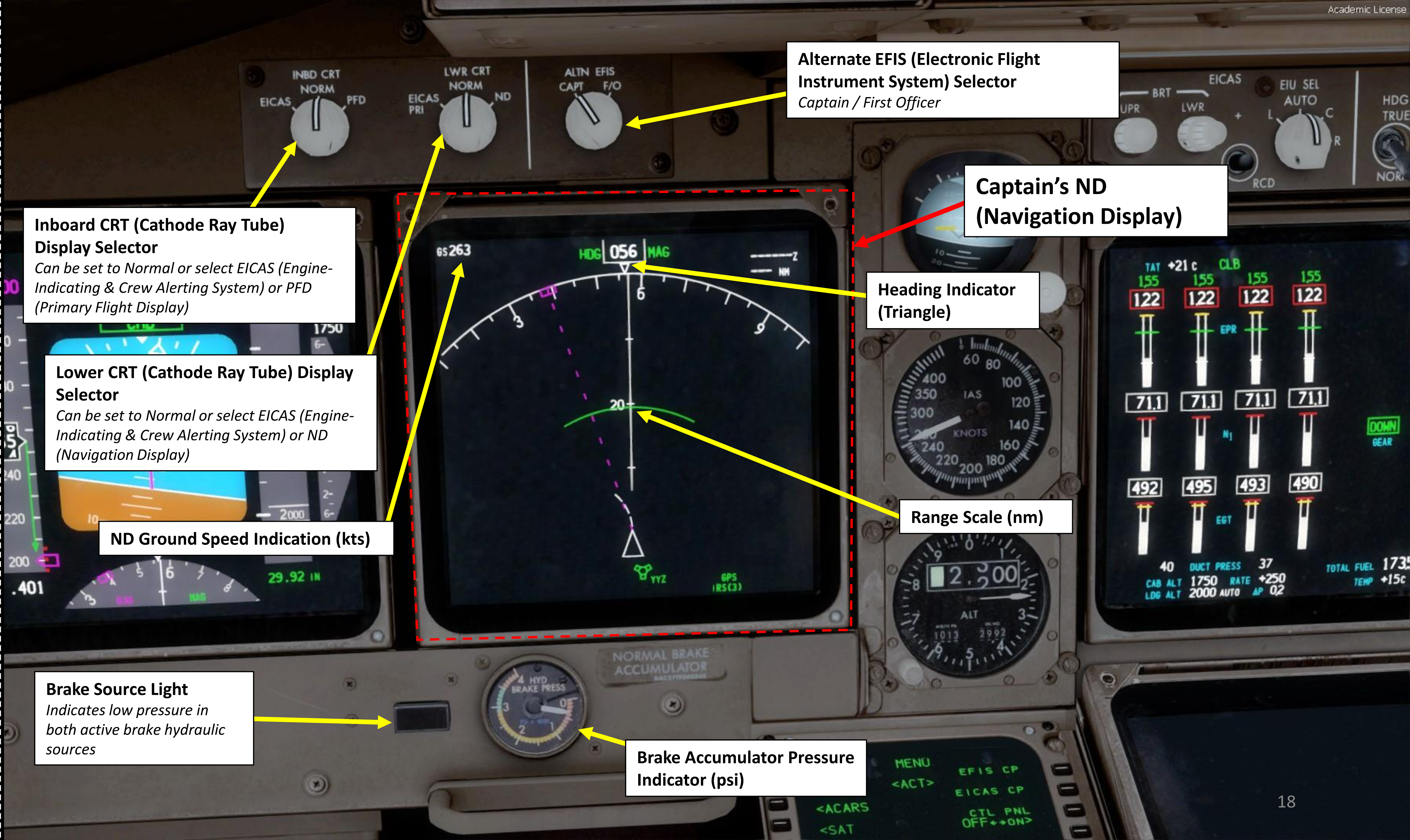
Chart Light Control Knob
Speaker
Nose Wheel Steering Tiller
Used to steer aircraft on the ground
Foot Heater Switch
Shoulder Heater Switch
Windshield Air Switch
Oxygen Mask Test Switch
Oxygen Mask
CHART LIGHT
CAUTION: DO NOT HOLD OR TURN TILLER WHILE TOWING AIRPLANE
NOSE GEAR CENTERED
HEATERS
FOOT
HI
LO
OFF
SHOULDER
HI
LO
OFF
WSHLD AIR
ON
OFF
OXYGEN MASK
N
100%
AUTOPILOT DISENGAGE


Academic License
Panel Lighting Brightness Control
Inner Knob: Pilot Main Panel & Center Panel Flood Lights
Outer Knob: Pilot Instrument Panel Lighting
PVD (Para-Visual Display) (Shown: in Test Mode while PVD lighting knob is pressed)
The para-visual display (PVD) has been developed as optional equipment for the 747. Mounted on the glareshield, the instrument guides the pilot along the runway centreline during takeoff roll-out in poor visibility. Guidance is provided by vertical white and black strips, which move to the left or right, according to the deviation from runway centreline.
Map Light Control Knob
Clock Chronograph Switch
PVD (Para-Visual Display) Lighting Knob
Push-to-Test
Flight Director/PVD Source Selector
(Left/Center/Right FMC)
Navigation Source Selector
(Left FMC/ Right FMC/Left CDU/Center CDU)
- *FMC: Flight Management Computer*
- *CDU: Control Display Unit*
EIU (EFIS/EICAS Interface Unit) Source Selector
(Left/Auto/Center/Right EIU provides information to Primary Flight Display and Navigation Display)
- *EFIS: Electronic Flight Instrument System*
- *EICAS: Engine-Indicating and Crew-Alerting System*
Outboard CRT (Cathode Ray Tube) Display Lighting Knob
Push-to-Talk Switch
IRS (Inertial Reference System) Source Selector
(Left/Center/Right IRU (Inertial Reference Unit) provides attitude and vertical speed information to Primary Flight Display.
Inboard CRT (Cathode Ray Tube) Display Lighting Knob
Air Data Source Selector
(Left/Center/Right Air Data Computer provides information to Primary Flight Display and Navigation Display)
CLOCK
PANEL
MAP
PVD
INBD CRT
OUTBD CRT
FLT DIR /PVD
NAV
EIU
AUTO
IRS
AIR DATA
CAUTION
AUTOPILOT DISENGAGE


Stabilizer Trim (Nose Up / Nose Down)
Autopilot Disengage Button
Aileron Trim Indicator
Control Wheel / Yoke
Memory Device Dials for Flight Number
Note: rotate these dials to the last three digits of your flight number (i.e. Flight 1__285__) in order to remember it when talking to the ATC (Air Traffic Controller).
Control Column


Clock
Lubber Line
Your current heading
VOR1/ADF1 Needle
VOR2/ADF2 Needle
VOR1/ADF1 Selector
VOR2/ADF2 Selector
Compass RMI (Radio Magnetic Indicator)


Captain's PFD
(Primary Flight Display)
Flight Mode Annunciator
Autopilot Roll Mode
Autopilot Pitch Mode
Radar Altitude (ft)
Altitude Above Ground Level
Bank Angle Scale
Autothrottle Thrust/Speed Mode
Autopilot Status
Pitch Angle Scale (deg)
Vertical Speed
Indicator (ft/min)
Altitude Indicator (ft)
Attitude Indicator
Barometric Pressure
(inches of Hg)
Calibrated Airspeed
Indicator (kts)
Ground Speed (kts or Mach)
Heading and Track Indicator



Alternate EFIS (Electronic Flight Instrument System) Selector
Captain / First Officer

Inboard CRT (Cathode Ray Tube) Display Selector
Can be set to Normal or select EICAS (Engine-Indicating & Crew Alerting System) or PFD (Primary Flight Display)

Captain's ND (Navigation Display)

Heading Indicator (Triangle)

Lower CRT (Cathode Ray Tube) Display Selector
Can be set to Normal or select EICAS (Engine-Indicating & Crew Alerting System) or ND (Navigation Display)

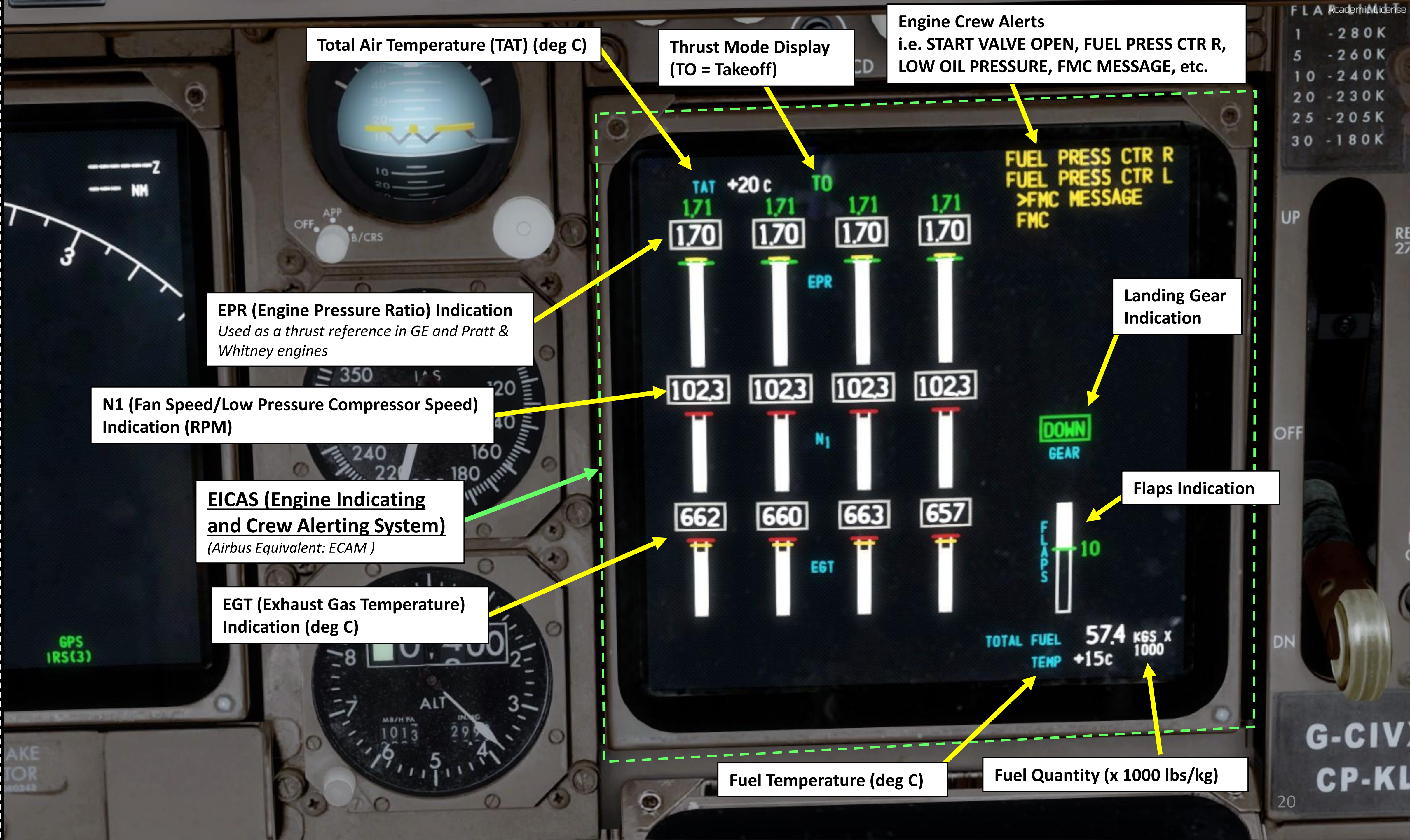
Range Scale (nm)

ND Ground Speed Indication (kts)

Brake Source Light
Indicates low pressure in both active brake hydraulic sources

Brake Accumulator Pressure Indicator (psi)


Standby Attitude Indicator
Standby Airspeed Indicator (kts)
Standby Altitude Indicator (ft)


Total Air Temperature (TAT) (deg C)
Thrust Mode Display
(TO = Takeoff)
Engine Crew Alerts
i.e. START VALVE OPEN, FUEL PRESS CTR R, LOW OIL PRESSURE, FMC MESSAGE, etc.
EPR (Engine Pressure Ratio) Indication
Used as a thrust reference in GE and Pratt & Whitney engines
N1 (Fan Speed/Low Pressure Compressor Speed) Indication (RPM)
Landing Gear Indication
Flaps Indication
EICAS (Engine Indicating and Crew Alerting System)
(Airbus Equivalent: ECAM)
EGT (Exhaust Gas Temperature) Indication (deg C)
Fuel Temperature (deg C)
Fuel Quantity (x 1000 lbs/kg)
TAT +20c
TO
FUEL PRESS CTR R
FUEL PRESS CTR L
>FMC MESSAGE
FMC
EPR
N1
EGT
DOWN
GEAR
FLAPS
10
TOTAL FUEL 57.4 KGS X 1000
TEMP +15c

EPR OR N1? WHAT? WHY? HOW?!?

You may be wondering… but why would an engine use different units for power settings like N1 and EPR?

Pratt & Whitney and Rolls-Royce use the Engine Pressure Ratio (EPR) for engines like the PW4056, while GE Aviation (General Electric) uses the engine Fan Speed (N1) for engines like the CF6. This difference originates from the way the two companies want the pilot to define his thrust reference.

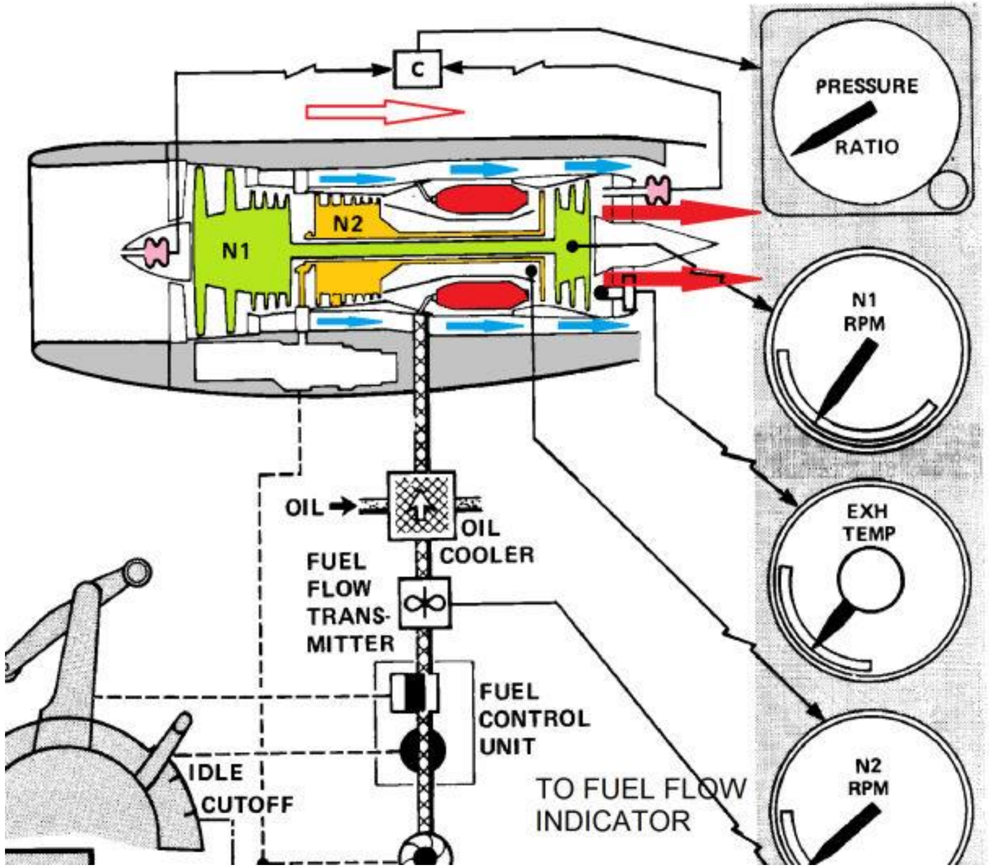
EPR is defined as the ratio between the pressure at the engine outlet and the engine inlet, and is dependent on the prevailing atmospheric conditions as pressure is affected by temperature and aircraft altitude.

- This is a somewhat more accurate indication of thrust reference since it's the result of simple physics: Thrust = Pressure x Area of Application.
  No matter the condition of the engine, a given EPR in the same atmospheric conditions is guaranteed to deliver the same amount of thrust.
- EPR relies on two pitot probes, and they are susceptible to foreign object damage, such as insects, icing, clogging… which can lead to faulty EPR readings. In multi-spool engines, there is also an issue of stability in control of thrust since filtering of noise from sensors delays response time.

N1 is defined as the speed of the engine compressor or fan, which is independent of the prevailing local atmospheric conditions.

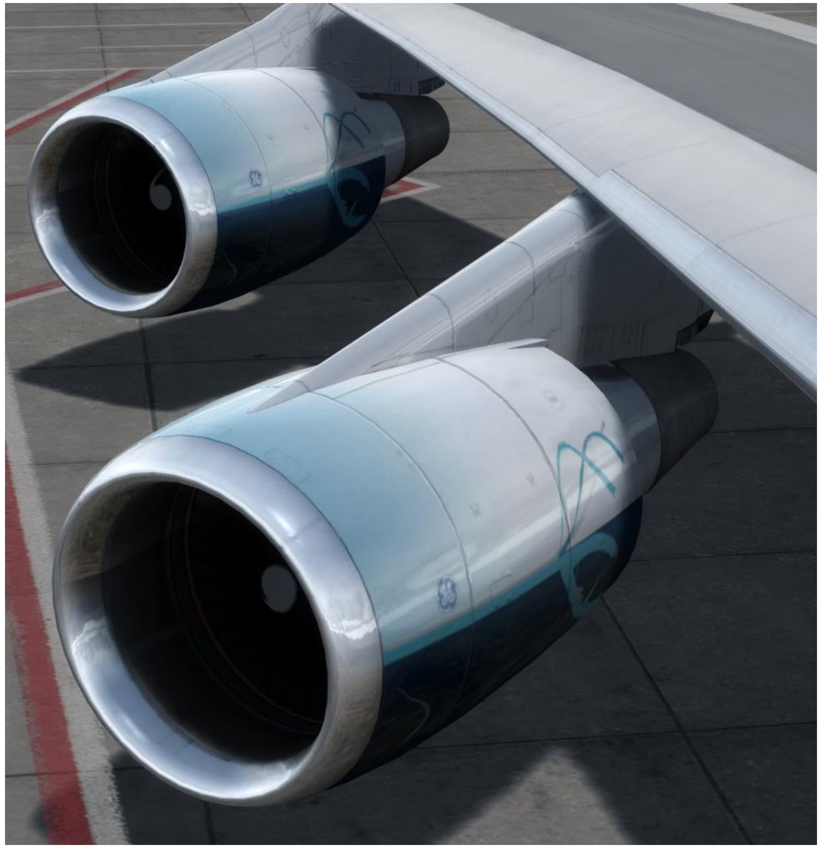
- The N1 sensors are not prone to failure, are more reliable and provide a much better response time. The measurement of speed is a lot more accurate, which allows for excellent stability in control. The N readings do not fluctuate with atmospheric variations, unlike EPR. For this reason, when penetrating a turbulent region in flight, N1 values are used as reference, even if EPR readings are available.
- N1 is a less accurate indication of thrust since it does not take into account engine degradation, which can generate less thrust for the same N1 . However, the presence of an N1 indication can allow the crew to recognize performance degradation.

Check out "The Flying Engineer" website for more information:
http://theflyingengineer.com/flightdeck/cockpit-design-epr-vs-n1-indication/

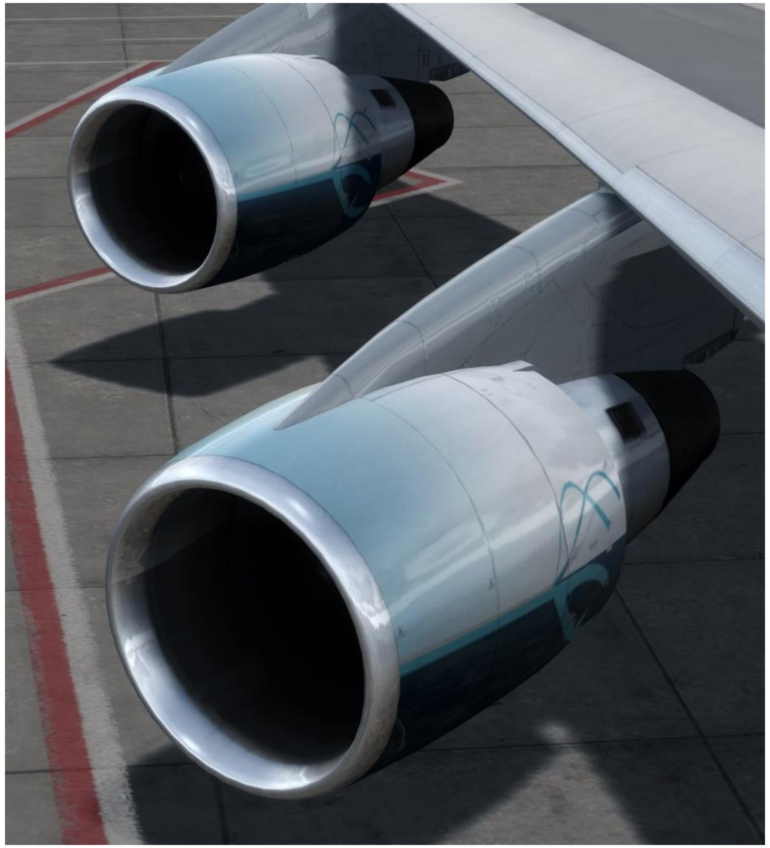


ENGINE TYPES INSTALLED ON THE 747-400

GENERAL ELECTRIC CF6-80C2B1F ENGINE



PRATT & WHITNEY PW4056 ENGINE

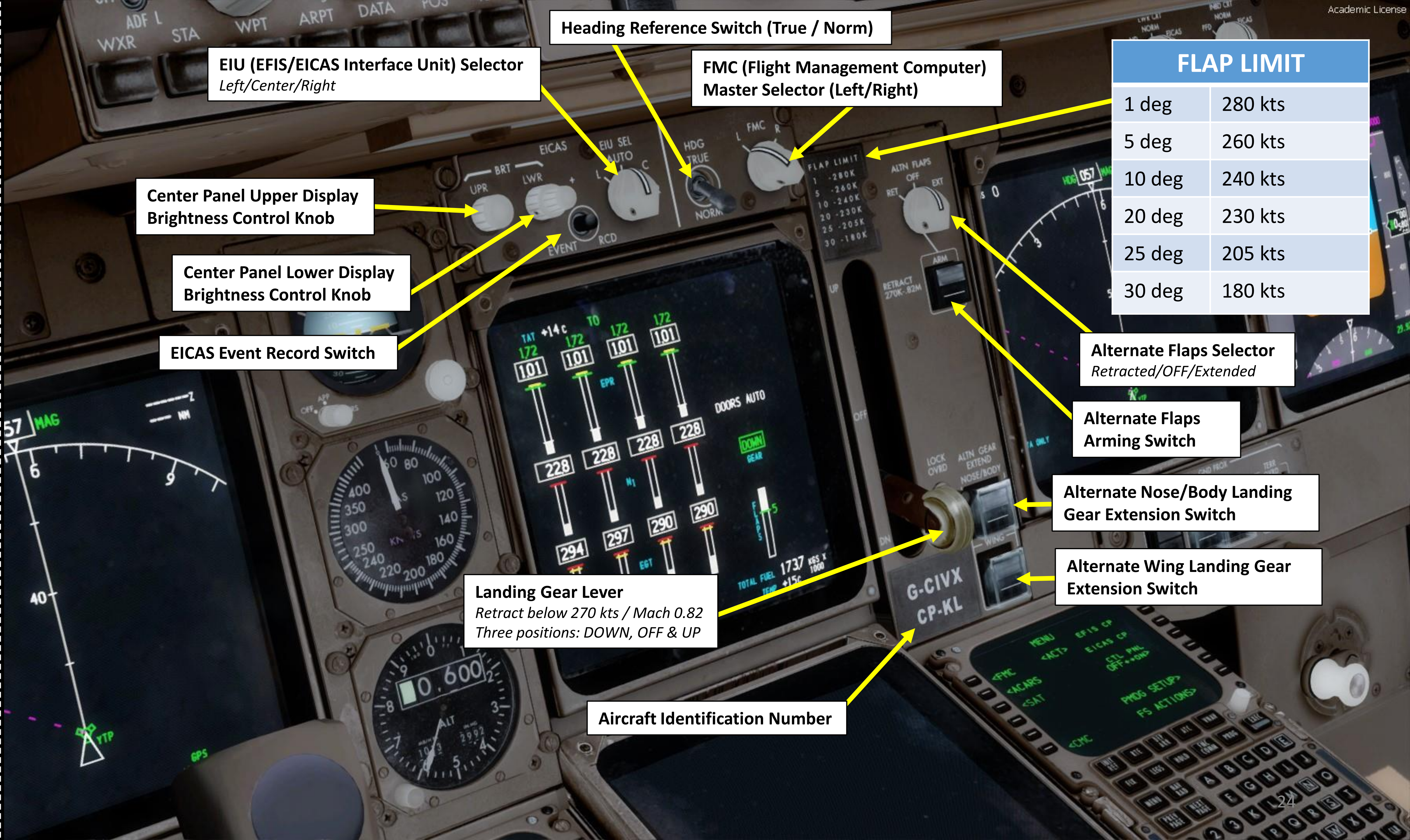


ROLLS-ROYCE RB211-524 ENGINE

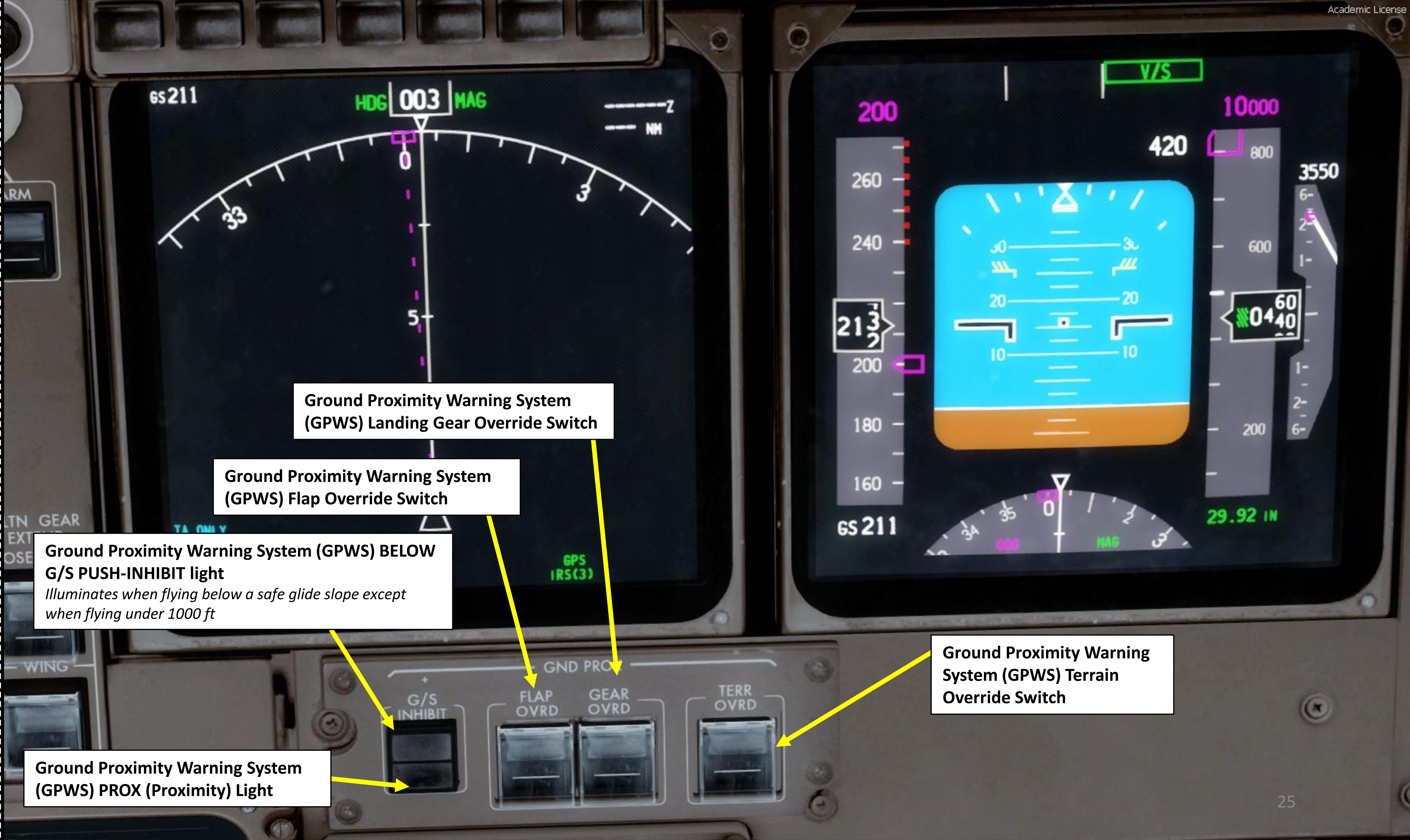
GENERAL ELECTRIC CF6-80C2B1F ENGINE

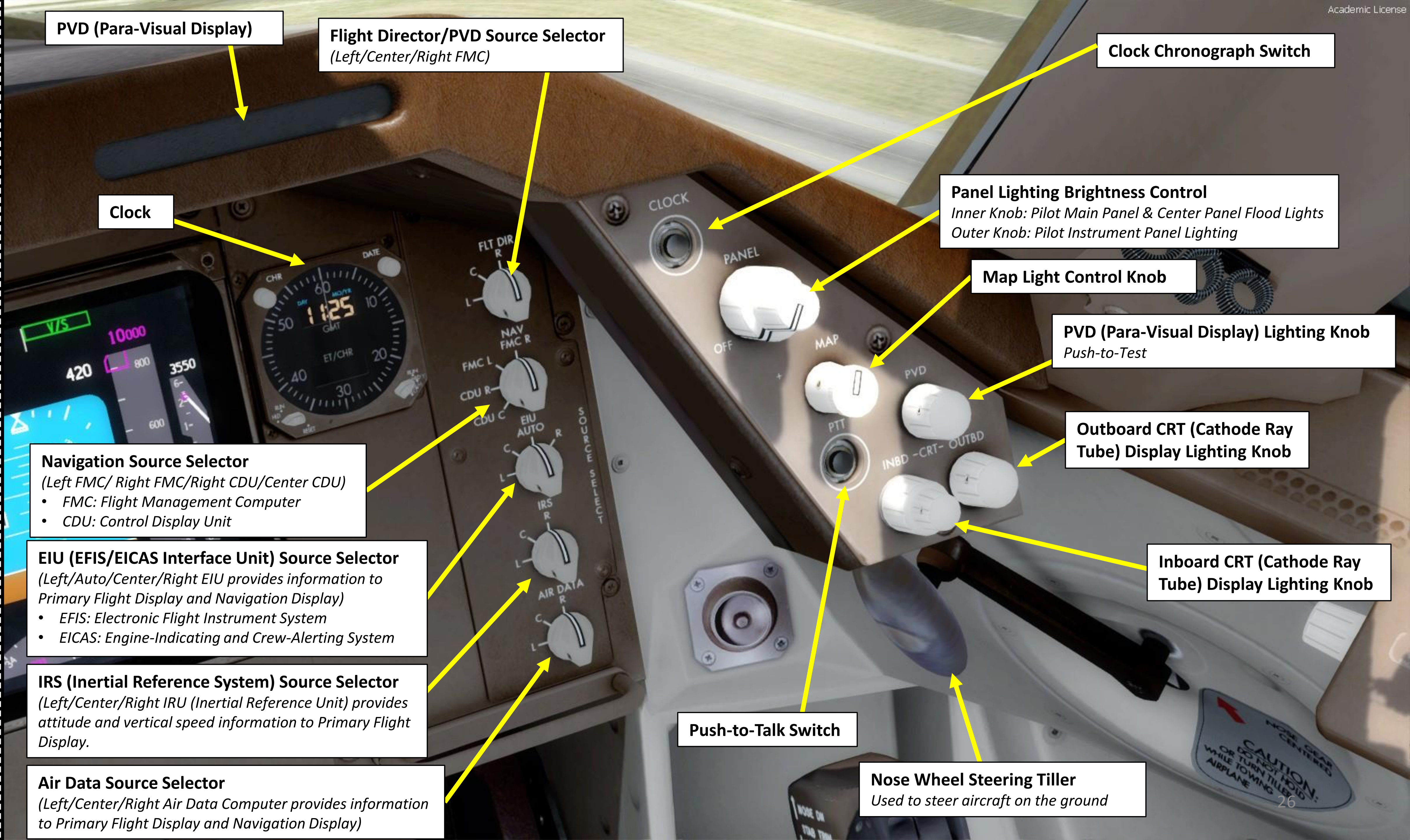
PRATT & WHITNEY PW4056 ENGINE

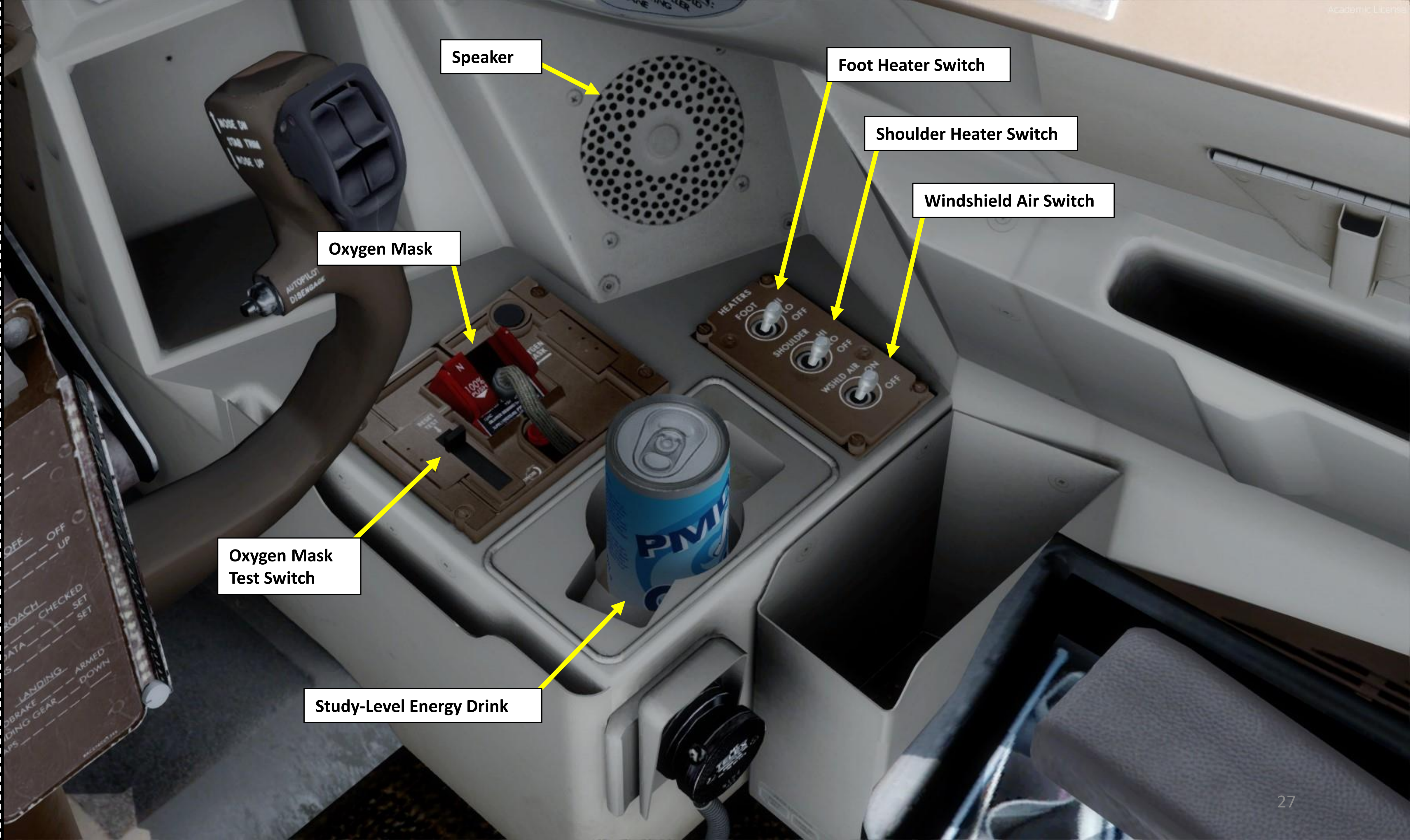
ROLLS-ROYCE RB211-524 ENGINE

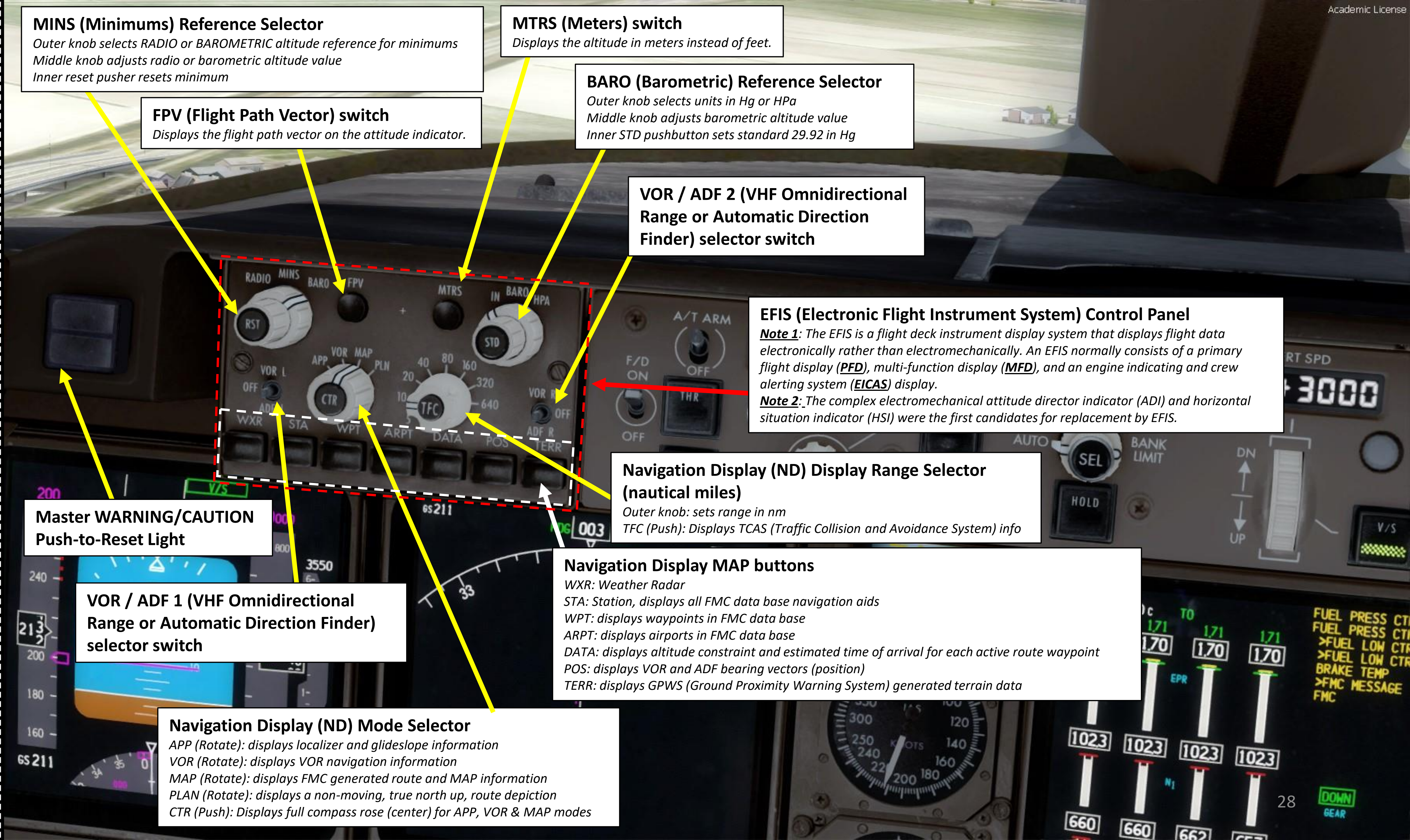


FLAP LIMIT	
1 deg	280 kts
5 deg	260 kts
10 deg	240 kts
20 deg	230 kts
25 deg	205 kts
30 deg	180 kts


Ground Proximity Warning System (GPWS) Landing Gear Override Switch
Ground Proximity Warning System (GPWS) Flap Override Switch
Ground Proximity Warning System (GPWS) BELOW G/S PUSH-INHIBIT light
Illuminates when flying below a safe glide slope except when flying under 1000 ft
Ground Proximity Warning System (GPWS) PROX (Proximity) Light
Ground Proximity Warning System (GPWS) Terrain Override Switch
G/S INHIBIT
FLAP OVRD
GEAR OVRD
TERR OVRD


PVD (Para-Visual Display)
Flight Director/PVD Source Selector
(Left/Center/Right FMC)
Clock Chronograph Switch
Clock
Panel Lighting Brightness Control
Inner Knob: Pilot Main Panel & Center Panel Flood Lights
Outer Knob: Pilot Instrument Panel Lighting
Map Light Control Knob
PVD (Para-Visual Display) Lighting Knob
Push-to-Test
Outboard CRT (Cathode Ray Tube) Display Lighting Knob
Navigation Source Selector
(Left FMC/ Right FMC/Right CDU/Center CDU)
• FMC: Flight Management Computer
• CDU: Control Display Unit
EIU (EFIS/EICAS Interface Unit) Source Selector
(Left/Auto/Center/Right EIU provides information to Primary Flight Display and Navigation Display)
• EFIS: Electronic Flight Instrument System
• EICAS: Engine-Indicating and Crew-Alerting System
Inboard CRT (Cathode Ray Tube) Display Lighting Knob
IRS (Inertial Reference System) Source Selector
(Left/Center/Right IRU (Inertial Reference Unit) provides attitude and vertical speed information to Primary Flight Display.
Push-to-Talk Switch
Air Data Source Selector
(Left/Center/Right Air Data Computer provides information to Primary Flight Display and Navigation Display)
Nose Wheel Steering Tiller
Used to steer aircraft on the ground
CLOCK
PANEL
OFF
MAP
PVD
PTT
INBD -CRT- OUTBD
FLT DIR
NAV
EIU
IRS
AIR DATA
SOURCE SELECT
CAUTION
Academic License


Speaker
Foot Heater Switch
Shoulder Heater Switch
Windshield Air Switch
Oxygen Mask
Oxygen Mask Test Switch
Study-Level Energy Drink



MINS (Minimums) Reference Selector
Outer knob selects RADIO or BAROMETRIC altitude reference for minimums
Middle knob adjusts radio or barometric altitude value
Inner reset pusher resets minimum

MTRS (Meters) switch
Displays the altitude in meters instead of feet.

FPV (Flight Path Vector) switch
Displays the flight path vector on the attitude indicator.

BARO (Barometric) Reference Selector
Outer knob selects units in Hg or HPa
Middle knob adjusts barometric altitude value
Inner STD pushbutton sets standard 29.92 in Hg

VOR / ADF 2 (VHF Omnidirectional Range or Automatic Direction Finder) selector switch

EFIS (Electronic Flight Instrument System) Control Panel
__Note 1__: The EFIS is a flight deck instrument display system that displays flight data electronically rather than electromechanically. An EFIS normally consists of a primary flight display (__PFD__), multi-function display (__MFD__), and an engine indicating and crew alerting system (__EICAS__) display.
__Note 2__: The complex electromechanical attitude director indicator (ADI) and horizontal situation indicator (HSI) were the first candidates for replacement by EFIS.

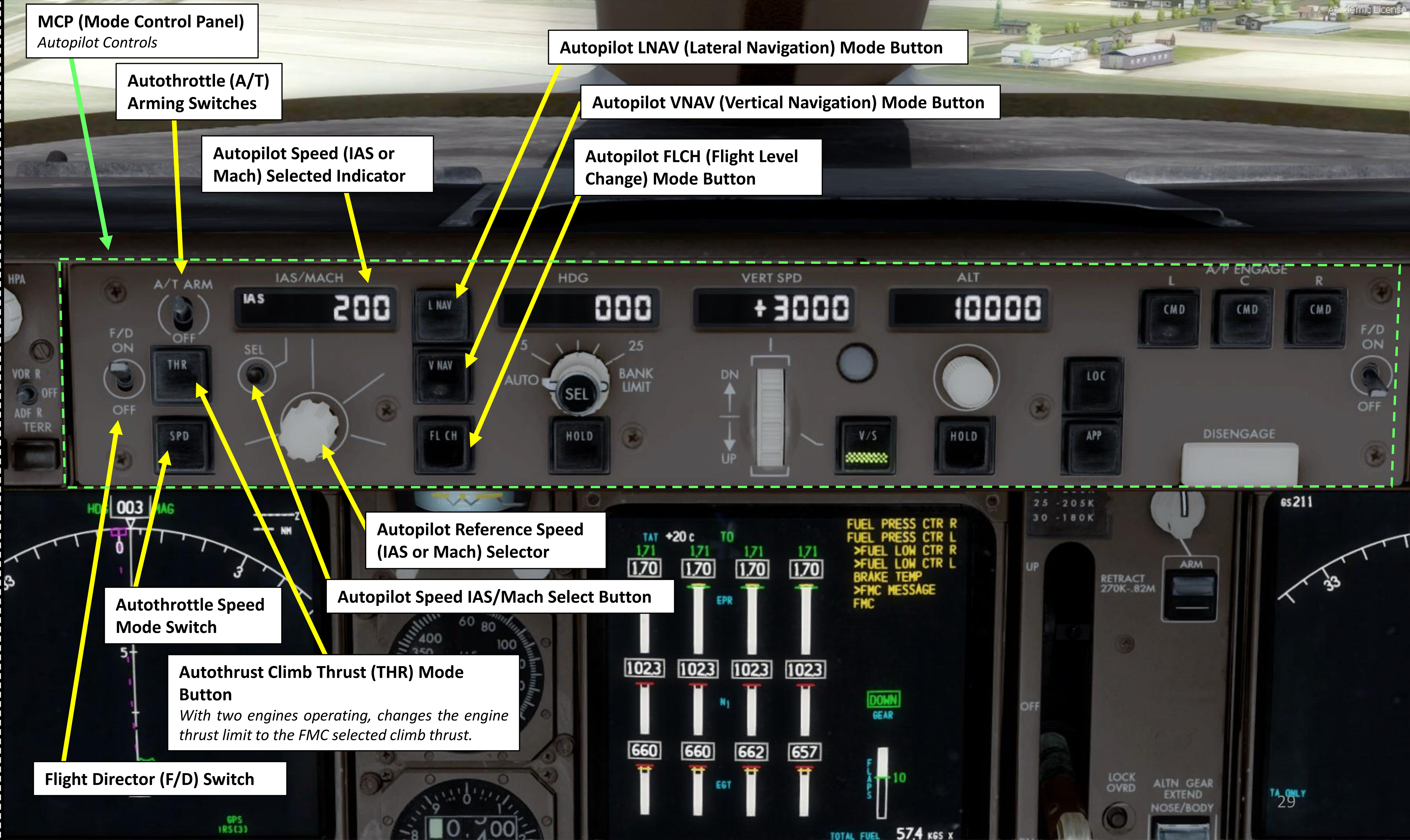
Navigation Display (ND) Display Range Selector (nautical miles)
Outer knob: sets range in nm
TFC (Push): Displays TCAS (Traffic Collision and Avoidance System) info

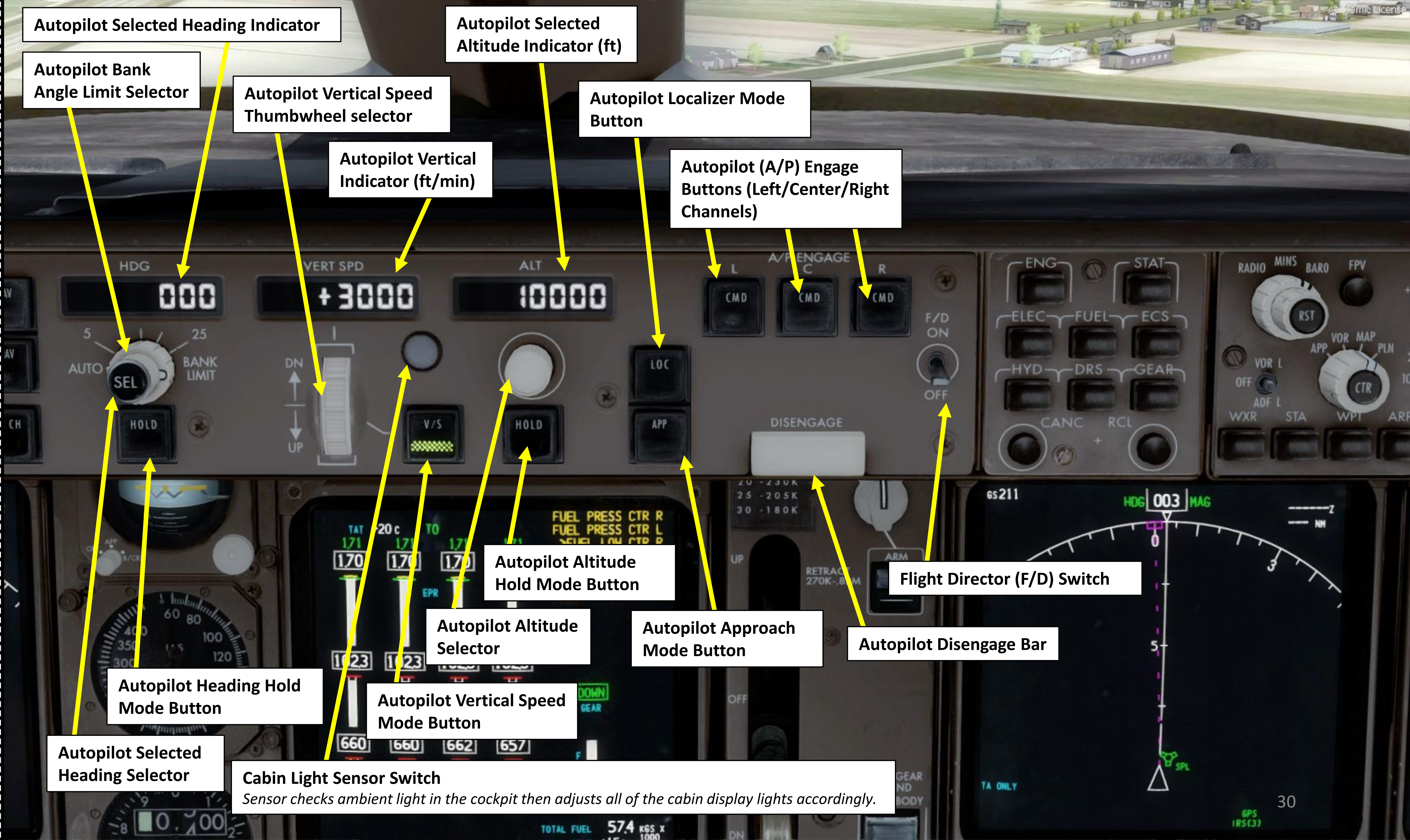
Master WARNING/CAUTION Push-to-Reset Light

Navigation Display MAP buttons
WXR: Weather Radar
STA: Station, displays all FMC data base navigation aids
WPT: displays waypoints in FMC data base
ARPT: displays airports in FMC data base
DATA: displays altitude constraint and estimated time of arrival for each active route waypoint
POS: displays VOR and ADF bearing vectors (position)
TERR: displays GPWS (Ground Proximity Warning System) generated terrain data

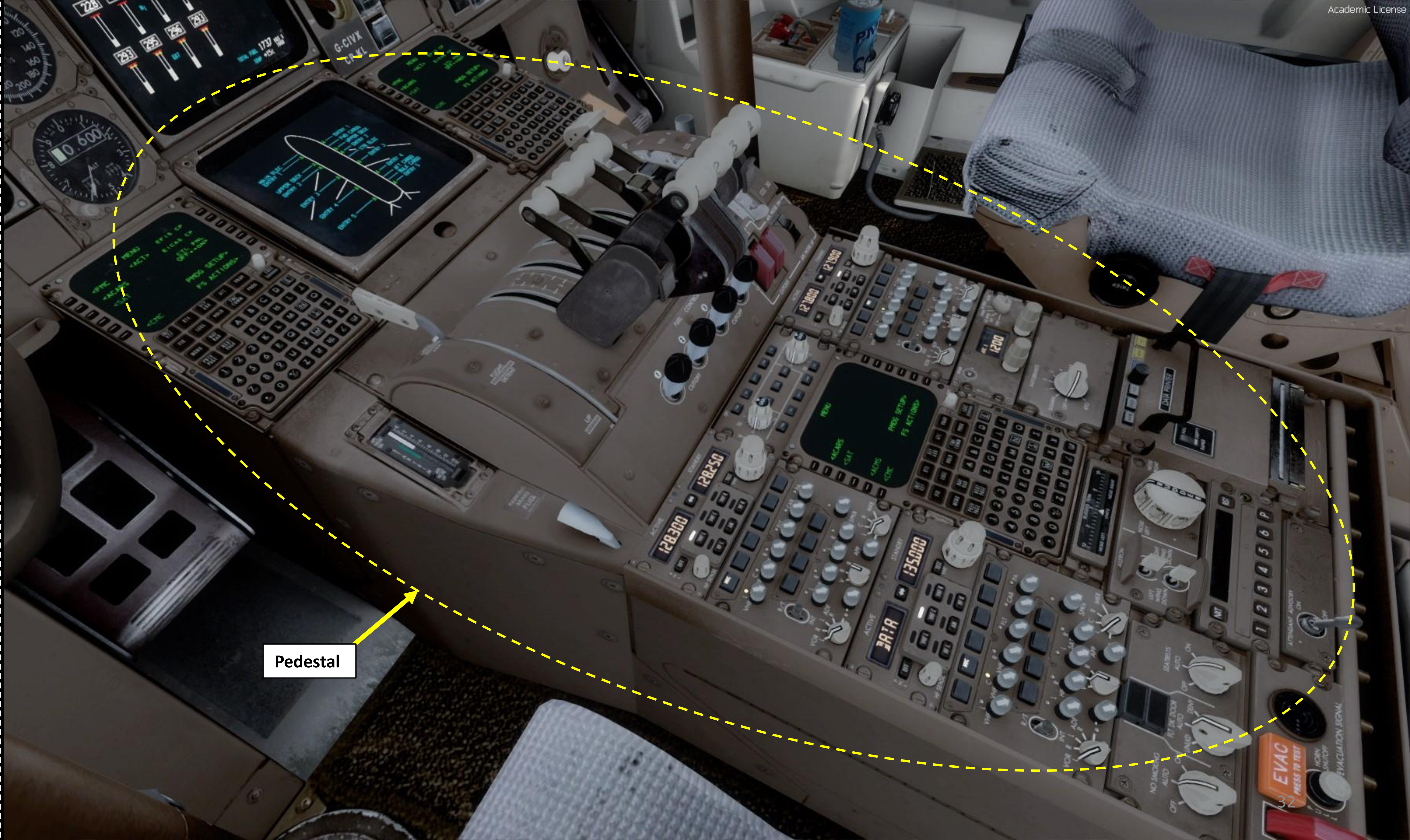
VOR / ADF 1 (VHF Omnidirectional Range or Automatic Direction Finder) selector switch

Navigation Display (ND) Mode Selector
APP (Rotate): displays localizer and glideslope information
VOR (Rotate): displays VOR navigation information
MAP (Rotate): displays FMC generated route and MAP information
PLAN (Rotate): displays a non-moving, true north up, route depiction
CTR (Push): Displays full compass rose (center) for APP, VOR & MAP modes


MCP (Mode Control Panel)
Autopilot Controls
Autothrottle (A/T) Arming Switches
Autopilot Speed (IAS or Mach) Selected Indicator
Autopilot LNAV (Lateral Navigation) Mode Button
Autopilot VNAV (Vertical Navigation) Mode Button
Autopilot FLCH (Flight Level Change) Mode Button
Autopilot Reference Speed (IAS or Mach) Selector
Autopilot Speed IAS/Mach Select Button
Autothrottle Speed Mode Switch
Autothrust Climb Thrust (THR) Mode Button
With two engines operating, changes the engine thrust limit to the FMC selected climb thrust.
Flight Director (F/D) Switch
HPA
A/T ARM
OFF
F/D
ON
THR
SPD
IAS/MACH
IAS
200
SEL
L NAV
V NAV
FL CH
HDG
000
5
25
AUTO
BANK LIMIT
HOLD
VERT SPD
+3000
DN
UP
V/S
ALT
10000
A/P ENGAGE
L
C
R
CMD
LOC
APP
DISENGAGE
VOR R
ADF R
TERR
FUEL PRESS CTR R
FUEL PRESS CTR L
>FUEL LOW CTR R
>FUEL LOW CTR L
BRAKE TEMP
>FMC MESSAGE
FMC
DOWN
GEAR
TOTAL FUEL
RETRACT
270K-.82M
ARM
LOCK OVRD
ALTN GEAR EXTEND
NOSE/BODY
Academic License

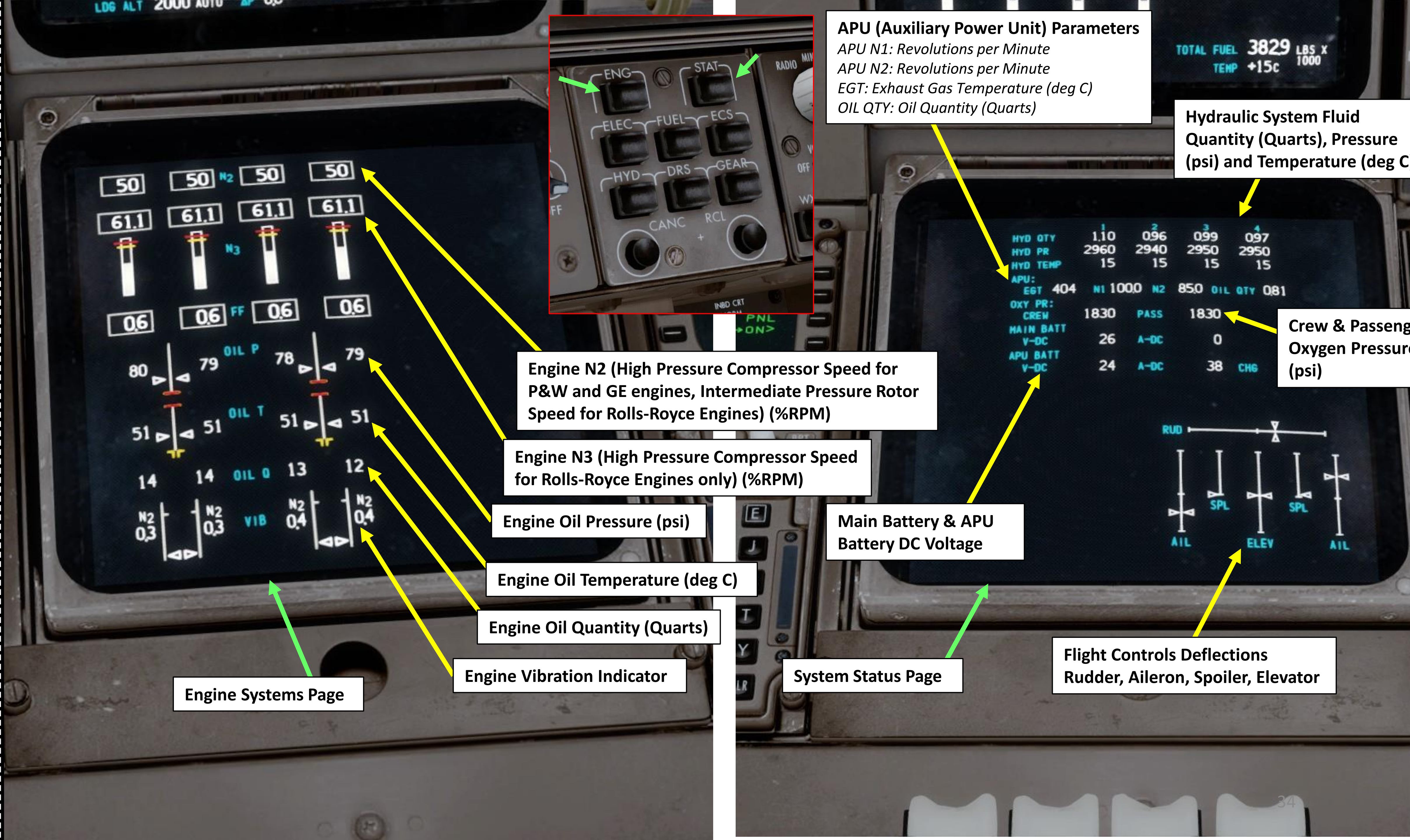

Autopilot Selected Heading Indicator
Autopilot Bank Angle Limit Selector
Autopilot Vertical Speed Thumbwheel selector
Autopilot Vertical Indicator (ft/min)
Autopilot Selected Altitude Indicator (ft)
Autopilot Localizer Mode Button
Autopilot (A/P) Engage Buttons (Left/Center/Right Channels)
Autopilot Altitude Hold Mode Button
Flight Director (F/D) Switch
Autopilot Altitude Selector
Autopilot Approach Mode Button
Autopilot Disengage Bar
Autopilot Heading Hold Mode Button
Autopilot Vertical Speed Mode Button
Autopilot Selected Heading Selector
Cabin Light Sensor Switch
Sensor checks ambient light in the cockpit then adjusts all of the cabin display lights accordingly.

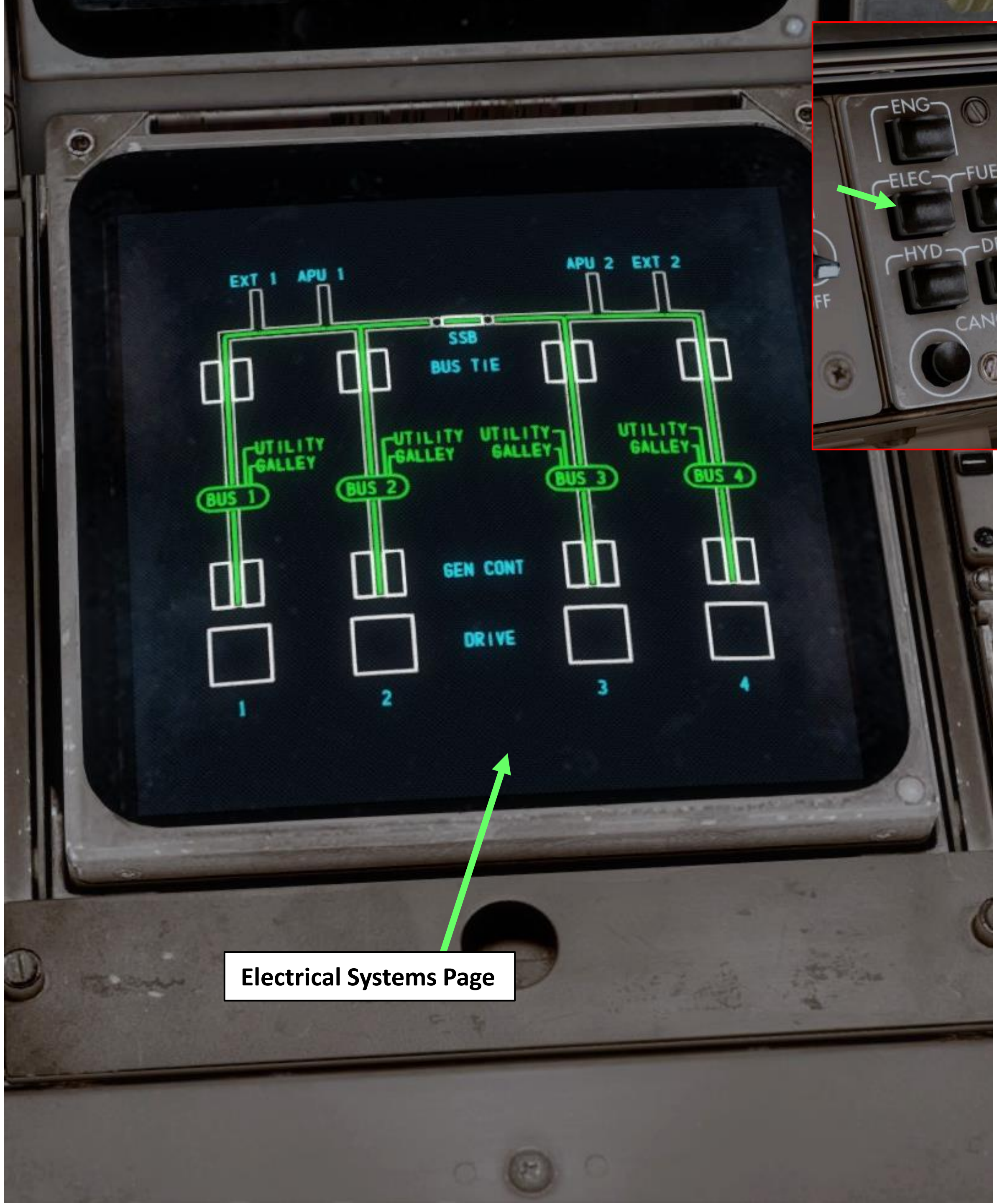

EICAS Display Select buttons
ENG: Engine Systems Page
STAT: System Status Page
ELEC: Electrical Systems Page
FUEL: Fuel Systems Page
ECS: Environmental Control Systems page
HYD: Hydraulic Systems Page
DRS: Doors Status Page
GEAR: Landing Gear Page
CANC (Cancel) Button
Cancel EICAS, Caution and Advisory Messages
RCL (Recall) Button
Recalls previously cancelled EICAS, Caution and Advisory Messages
ENG
STAT
ELEC
FUEL
ECS
HYD
DRS
GEAR
CANC
RCL


Pedestal

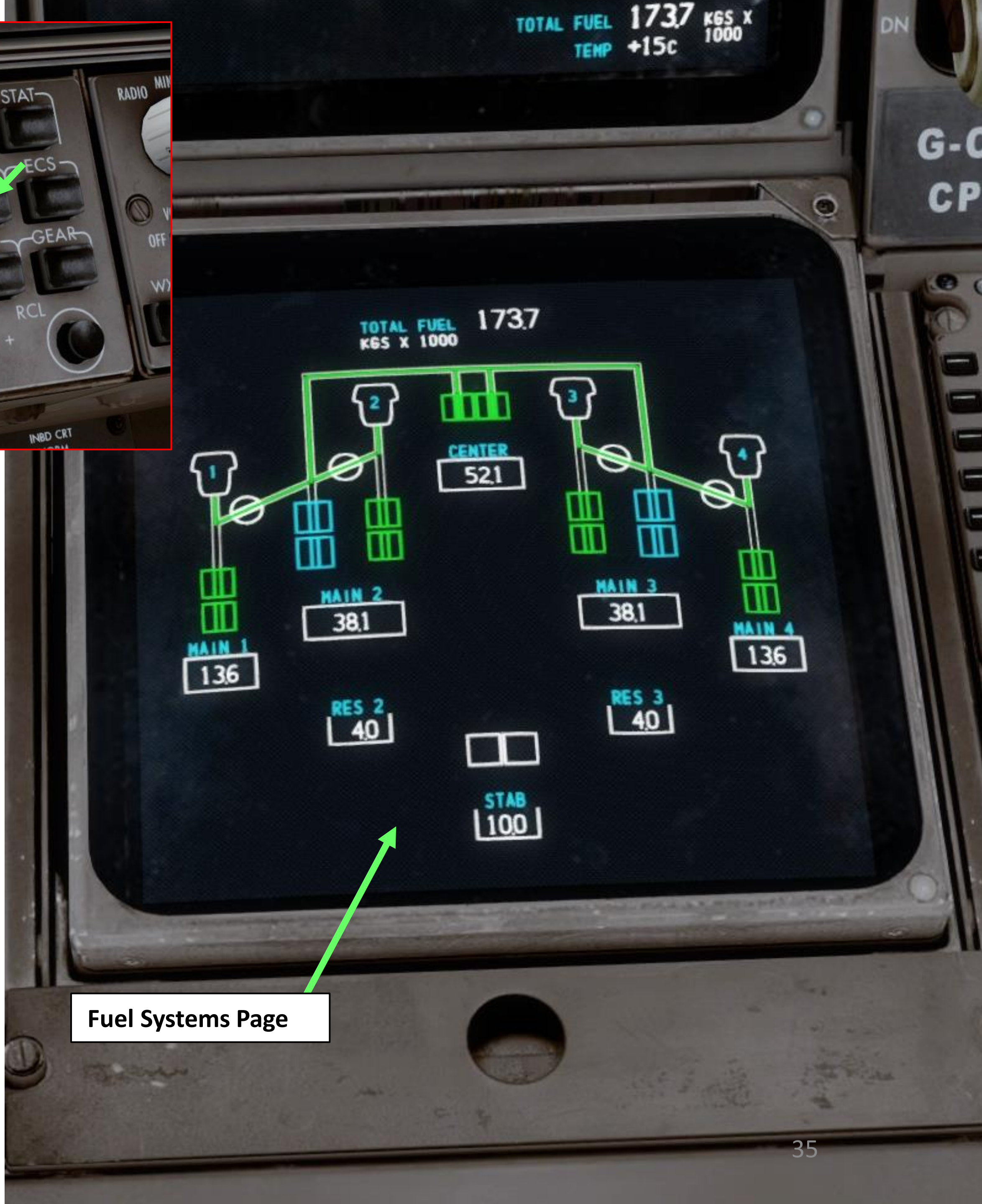
FMS (Flight Management System) CDU (Control Display Unit)

- An **FMS** is a specialized computer system that automates a wide variety of in-flight tasks, reducing the workload on the flight crew to the point that modern civilian aircraft no longer carry flight engineers or navigators. A primary function is in-flight management of the flight plan.
- The FMS is controlled through the **CDU** physical interface.
- The FMS sends the flight plan for display to the Electronic Flight Instrument System (**EFIS**), Navigation Display (**ND**), or other displays (CRTs, or Cathode Ray Tubes).

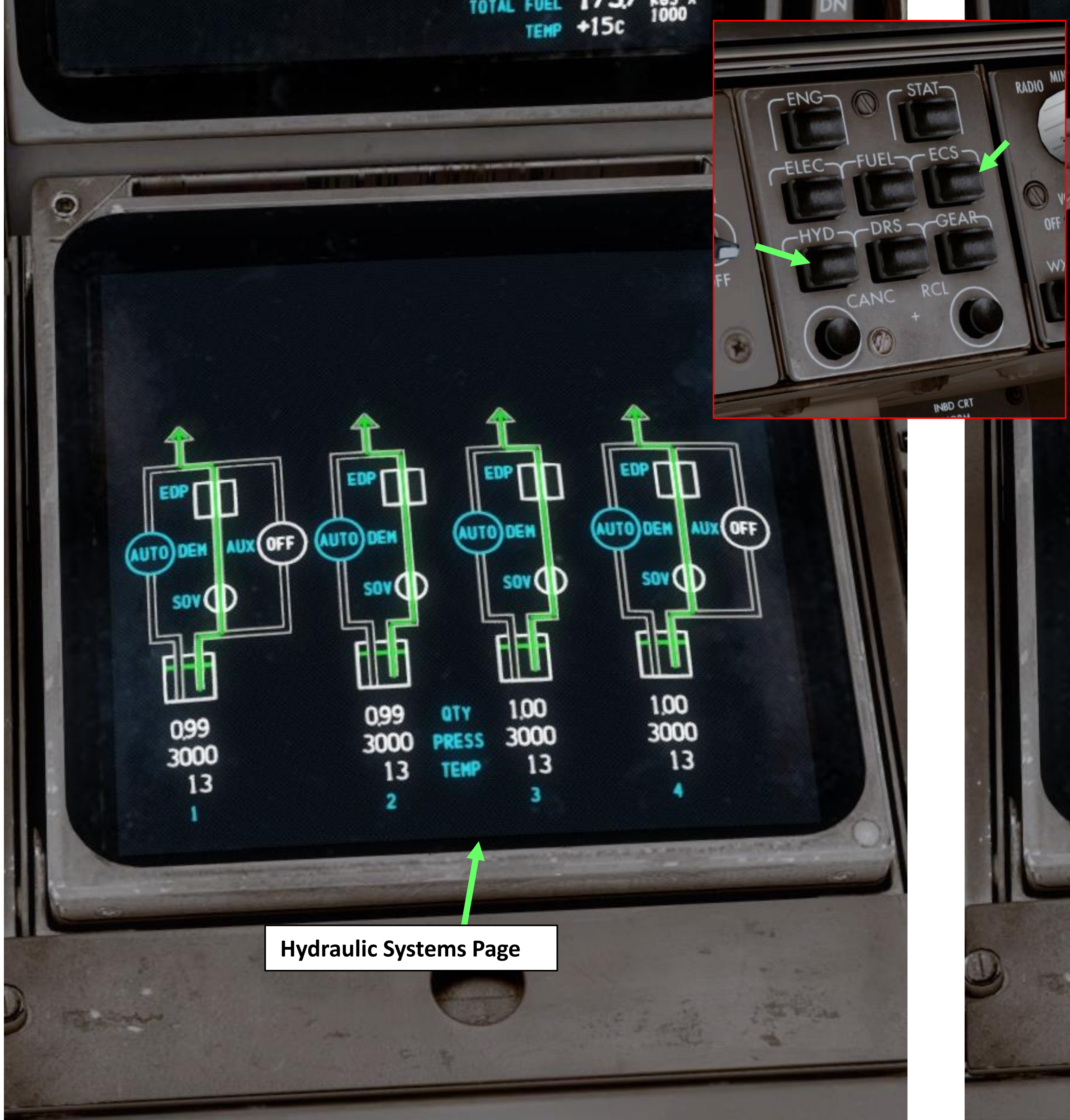

APU (Auxiliary Power Unit) Parameters
APU N1: Revolutions per Minute
APU N2: Revolutions per Minute
EGT: Exhaust Gas Temperature (deg C)
OIL QTY: Oil Quantity (Quarts)
Hydraulic System Fluid Quantity (Quarts), Pressure (psi) and Temperature (deg C
Crew & Passeng Oxygen Pressur (psi)
Engine N2 (High Pressure Compressor Speed for P&W and GE engines, Intermediate Pressure Rotor Speed for Rolls-Royce Engines) (%RPM)
Engine N3 (High Pressure Compressor Speed for Rolls-Royce Engines only) (%RPM)
Engine Oil Pressure (psi)
Main Battery & APU Battery DC Voltage
Engine Oil Temperature (deg C)
Engine Oil Quantity (Quarts)
Engine Vibration Indicator
Engine Systems Page
System Status Page
Flight Controls Deflections Rudder, Aileron, Spoiler, Elevator



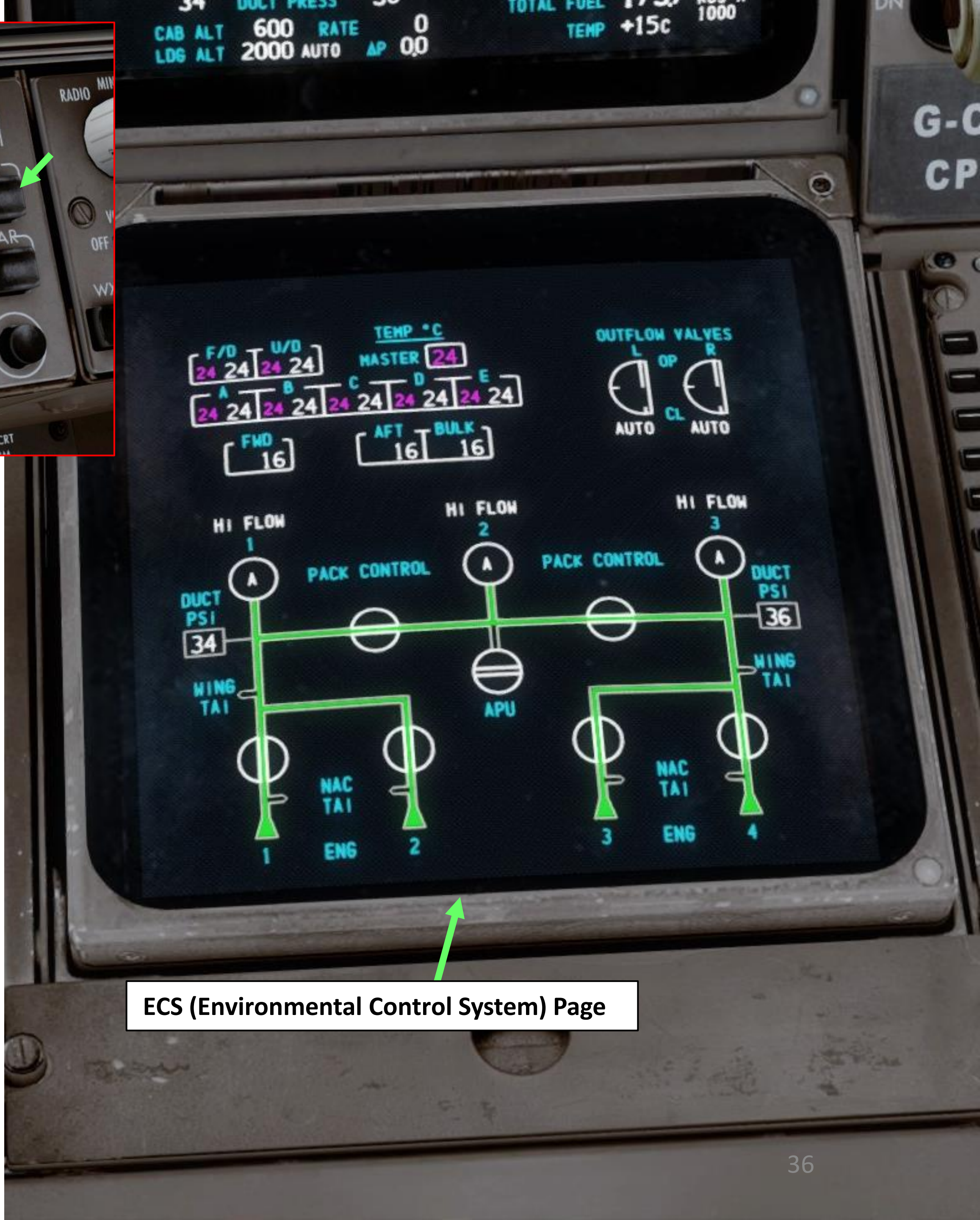
Electrical Systems Page



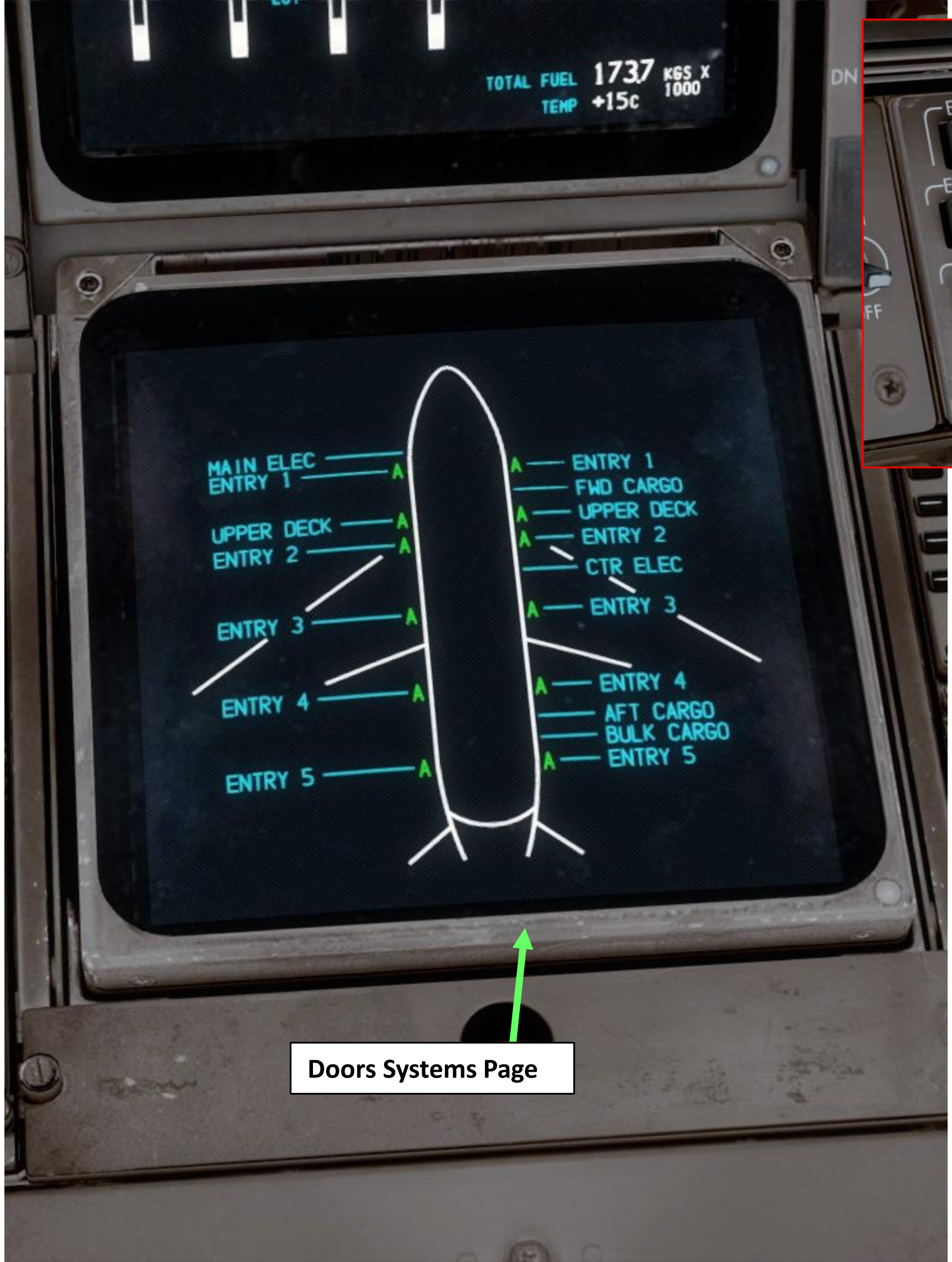
Fuel Systems Page



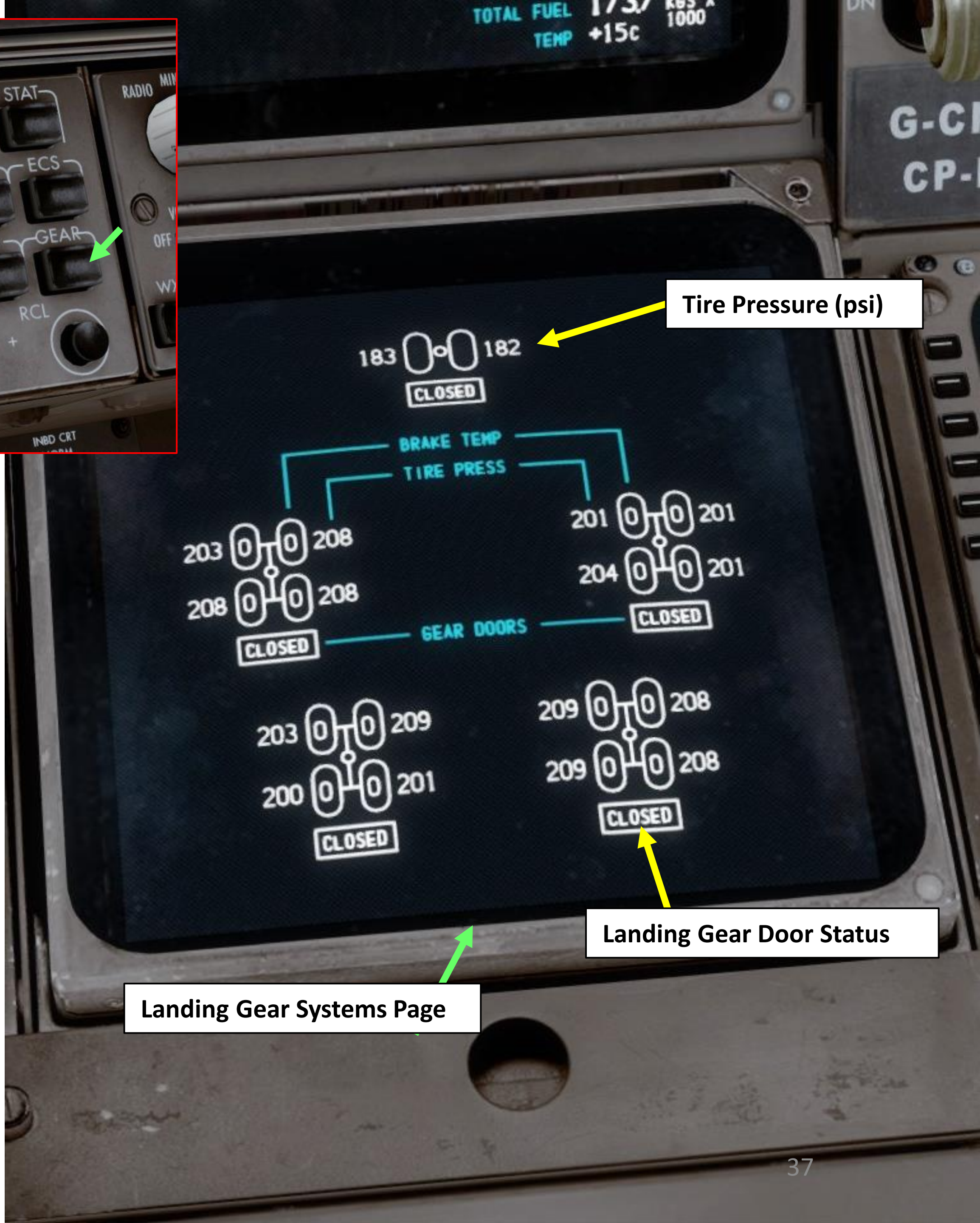
Hydraulic Systems Page

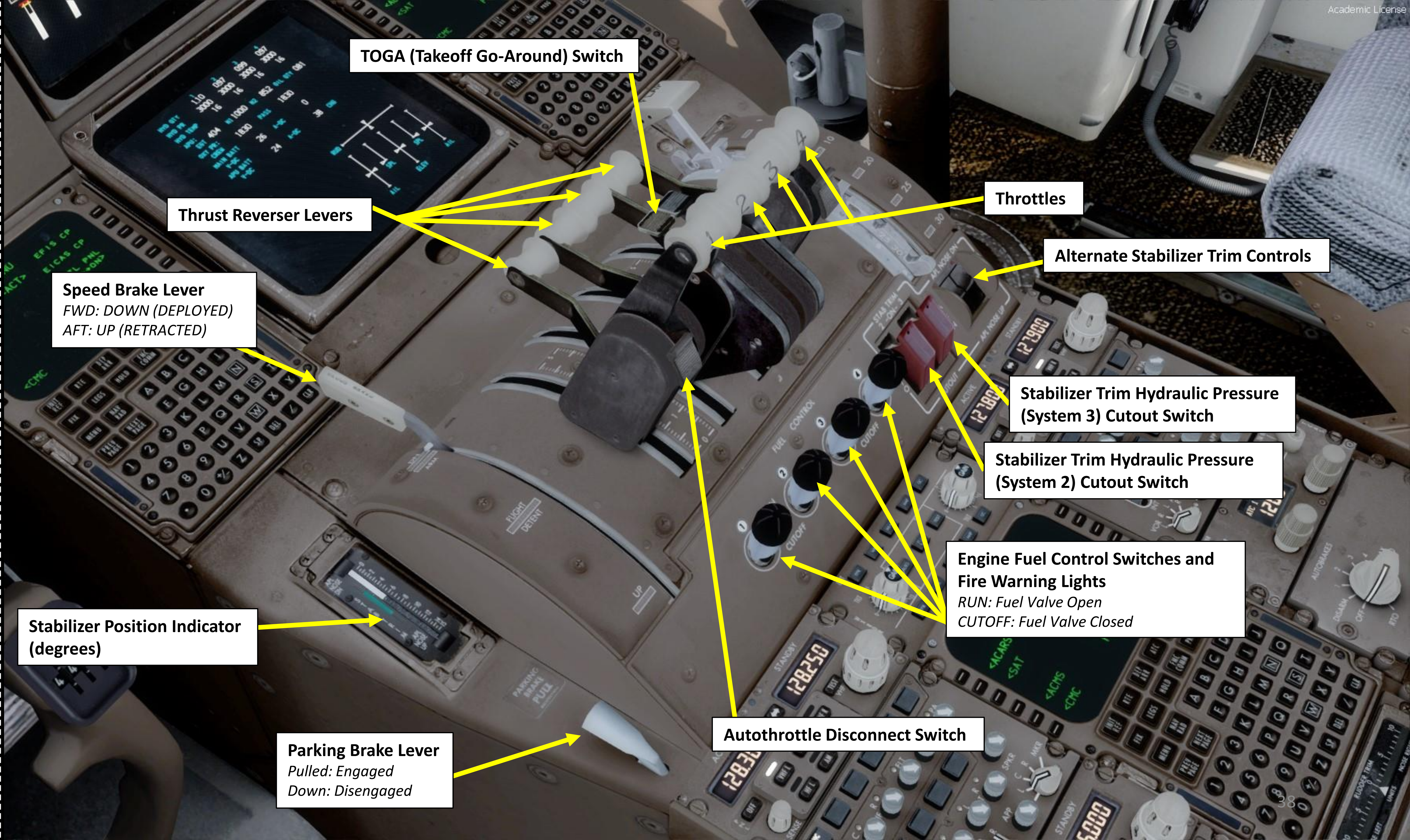


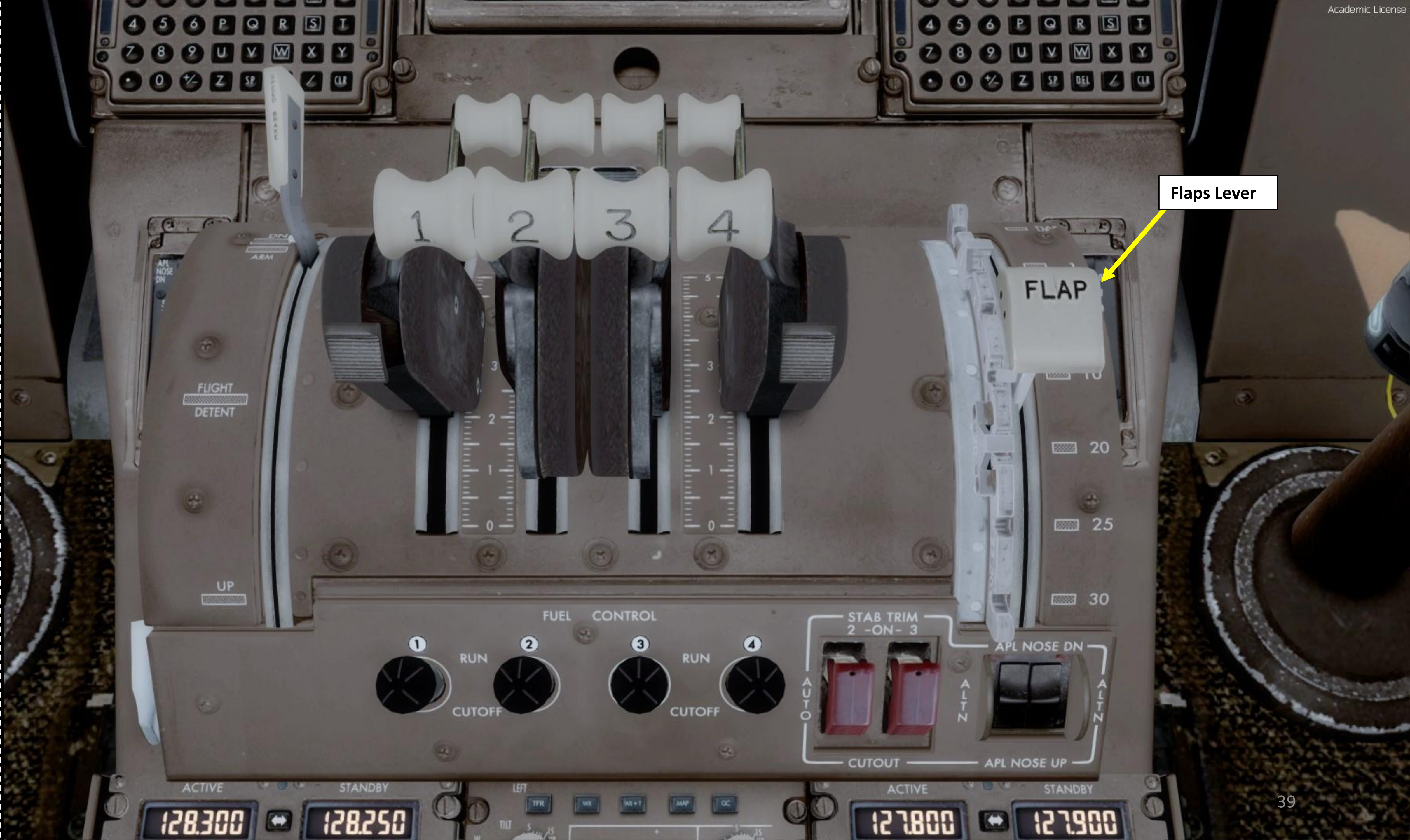
ECS (Environmental Control System) Page

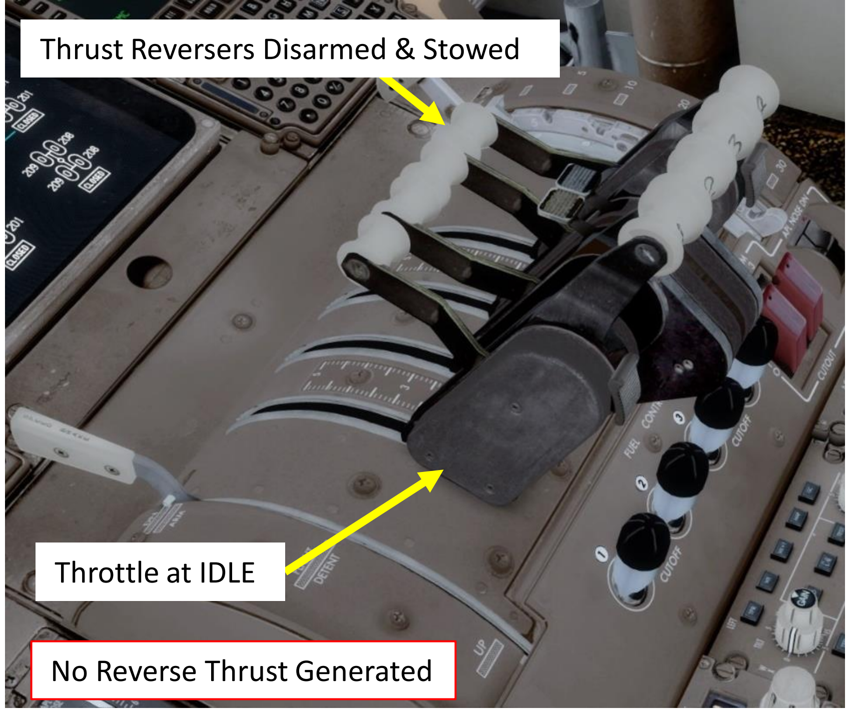

TOTAL FUEL 1737 KGS X 1000
TEMP +15c
MAIN ELEC
ENTRY 1
UPPER DECK
ENTRY 2
ENTRY 3
ENTRY 4
ENTRY 5
ENTRY 1
FWD CARGO
UPPER DECK
ENTRY 2
CTR ELEC
ENTRY 3
ENTRY 4
AFT CARGO
BULK CARGO
ENTRY 5
Doors Systems Page

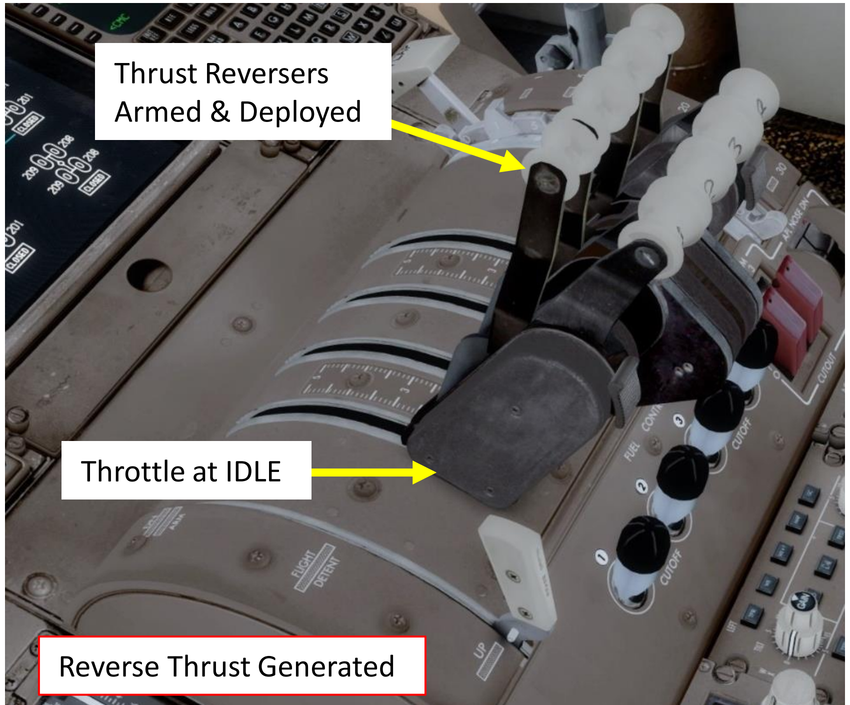

ENG
STAT
ELEC
FUEL
ECS
HYD
DRS
GEAR
CANC
RCL

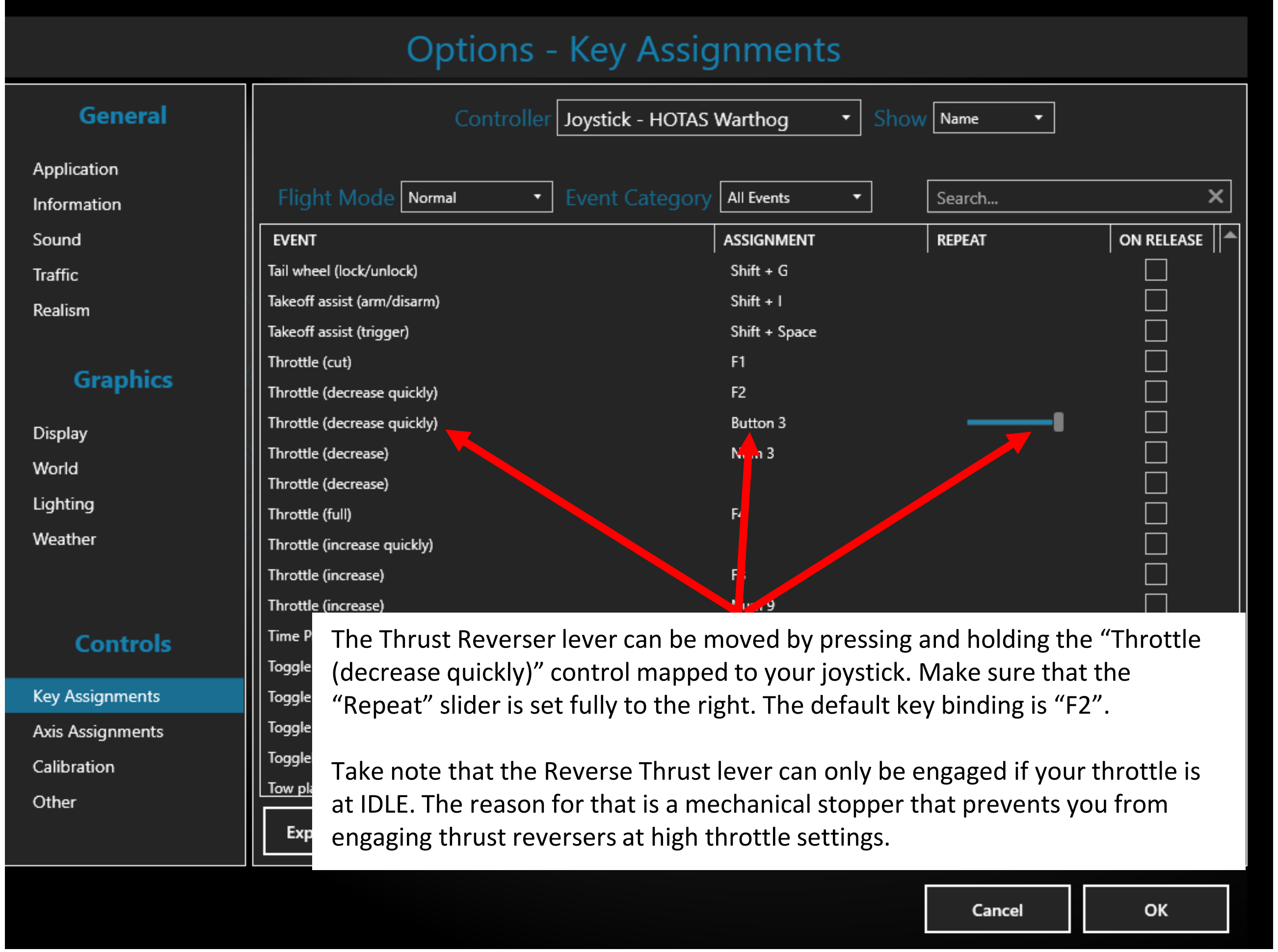

Tire Pressure (psi)
183
182
CLOSED
BRAKE TEMP
TIRE PRESS
GEAR DOORS
Landing Gear Door Status
Landing Gear Systems Page


TOGA (Takeoff Go-Around) Switch
Thrust Reverser Levers
Throttles
Alternate Stabilizer Trim Controls
Speed Brake Lever
FWD: DOWN (DEPLOYED)
AFT: UP (RETRACTED)
Stabilizer Trim Hydraulic Pressure (System 3) Cutout Switch
Stabilizer Trim Hydraulic Pressure (System 2) Cutout Switch
Engine Fuel Control Switches and Fire Warning Lights
RUN: Fuel Valve Open
CUTOFF: Fuel Valve Closed
Stabilizer Position Indicator (degrees)
Autothrottle Disconnect Switch
Parking Brake Lever
Pulled: Engaged
Down: Disengaged


Academic License
Flaps Lever
1
2
3
4
FLAP
20
25
30
FLIGHT DETENT
UP
ARM
FUEL CONTROL
RUN
CUTOFF
RUN
CUTOFF
STAB TRIM 2 -ON- 3
AUTO
ALTN
CUTOUT
APL NOSE DN
ALTN
APL NOSE UP
ACTIVE
STANDBY
128.300
128.250
ACTIVE
STANDBY
127.800
127.900

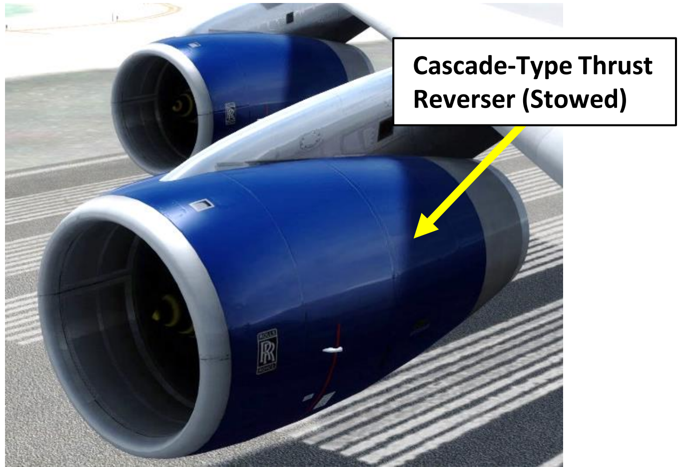


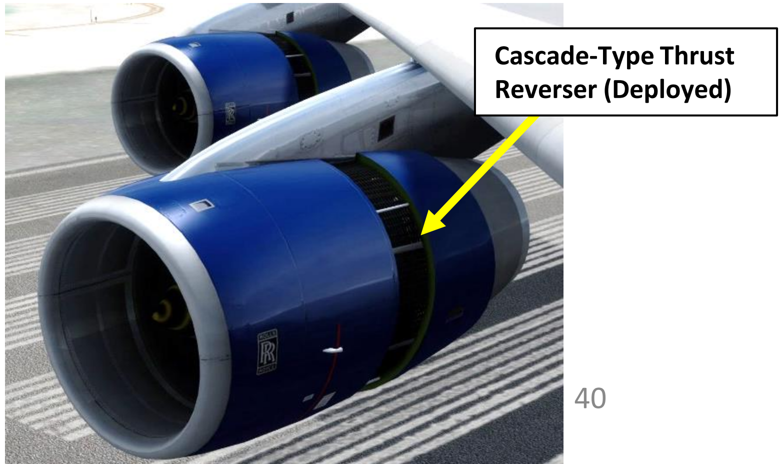




The Thrust Reverser lever can be moved by pressing and holding the “Throttle (decrease quickly)” control mapped to your joystick. Make sure that the “Repeat” slider is set fully to the right. The default key binding is “F2”.

Take note that the Reverse Thrust lever can only be engaged if your throttle is at IDLE. The reason for that is a mechanical stopper that prevents you from engaging thrust reversers at high throttle settings.

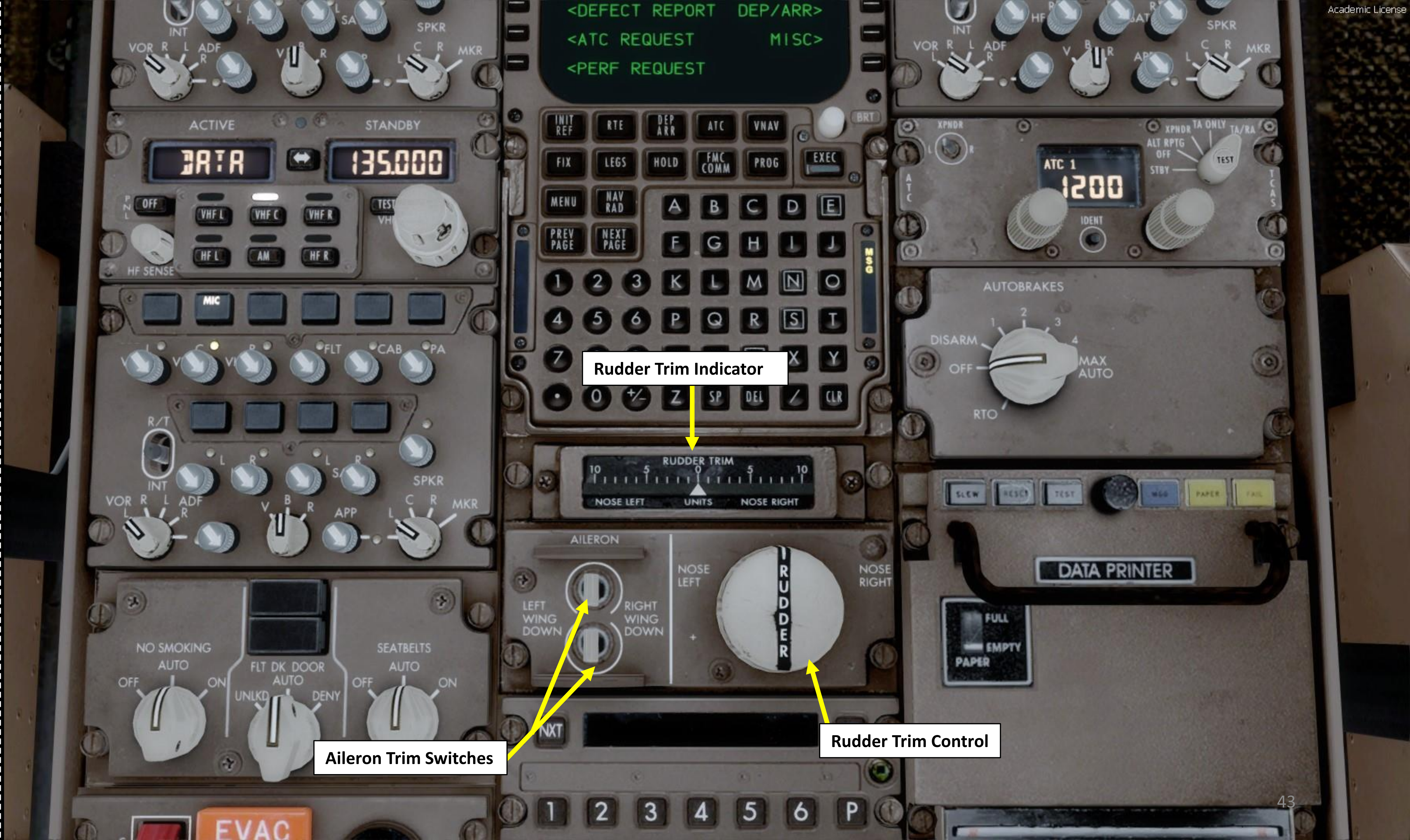


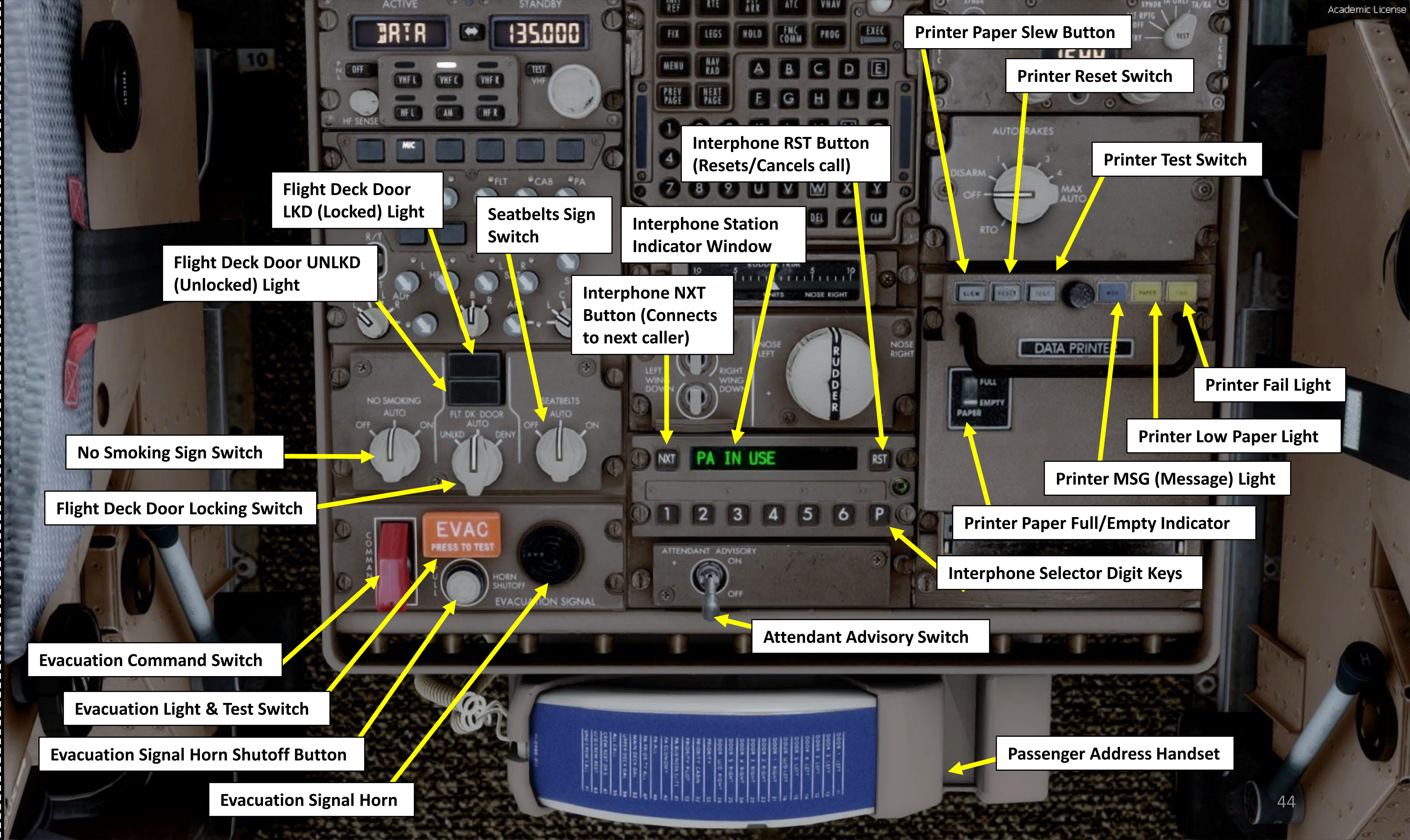


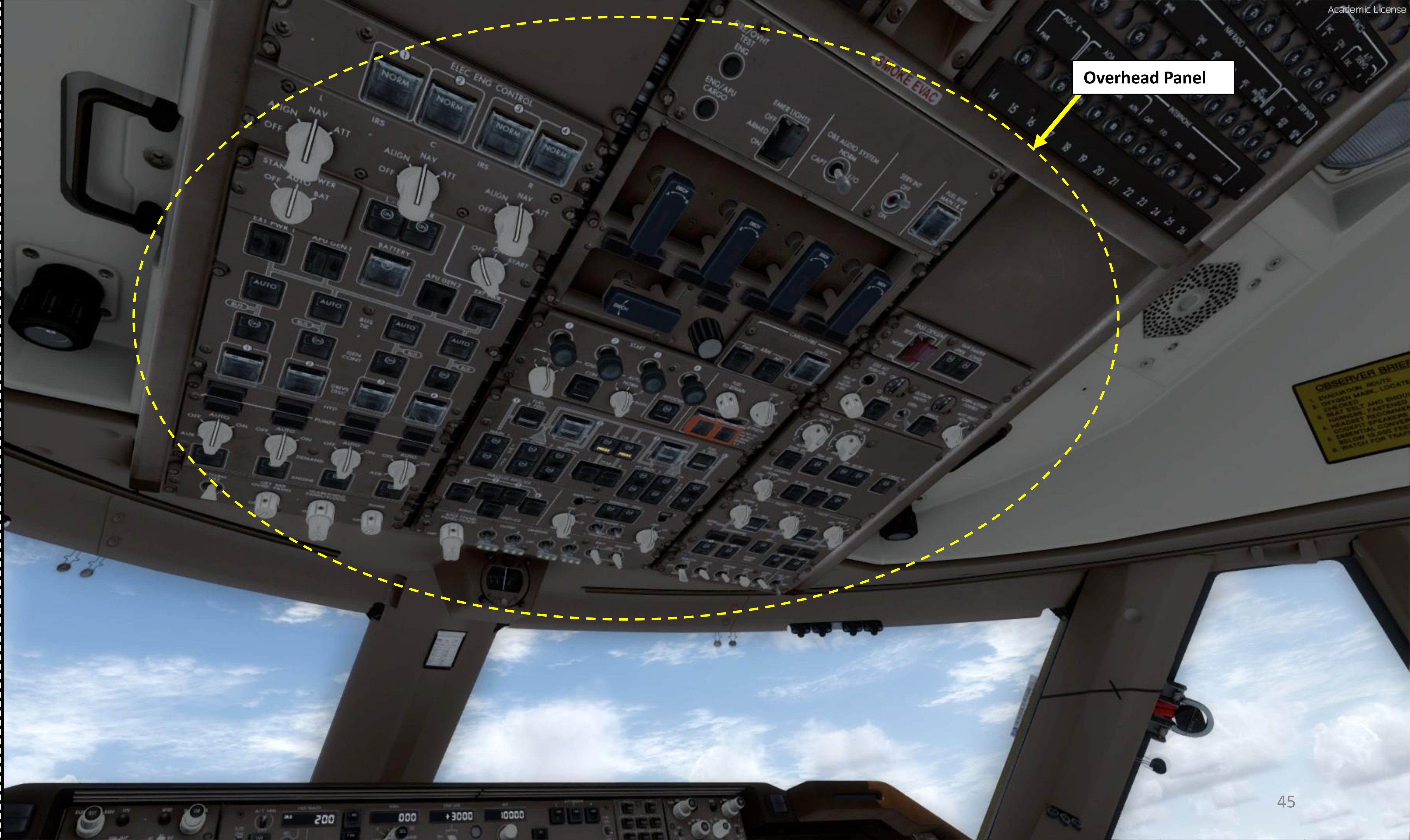
747-400

PART 2 – COCKPIT LAYOUT

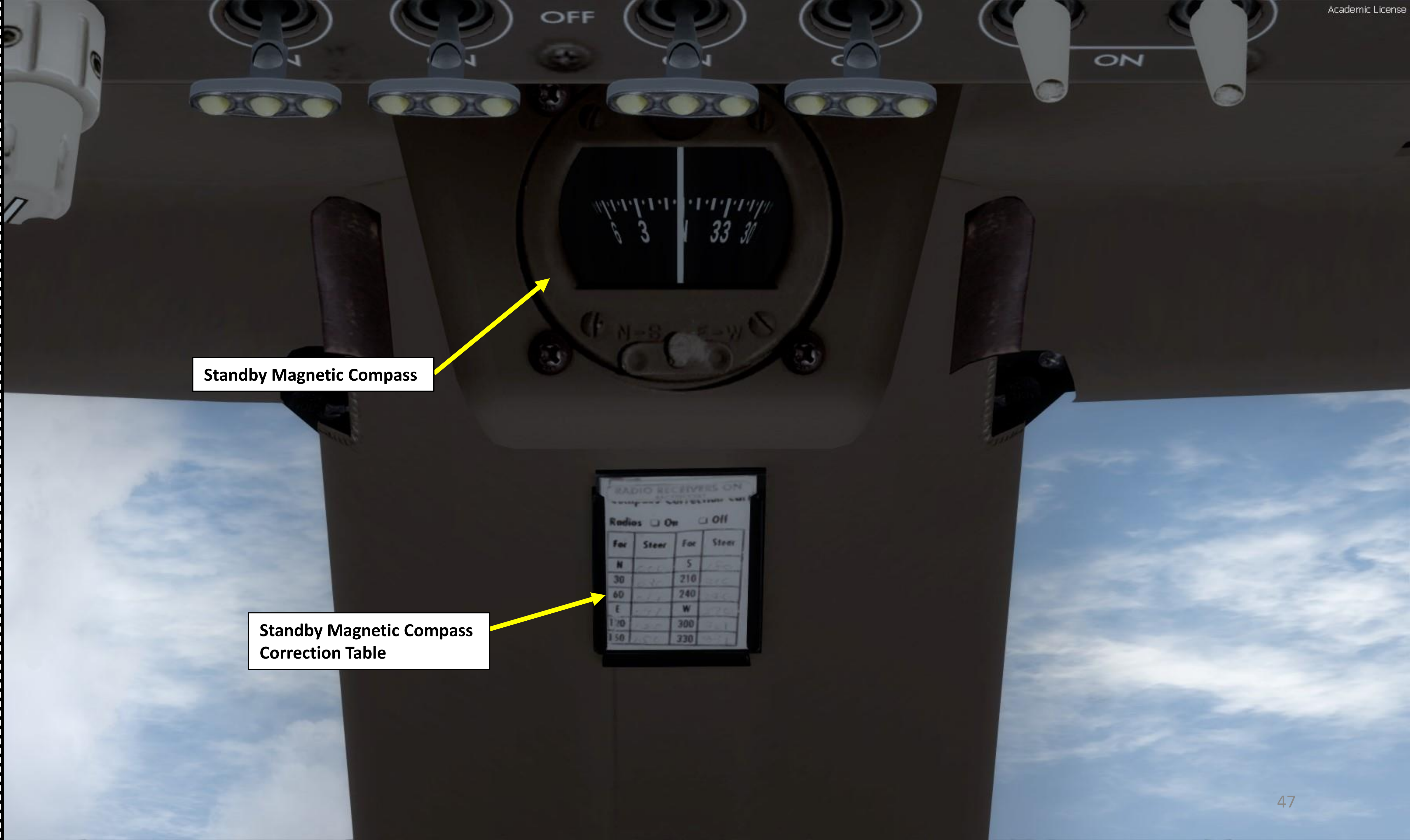

Audio Control Panel
Autobrake Switch
OFF / DISARM / 1 / 2 / 3 / 4 / MAX AUTO / RTO (Rejected Takeoff)
ACARS MAIN MENU
<PREFLIGHT FLT LOG>
<WT/BAL FLIGHT PLAN>
<0001 STATUS DIVERTING>
<DEFECT REPORT DEP/ARR>
<ATC REQUEST MISC>
<PERF REQUEST
AUTOBRAKES
DISARM
OFF
RTO
MAX AUTO
RUDDER TRIM
DATA PRINTER

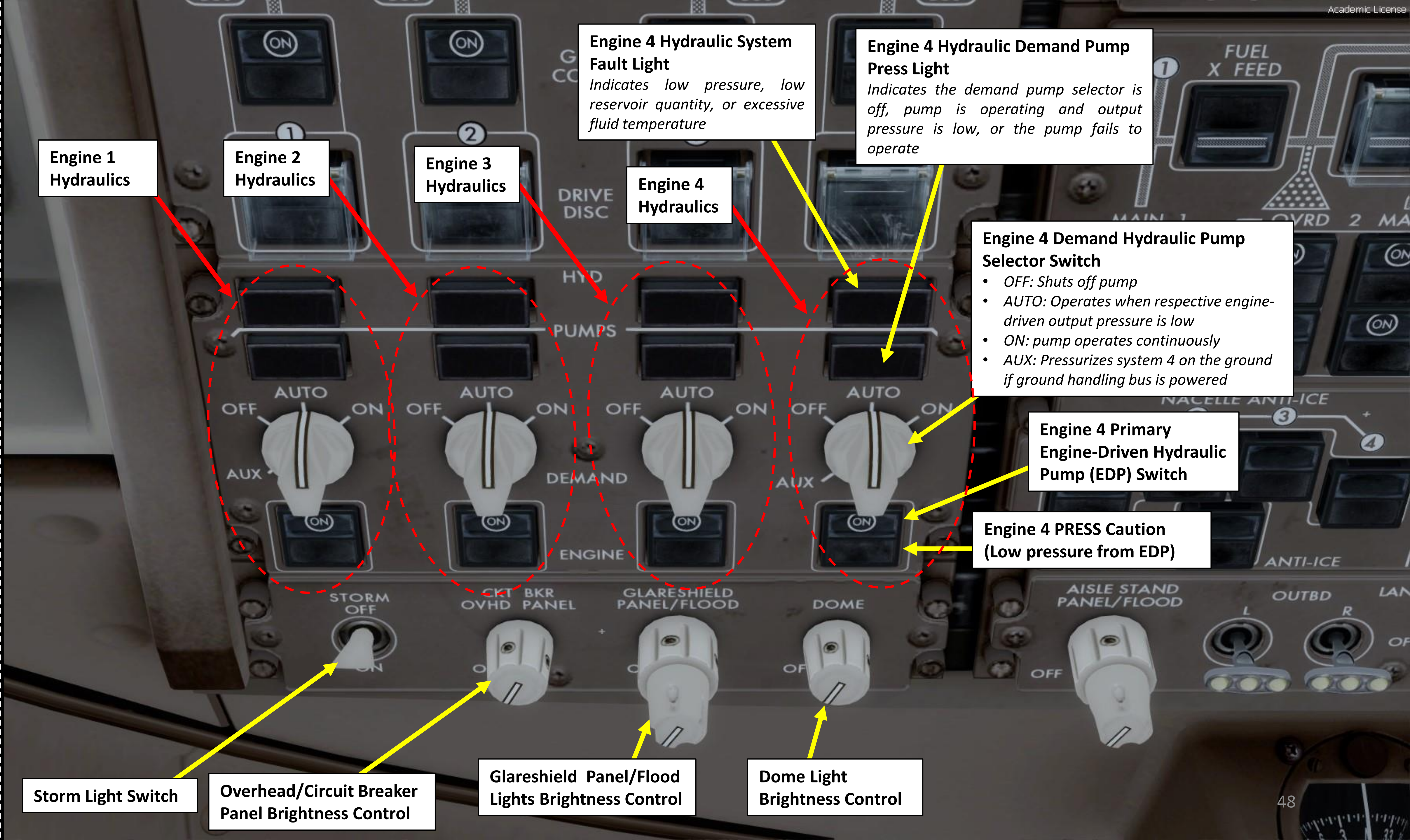

Rudder Trim Indicator
Aileron Trim Switches
Rudder Trim Control
RUDDER TRIM
NOSE LEFT
UNITS
NOSE RIGHT
AILERON
LEFT WING DOWN
RIGHT WING DOWN
RUDDER
AUTOBRAKES
DATA PRINTER
Academic License


Printer Paper Slew Button
Printer Reset Switch
Interphone RST Button (Resets/Cancels call)
Printer Test Switch
Flight Deck Door LKD (Locked) Light
Seatbelts Sign Switch
Interphone Station Indicator Window
Flight Deck Door UNLKD (Unlocked) Light
Interphone NXT Button (Connects to next caller)
Printer Fail Light
Printer Low Paper Light
No Smoking Sign Switch
Printer MSG (Message) Light
Flight Deck Door Locking Switch
Printer Paper Full/Empty Indicator
Interphone Selector Digit Keys
Attendant Advisory Switch
Evacuation Command Switch
Evacuation Light & Test Switch
Evacuation Signal Horn Shutoff Button
Passenger Address Handset
Evacuation Signal Horn
PA IN USE
EVAC
PRESS TO TEST
DATA PRINTER

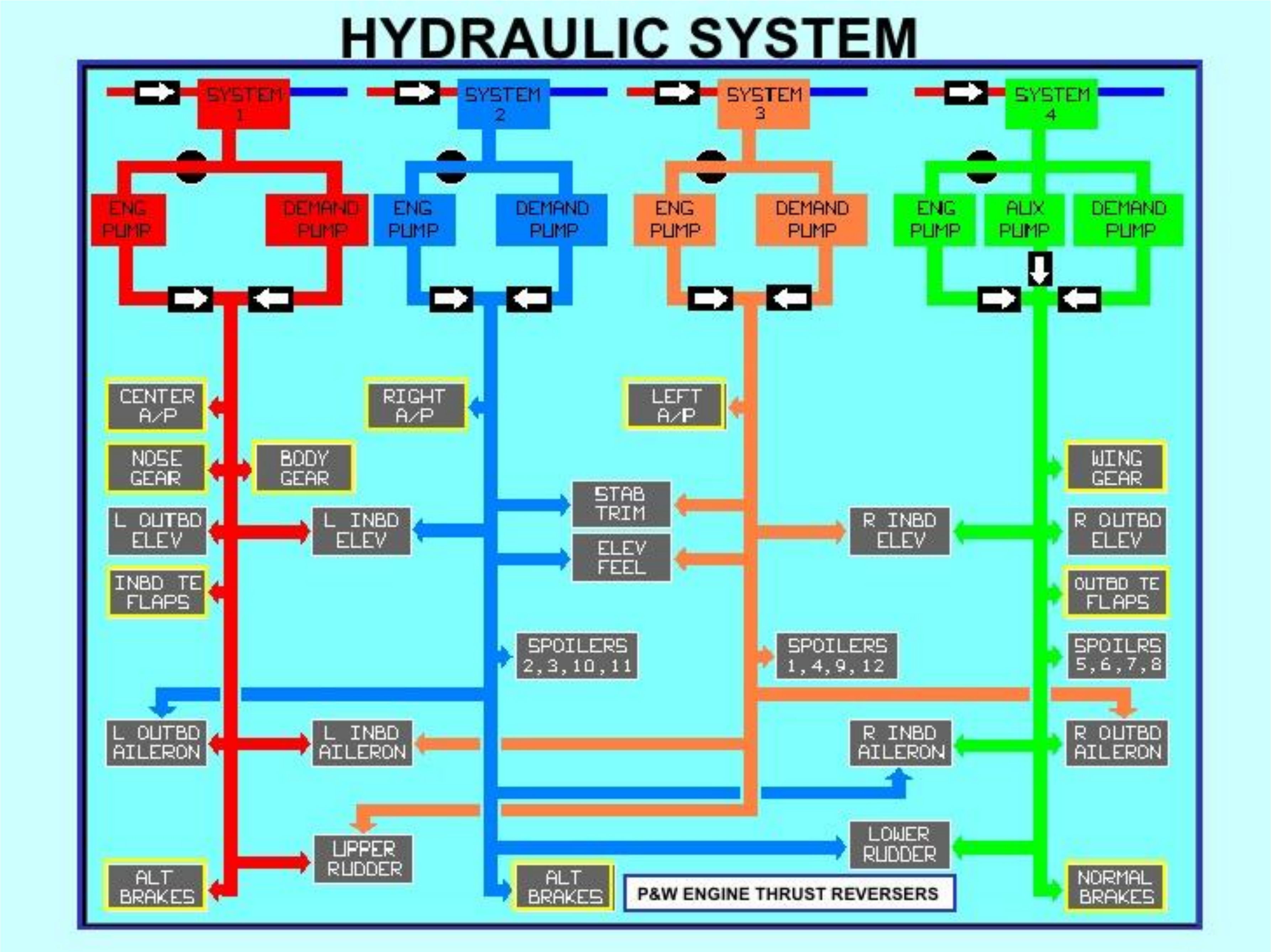

Overhead Panel
Academic License

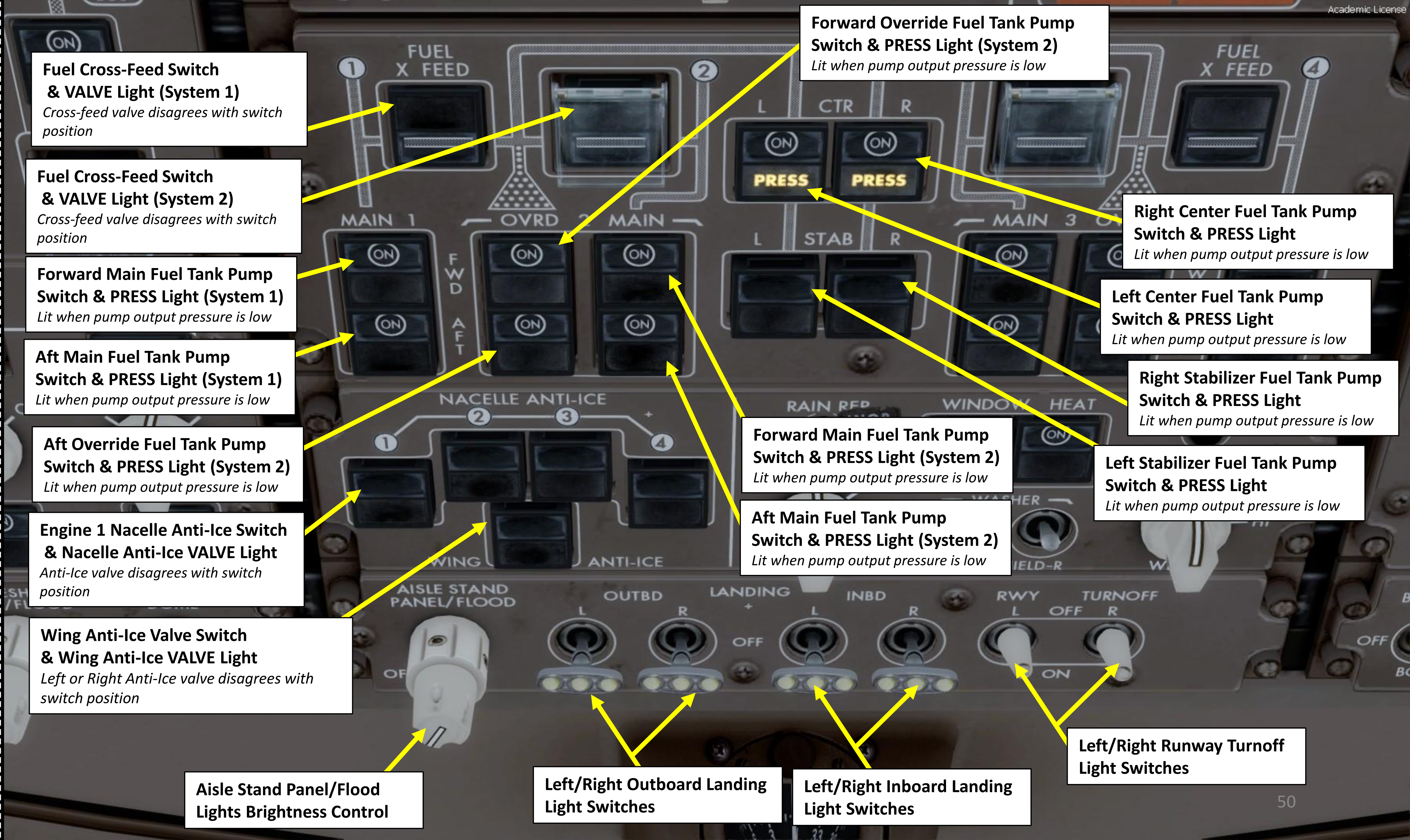

Miscellaneous Panel
Electrical Engine Control Panel
ADIRU Control Panel
APU (Auxiliary Power Unit) Panel
Fire Detection & Extinguisher Control Panel
Oxygen Control & Yaw Damper Panel
Engine Start Panel
Electrical Panel
Fuel Panel
Air System Panel (Aircraft Pressurization, Bleed Air & Air Conditioning)
Hydraulics Panel
Anti-Ice & Window Heating Panel
Lighting Panels

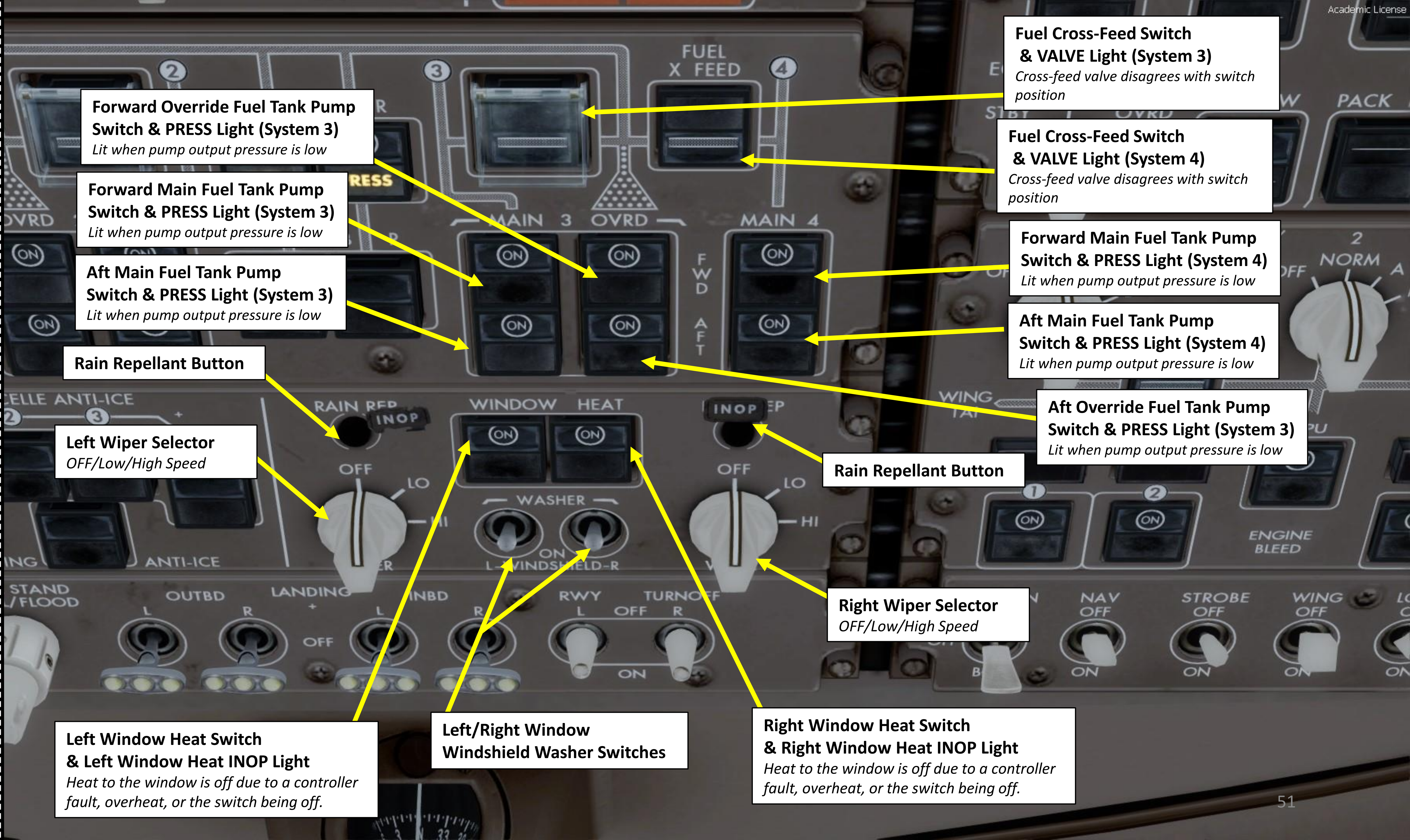

Academic License
OFF
ON
Standby Magnetic Compass
Standby Magnetic Compass Correction Table
Radios On Off
For Steer For Steer
N S
30 210
60 240
E W
300
330

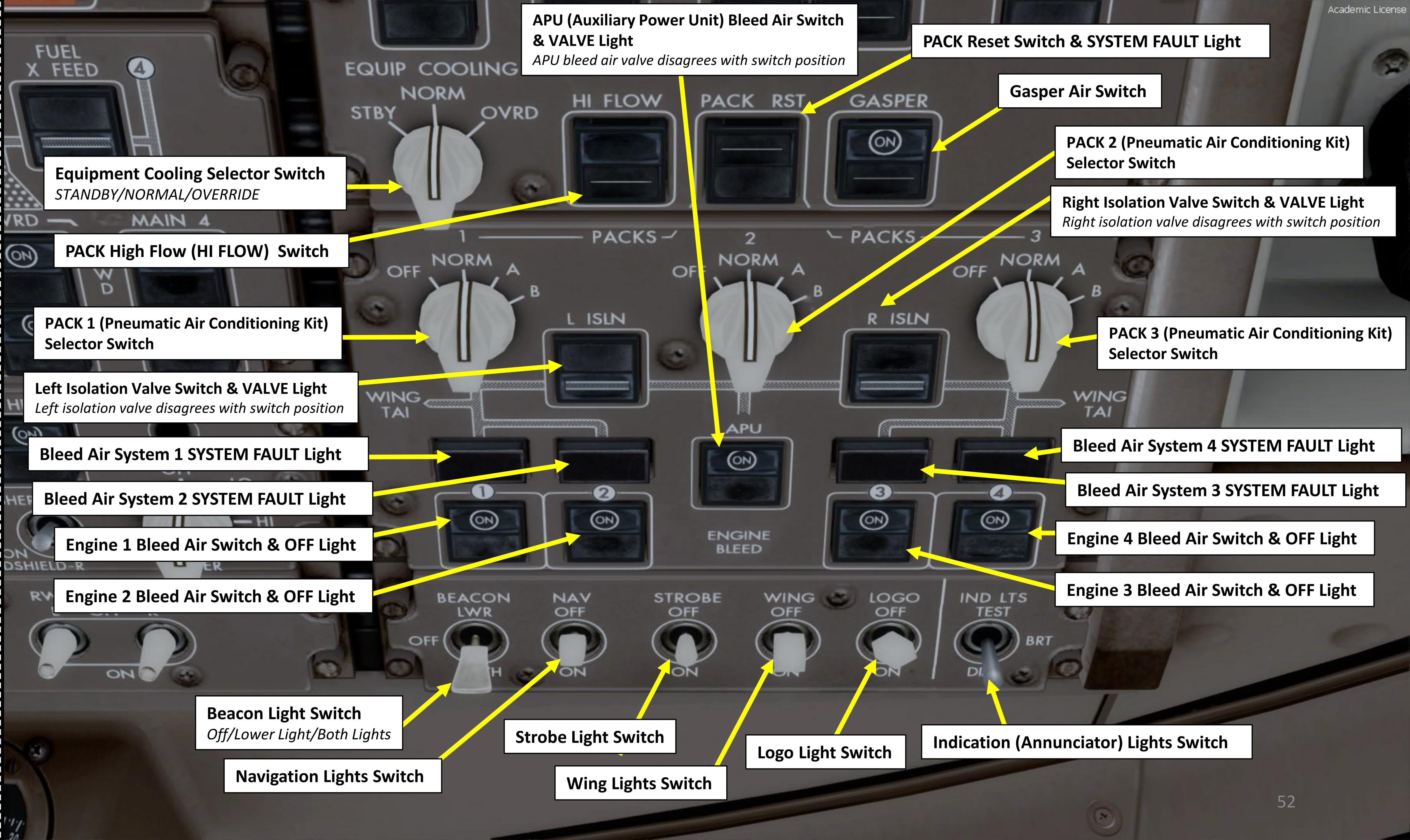

Engine 1 Hydraulics
Engine 2 Hydraulics
Engine 3 Hydraulics
Engine 4 Hydraulics
Engine 4 Hydraulic System Fault Light
Indicates low pressure, low reservoir quantity, or excessive fluid temperature
Engine 4 Hydraulic Demand Pump Press Light
Indicates the demand pump selector is off, pump is operating and output pressure is low, or the pump fails to operate
Engine 4 Demand Hydraulic Pump Selector Switch
• OFF: Shuts off pump
• AUTO: Operates when respective engine-driven output pressure is low
• ON: pump operates continuously
• AUX: Pressurizes system 4 on the ground if ground handling bus is powered
Engine 4 Primary Engine-Driven Hydraulic Pump (EDP) Switch
Engine 4 PRESS Caution (Low pressure from EDP)
Storm Light Switch
Overhead/Circuit Breaker Panel Brightness Control
Glareshield Panel/Flood Lights Brightness Control
Dome Light Brightness Control

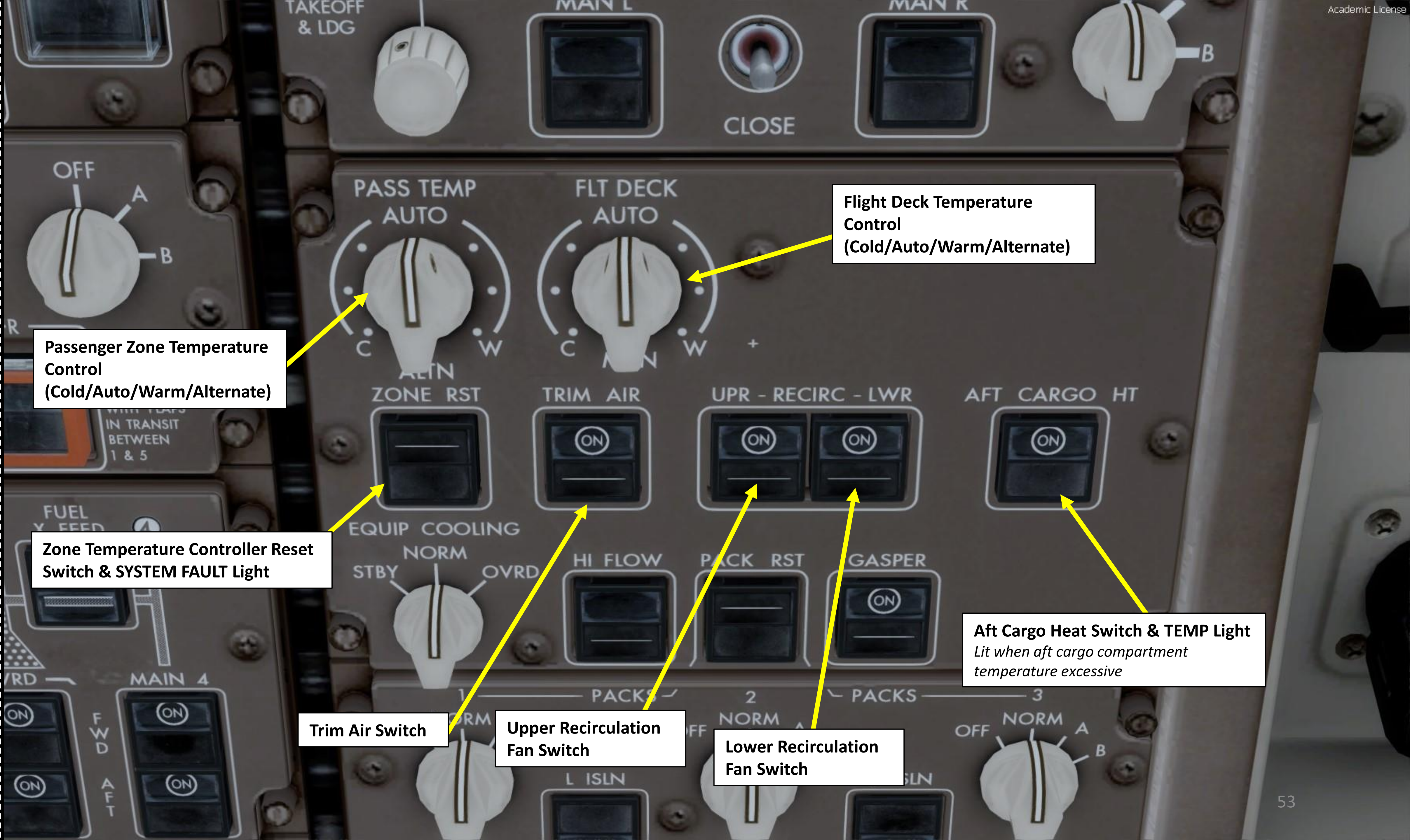
Hydraulic Systems in a Nutshell

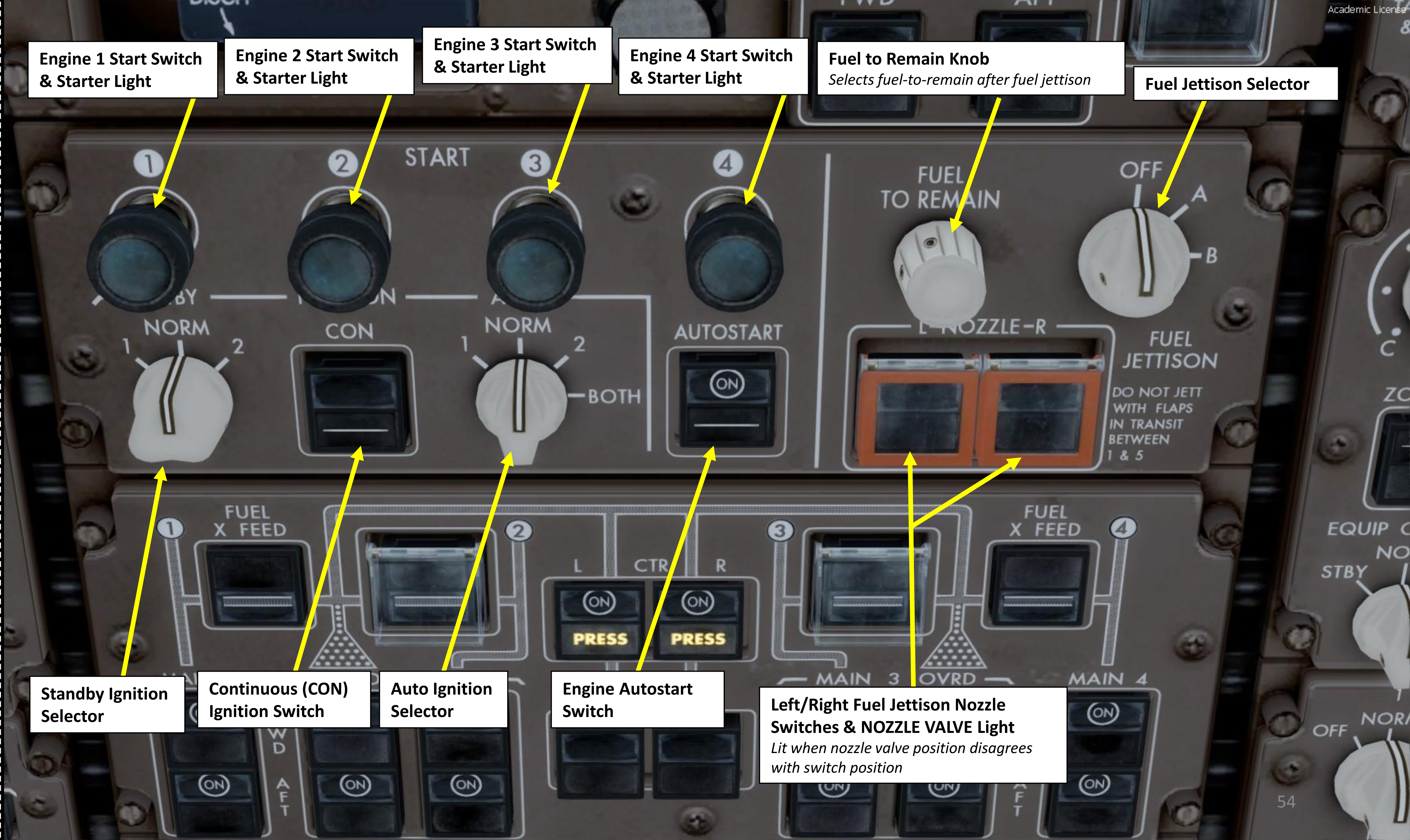


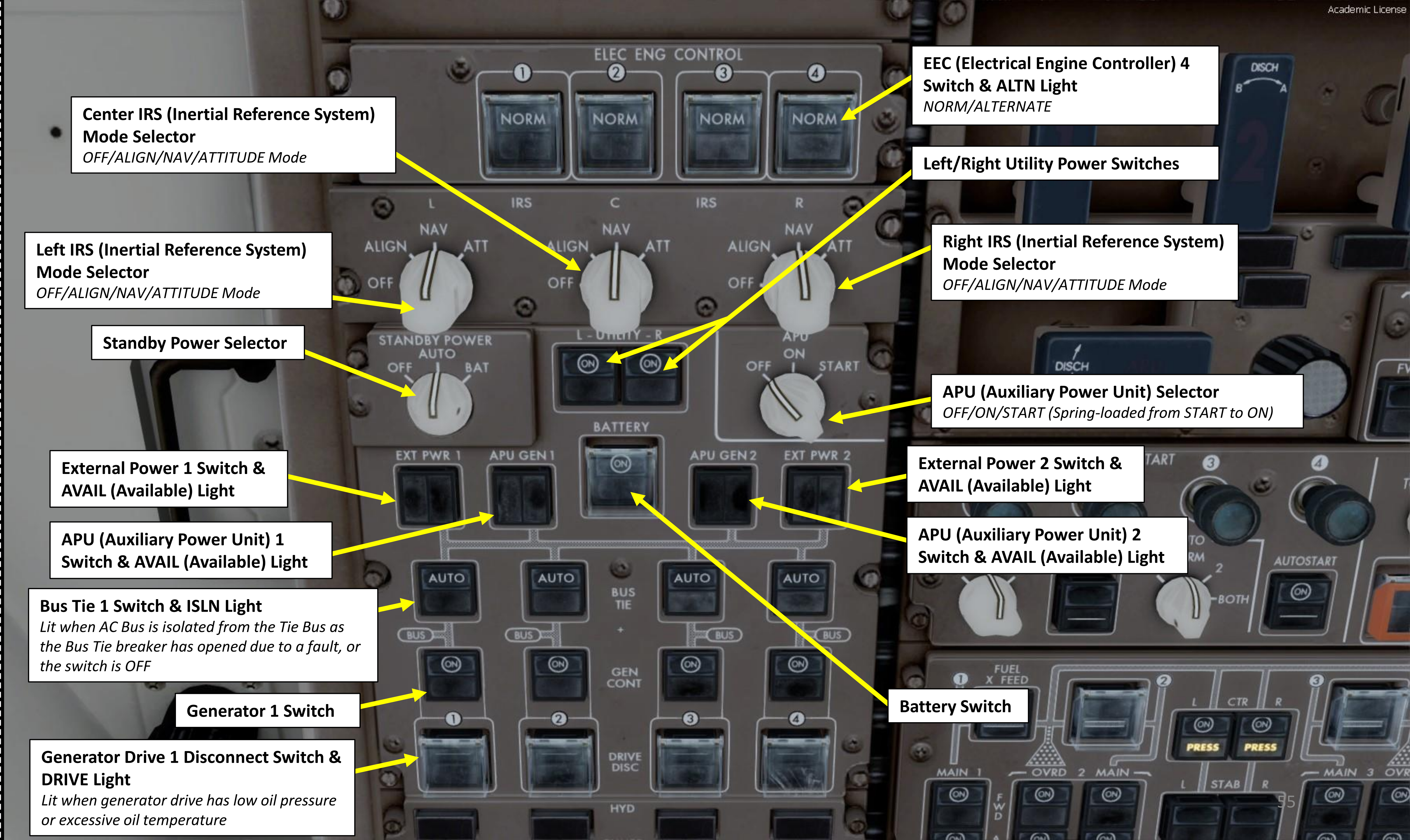

Fuel Cross-Feed Switch & VALVE Light (System 1)
Cross-feed valve disagrees with switch position
Fuel Cross-Feed Switch & VALVE Light (System 2)
Cross-feed valve disagrees with switch position
Forward Main Fuel Tank Pump Switch & PRESS Light (System 1)
Lit when pump output pressure is low
Aft Main Fuel Tank Pump Switch & PRESS Light (System 1)
Lit when pump output pressure is low
Aft Override Fuel Tank Pump Switch & PRESS Light (System 2)
Lit when pump output pressure is low
Engine 1 Nacelle Anti-Ice Switch & Nacelle Anti-Ice VALVE Light
Anti-Ice valve disagrees with switch position
Wing Anti-Ice Valve Switch & Wing Anti-Ice VALVE Light
Left or Right Anti-Ice valve disagrees with switch position
Aisle Stand Panel/Flood Lights Brightness Control
Left/Right Outboard Landing Light Switches
Left/Right Inboard Landing Light Switches
Left/Right Runway Turnoff Light Switches
Forward Override Fuel Tank Pump Switch & PRESS Light (System 2)
Lit when pump output pressure is low
Right Center Fuel Tank Pump Switch & PRESS Light
Lit when pump output pressure is low
Left Center Fuel Tank Pump Switch & PRESS Light
Lit when pump output pressure is low
Right Stabilizer Fuel Tank Pump Switch & PRESS Light
Lit when pump output pressure is low
Left Stabilizer Fuel Tank Pump Switch & PRESS Light
Lit when pump output pressure is low
Forward Main Fuel Tank Pump Switch & PRESS Light (System 2)
Lit when pump output pressure is low
Aft Main Fuel Tank Pump Switch & PRESS Light (System 2)
Lit when pump output pressure is low
FUEL X FEED
CTR
L
R
PRESS
PRESS
MAIN 1
OVRD
MAIN
STAB
MAIN 3
FWD
AFT
NACELLE ANTI-ICE
WING
ANTI-ICE
AISLE STAND PANEL/FLOOD
OUTBD
LANDING
INBD
OFF
RWY
TURNOFF
ON

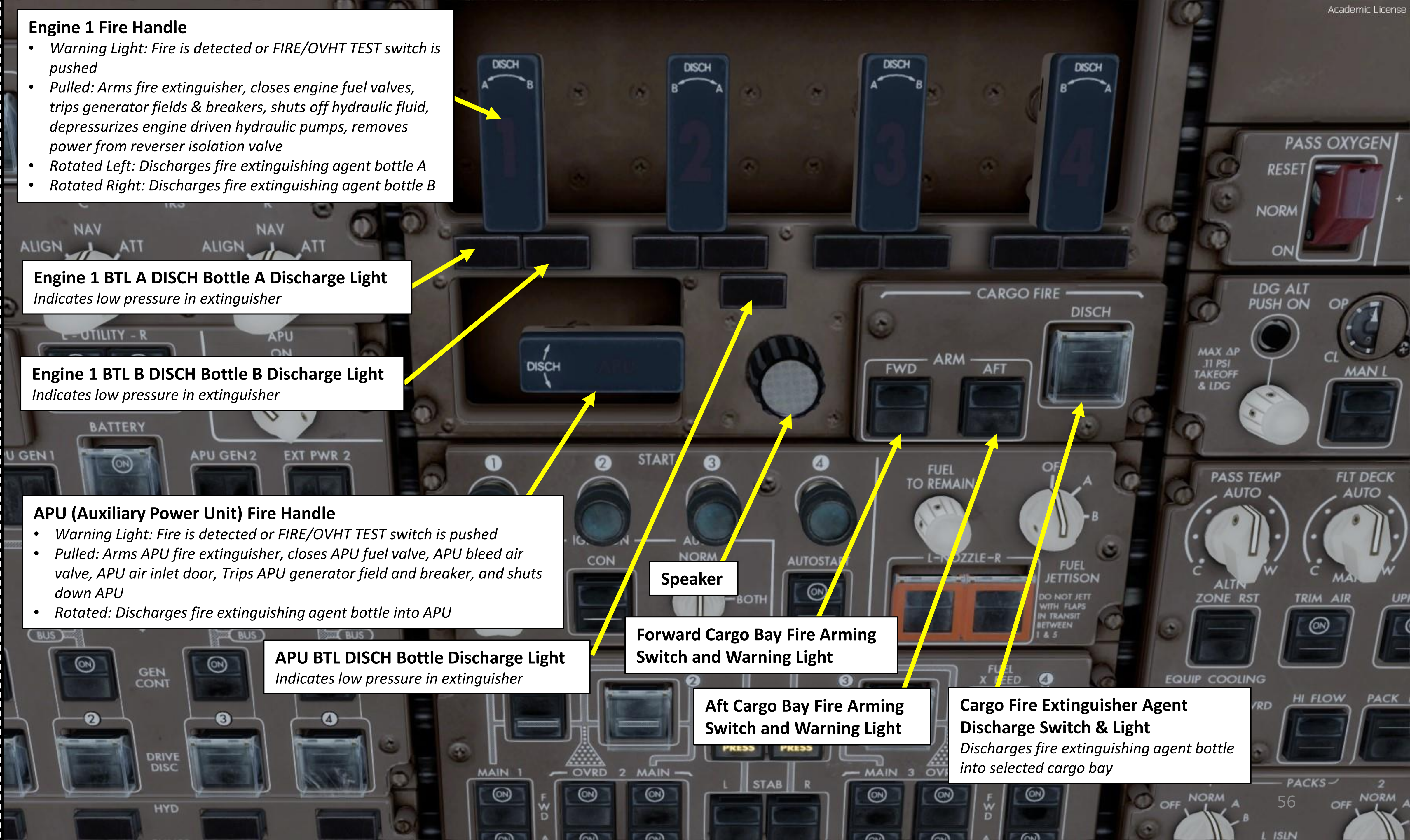

Forward Override Fuel Tank Pump Switch & PRESS Light (System 3)
Lit when pump output pressure is low
Forward Main Fuel Tank Pump Switch & PRESS Light (System 3)
Lit when pump output pressure is low
Aft Main Fuel Tank Pump Switch & PRESS Light (System 3)
Lit when pump output pressure is low
Rain Repellant Button
Left Wiper Selector
OFF/Low/High Speed
Left Window Heat Switch & Left Window Heat INOP Light
Heat to the window is off due to a controller fault, overheat, or the switch being off.
Left/Right Window Windshield Washer Switches
Right Window Heat Switch & Right Window Heat INOP Light
Heat to the window is off due to a controller fault, overheat, or the switch being off.
Right Wiper Selector
OFF/Low/High Speed
Rain Repellant Button
Aft Override Fuel Tank Pump Switch & PRESS Light (System 3)
Lit when pump output pressure is low
Aft Main Fuel Tank Pump Switch & PRESS Light (System 4)
Lit when pump output pressure is low
Forward Main Fuel Tank Pump Switch & PRESS Light (System 4)
Lit when pump output pressure is low
Fuel Cross-Feed Switch & VALVE Light (System 4)
Cross-feed valve disagrees with switch position
Fuel Cross-Feed Switch & VALVE Light (System 3)
Cross-feed valve disagrees with switch position
Academic License


APU (Auxiliary Power Unit) Bleed Air Switch & VALVE Light
APU bleed air valve disagrees with switch position
PACK Reset Switch & SYSTEM FAULT Light
Gasper Air Switch
PACK 2 (Pneumatic Air Conditioning Kit) Selector Switch
Right Isolation Valve Switch & VALVE Light
Right isolation valve disagrees with switch position
Equipment Cooling Selector Switch
STANDBY/NORMAL/OVERRIDE
PACK High Flow (HI FLOW) Switch
PACK 1 (Pneumatic Air Conditioning Kit) Selector Switch
PACK 3 (Pneumatic Air Conditioning Kit) Selector Switch
Left Isolation Valve Switch & VALVE Light
Left isolation valve disagrees with switch position
Bleed Air System 1 SYSTEM FAULT Light
Bleed Air System 2 SYSTEM FAULT Light
Bleed Air System 4 SYSTEM FAULT Light
Bleed Air System 3 SYSTEM FAULT Light
Engine 1 Bleed Air Switch & OFF Light
Engine 2 Bleed Air Switch & OFF Light
Engine 4 Bleed Air Switch & OFF Light
Engine 3 Bleed Air Switch & OFF Light
Beacon Light Switch
Off/Lower Light/Both Lights
Navigation Lights Switch
Strobe Light Switch
Wing Lights Switch
Logo Light Switch
Indication (Annunciator) Lights Switch


Flight Deck Temperature Control (Cold/Auto/Warm/Alternate)
Passenger Zone Temperature Control (Cold/Auto/Warm/Alternate)
Zone Temperature Controller Reset Switch & SYSTEM FAULT Light
Aft Cargo Heat Switch & TEMP Light
Lit when aft cargo compartment temperature excessive
Trim Air Switch
Upper Recirculation Fan Switch
Lower Recirculation Fan Switch
PASS TEMP
AUTO
FLT DECK
AUTO
ZONE RST
TRIM AIR
UPR - RECIRC - LWR
AFT CARGO HT
EQUIP COOLING
NORM
STBY
OVRD
HI FLOW
PACK RST
GASPER
PACKS
CLOSE
Academic License


Engine 1 Start Switch & Starter Light
Engine 2 Start Switch & Starter Light
Engine 3 Start Switch & Starter Light
Engine 4 Start Switch & Starter Light
Fuel to Remain Knob
Selects fuel-to-remain after fuel jettison
Fuel Jettison Selector
Standby Ignition Selector
Continuous (CON) Ignition Switch
Auto Ignition Selector
Engine Autostart Switch
Left/Right Fuel Jettison Nozzle Switches & NOZZLE VALVE Light
Lit when nozzle valve position disagrees with switch position
START
NORM
CON
BOTH
AUTOSTART
FUEL TO REMAIN
OFF
A
B
FUEL JETTISON
DO NOT JETT WITH FLAPS IN TRANSIT BETWEEN 1 & 5
FUEL X FEED
CTR
PRESS
MAIN 3 OVRD
MAIN 4


EEC (Electrical Engine Controller) 4 Switch & ALTN Light
NORM/ALTERNATE
Center IRS (Inertial Reference System) Mode Selector
OFF/ALIGN/NAV/ATTITUDE Mode
Left/Right Utility Power Switches
Left IRS (Inertial Reference System) Mode Selector
OFF/ALIGN/NAV/ATTITUDE Mode
Right IRS (Inertial Reference System) Mode Selector
OFF/ALIGN/NAV/ATTITUDE Mode
Standby Power Selector
APU (Auxiliary Power Unit) Selector
OFF/ON/START (Spring-loaded from START to ON)
External Power 1 Switch & AVAIL (Available) Light
External Power 2 Switch & AVAIL (Available) Light
APU (Auxiliary Power Unit) 1 Switch & AVAIL (Available) Light
APU (Auxiliary Power Unit) 2 Switch & AVAIL (Available) Light
Bus Tie 1 Switch & ISLN Light
Lit when AC Bus is isolated from the Tie Bus as the Bus Tie breaker has opened due to a fault, or the switch is OFF
Generator 1 Switch
Battery Switch
Generator Drive 1 Disconnect Switch & DRIVE Light
Lit when generator drive has low oil pressure or excessive oil temperature



Engine 1 Fire Handle

- *Warning Light: Fire is detected or FIRE/OVHT TEST switch is pushed*
- *Pulled: Arms fire extinguisher, closes engine fuel valves, trips generator fields & breakers, shuts off hydraulic fluid, depressurizes engine driven hydraulic pumps, removes power from reverser isolation valve*
- *Rotated Left: Discharges fire extinguishing agent bottle A*
- *Rotated Right: Discharges fire extinguishing agent bottle B*

Engine 1 BTL A DISCH Bottle A Discharge Light

Indicates low pressure in extinguisher

Engine 1 BTL B DISCH Bottle B Discharge Light

Indicates low pressure in extinguisher

APU (Auxiliary Power Unit) Fire Handle

- *Warning Light: Fire is detected or FIRE/OVHT TEST switch is pushed*
- *Pulled: Arms APU fire extinguisher, closes APU fuel valve, APU bleed air valve, APU air inlet door, Trips APU generator field and breaker, and shuts down APU*
- *Rotated: Discharges fire extinguishing agent bottle into APU*

APU BTL DISCH Bottle Discharge Light

Indicates low pressure in extinguisher

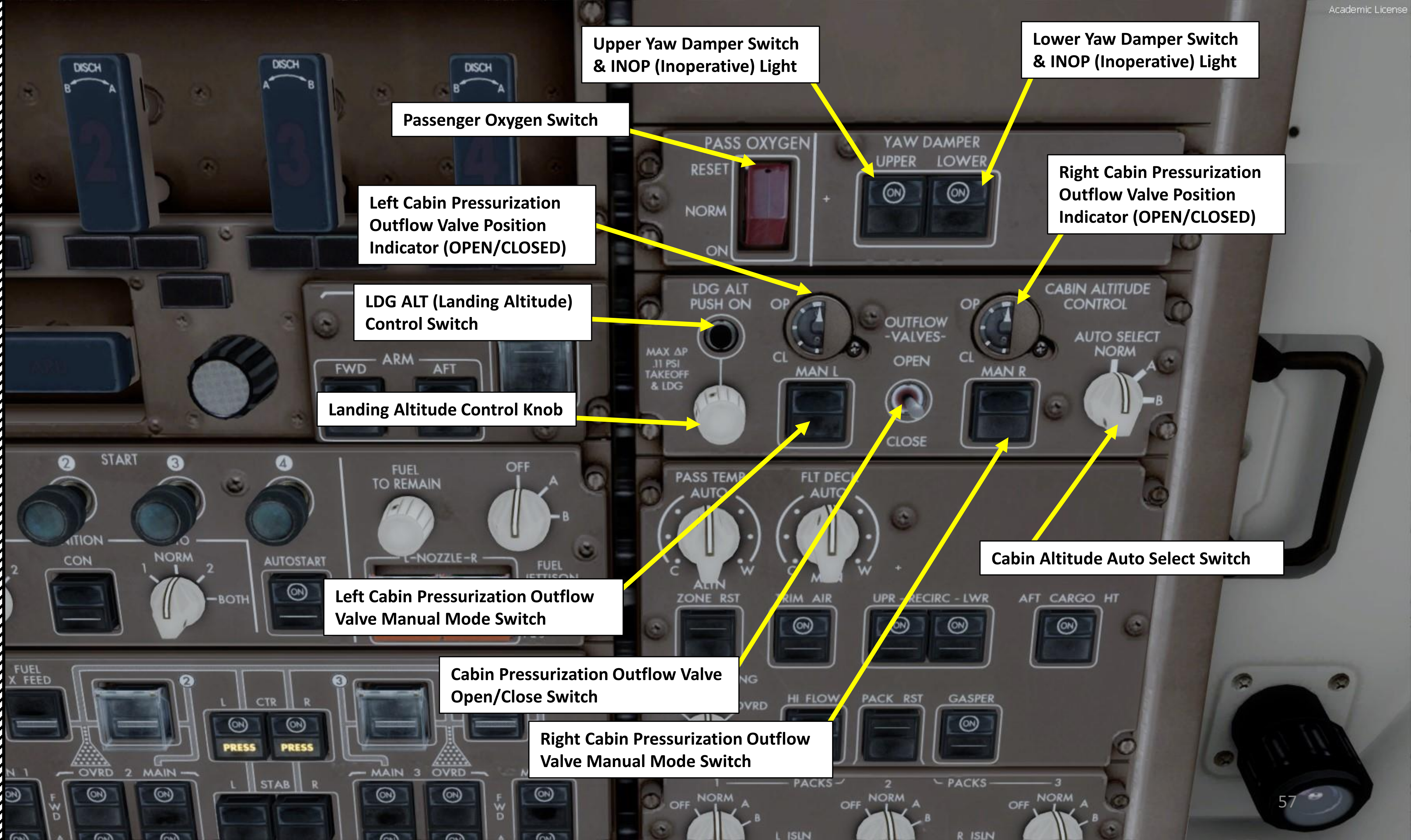
Speaker

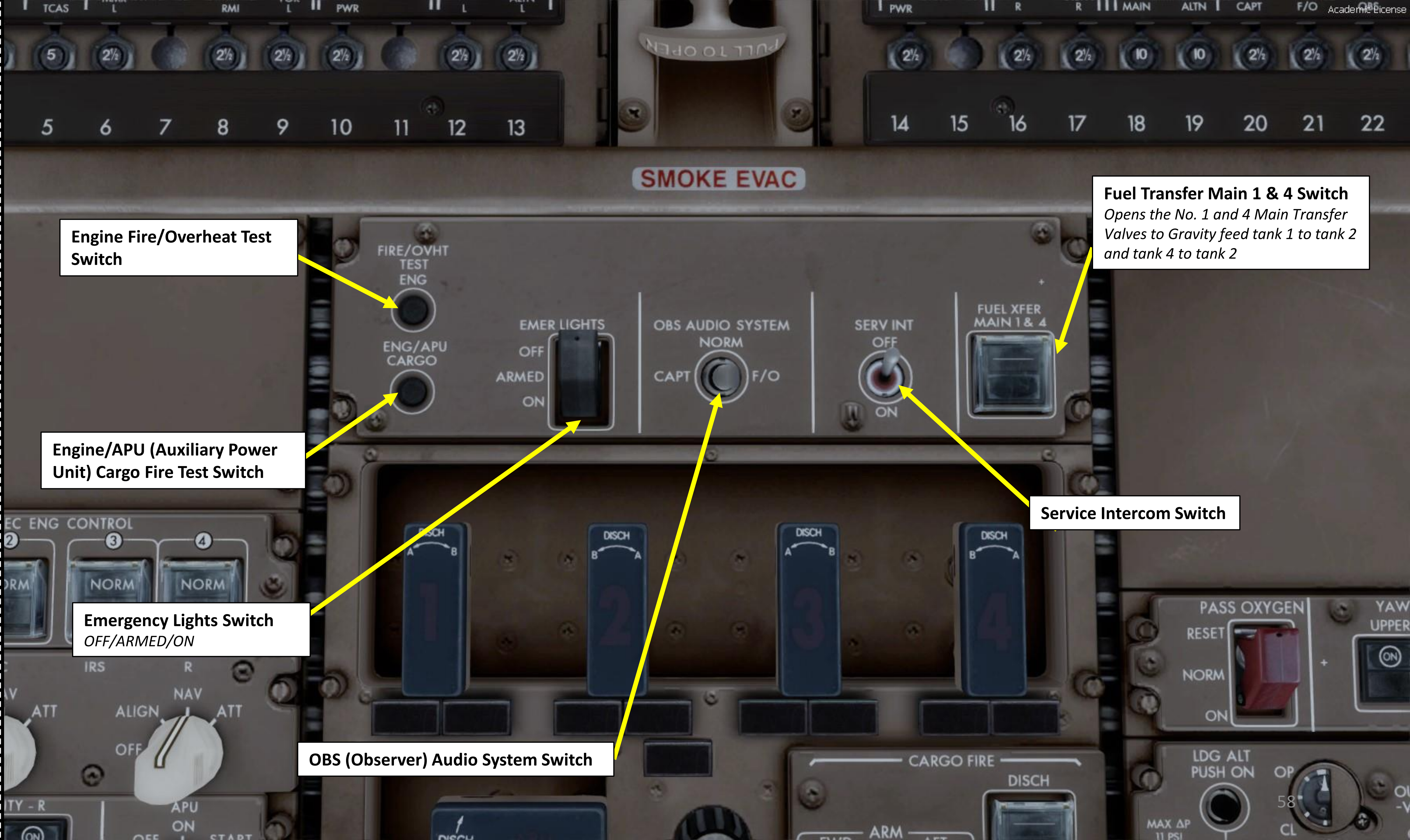
Forward Cargo Bay Fire Arming Switch and Warning Light

Aft Cargo Bay Fire Arming Switch and Warning Light

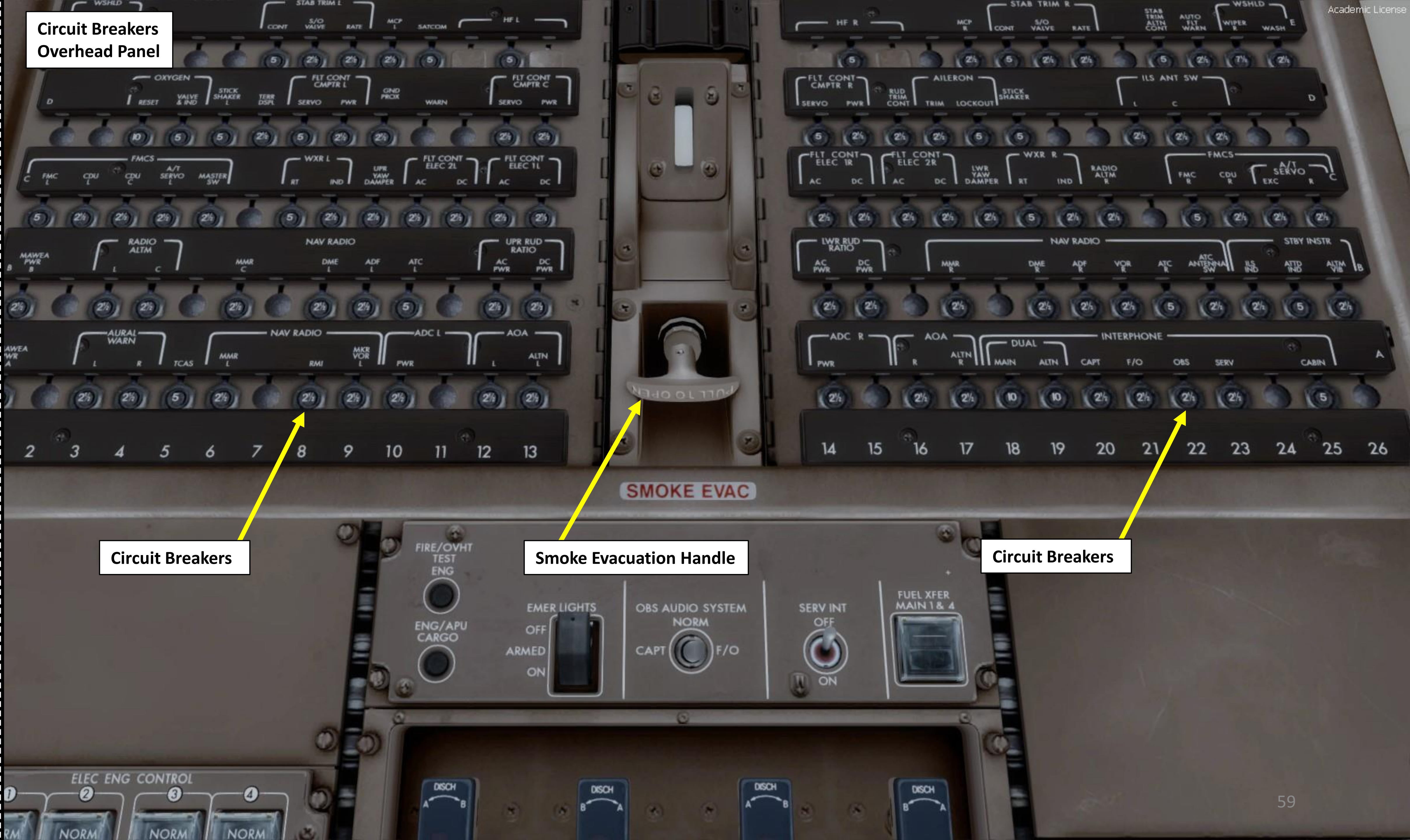
Cargo Fire Extinguisher Agent Discharge Switch & Light

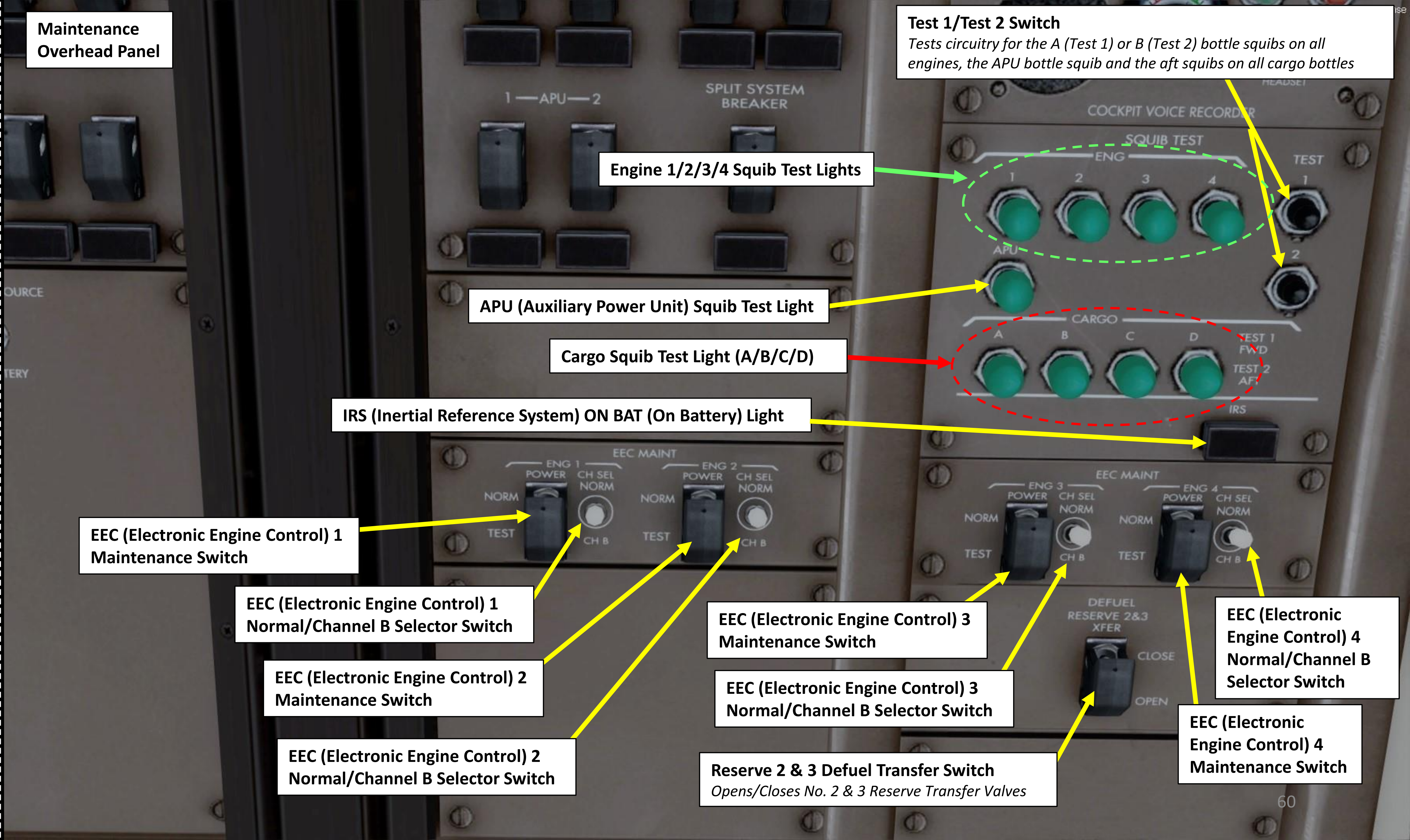
Discharges fire extinguishing agent bottle into selected cargo bay

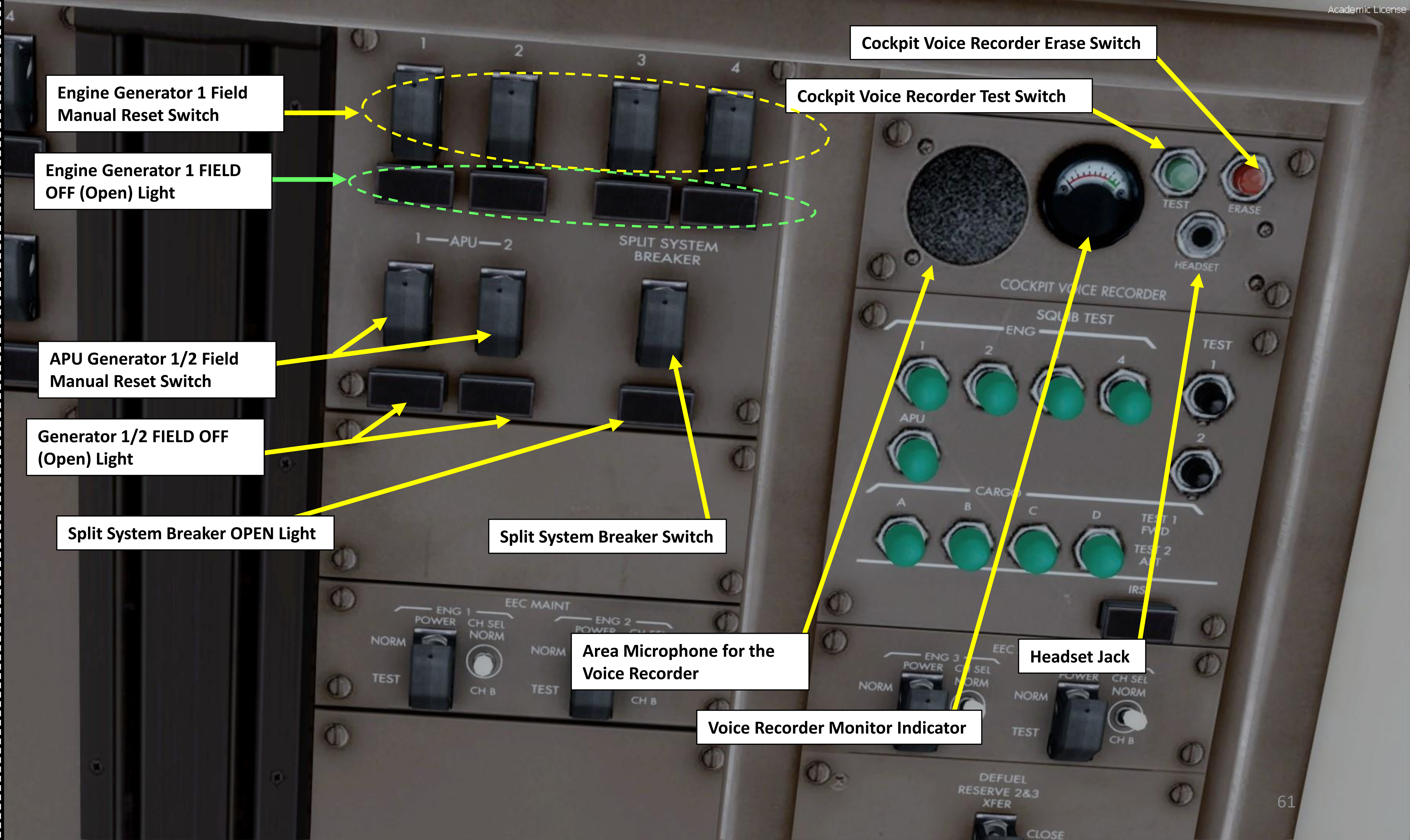

Upper Yaw Damper Switch & INOP (Inoperative) Light
Lower Yaw Damper Switch & INOP (Inoperative) Light
Passenger Oxygen Switch
Right Cabin Pressurization Outflow Valve Position Indicator (OPEN/CLOSED)
Left Cabin Pressurization Outflow Valve Position Indicator (OPEN/CLOSED)
LDG ALT (Landing Altitude) Control Switch
Landing Altitude Control Knob
Cabin Altitude Auto Select Switch
Left Cabin Pressurization Outflow Valve Manual Mode Switch
Cabin Pressurization Outflow Valve Open/Close Switch
Right Cabin Pressurization Outflow Valve Manual Mode Switch
PASS OXYGEN
RESET
NORM
ON
YAW DAMPER
UPPER
LOWER
LDG ALT
PUSH ON
OUTFLOW
-VALVES-
OPEN
CLOSE
MAN L
MAN R
CABIN ALTITUDE
CONTROL
AUTO SELECT
NORM
MAX ΔP
.11 PSI
TAKEOFF
& LDG

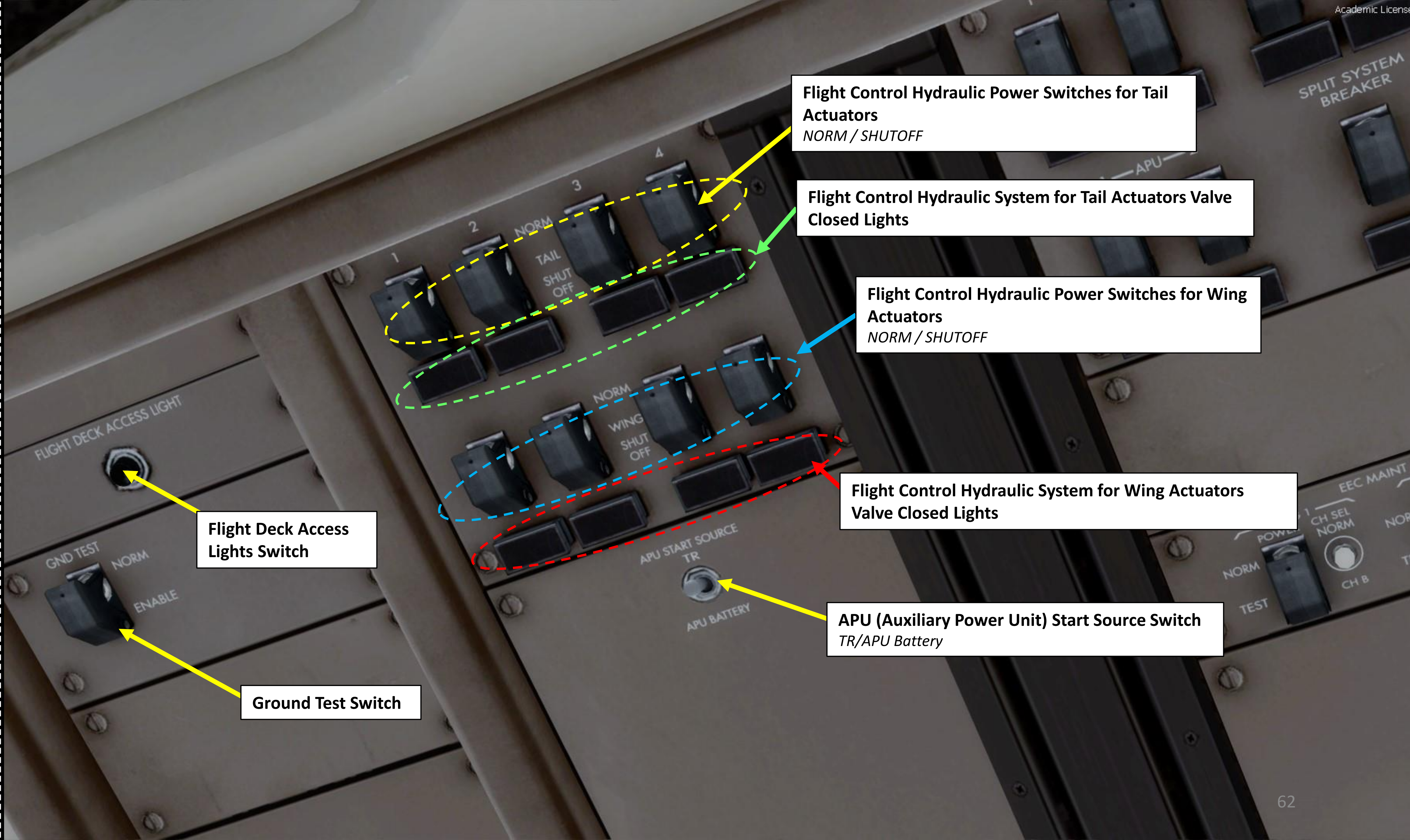

Engine Fire/Overheat Test Switch
Engine/APU (Auxiliary Power Unit) Cargo Fire Test Switch
Emergency Lights Switch
OFF/ARMED/ON
OBS (Observer) Audio System Switch
Service Intercom Switch
Fuel Transfer Main 1 & 4 Switch
Opens the No. 1 and 4 Main Transfer Valves to Gravity feed tank 1 to tank 2 and tank 4 to tank 2
SMOKE EVAC
FIRE/OVHT TEST ENG
ENG/APU CARGO
EMER LIGHTS
OFF
ARMED
ON
OBS AUDIO SYSTEM
NORM
CAPT
F/O
SERV INT
OFF
ON
FUEL XFER MAIN 1 & 4
CARGO FIRE
PASS OXYGEN

Circuit Breakers Overhead Panel



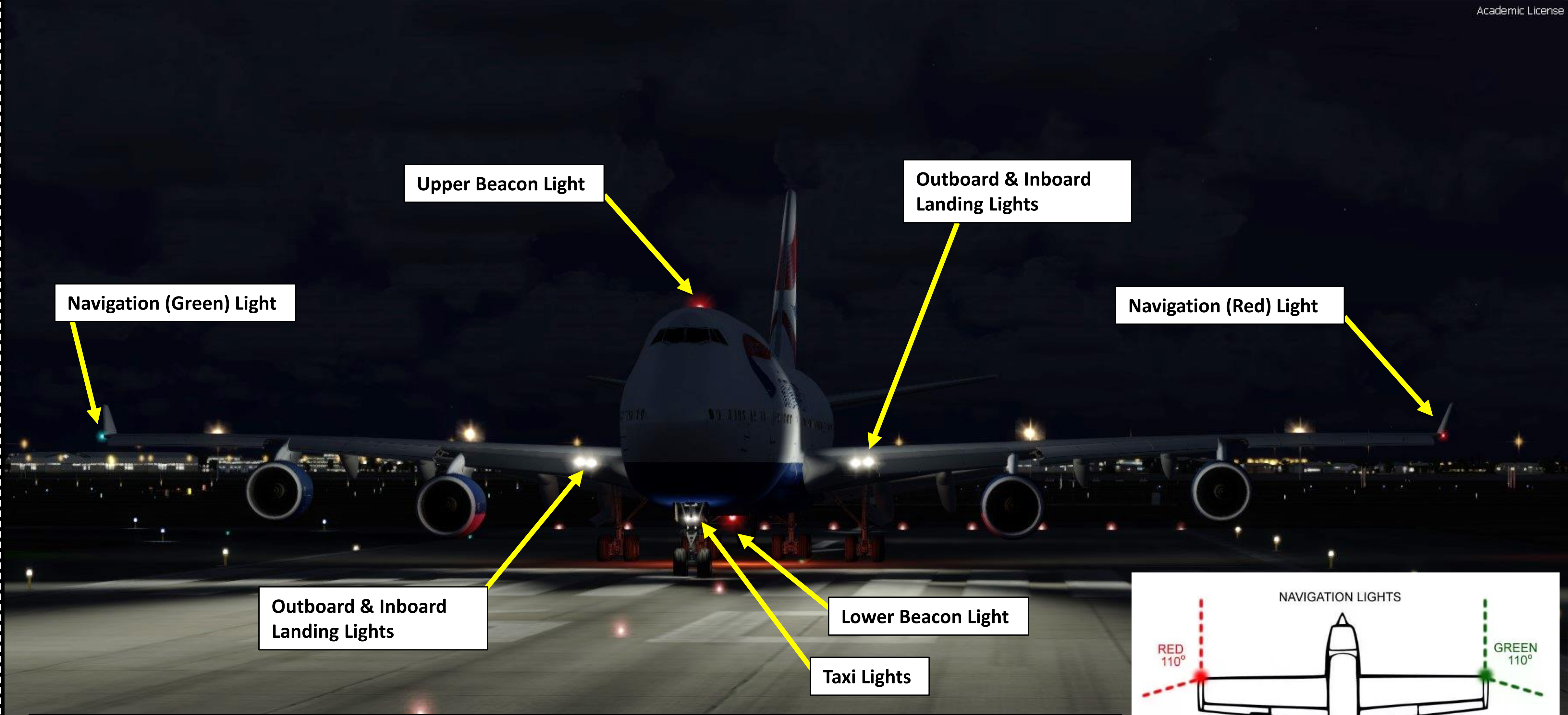

Maintenance Overhead Panel
Test 1/Test 2 Switch
Tests circuitry for the A (Test 1) or B (Test 2) bottle squibs on all engines, the APU bottle squib and the aft squibs on all cargo bottles
Engine 1/2/3/4 Squib Test Lights
APU (Auxiliary Power Unit) Squib Test Light
Cargo Squib Test Light (A/B/C/D)
IRS (Inertial Reference System) ON BAT (On Battery) Light
EEC (Electronic Engine Control) 1 Maintenance Switch
EEC (Electronic Engine Control) 1 Normal/Channel B Selector Switch
EEC (Electronic Engine Control) 2 Maintenance Switch
EEC (Electronic Engine Control) 2 Normal/Channel B Selector Switch
EEC (Electronic Engine Control) 3 Maintenance Switch
EEC (Electronic Engine Control) 3 Normal/Channel B Selector Switch
Reserve 2 & 3 Defuel Transfer Switch
Opens/Closes No. 2 & 3 Reserve Transfer Valves
EEC (Electronic Engine Control) 4 Normal/Channel B Selector Switch
EEC (Electronic Engine Control) 4 Maintenance Switch
1 —APU— 2
SPLIT SYSTEM BREAKER
COCKPIT VOICE RECORDER
SQUIB TEST
ENG
TEST
APU
CARGO
IRS
EEC MAINT
ENG 1
ENG 2
ENG 3
ENG 4
POWER
CH SEL
NORM
TEST
CH B
DEFUEL RESERVE 2&3 XFER
CLOSE
OPEN

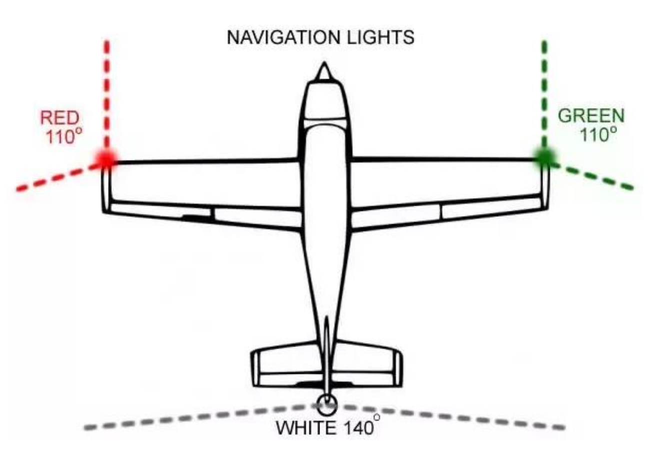

Academic License
Engine Generator 1 Field Manual Reset Switch
Engine Generator 1 FIELD OFF (Open) Light
APU Generator 1/2 Field Manual Reset Switch
Generator 1/2 FIELD OFF (Open) Light
Split System Breaker OPEN Light
Split System Breaker Switch
Cockpit Voice Recorder Erase Switch
Cockpit Voice Recorder Test Switch
Area Microphone for the Voice Recorder
Voice Recorder Monitor Indicator
Headset Jack
1
2
3
4
1 —APU— 2
SPLIT SYSTEM BREAKER
TEST
ERASE
HEADSET
SQUIB TEST
ENG
APU
CARGO
A
B
C
D
EEC MAINT
ENG 1
POWER
CH SEL
NORM
TEST
CH B
DEFUEL
RESERVE 2&3
XFER
CLOSE


Flight Control Hydraulic Power Switches for Tail Actuators
NORM / SHUTOFF
Flight Control Hydraulic System for Tail Actuators Valve Closed Lights
Flight Control Hydraulic Power Switches for Wing Actuators
NORM / SHUTOFF
Flight Control Hydraulic System for Wing Actuators Valve Closed Lights
Flight Deck Access Lights Switch
APU (Auxiliary Power Unit) Start Source Switch
TR/APU Battery
Ground Test Switch
FLIGHT DECK ACCESS LIGHT
GND TEST
NORM
ENABLE
NORM
TAIL
SHUT OFF
WING
SHUT OFF
APU START SOURCE
TR
APU BATTERY
SPLIT SYSTEM BREAKER
APU
EEC MAINT
CH SEL
NORM
CH B
NORM
TEST

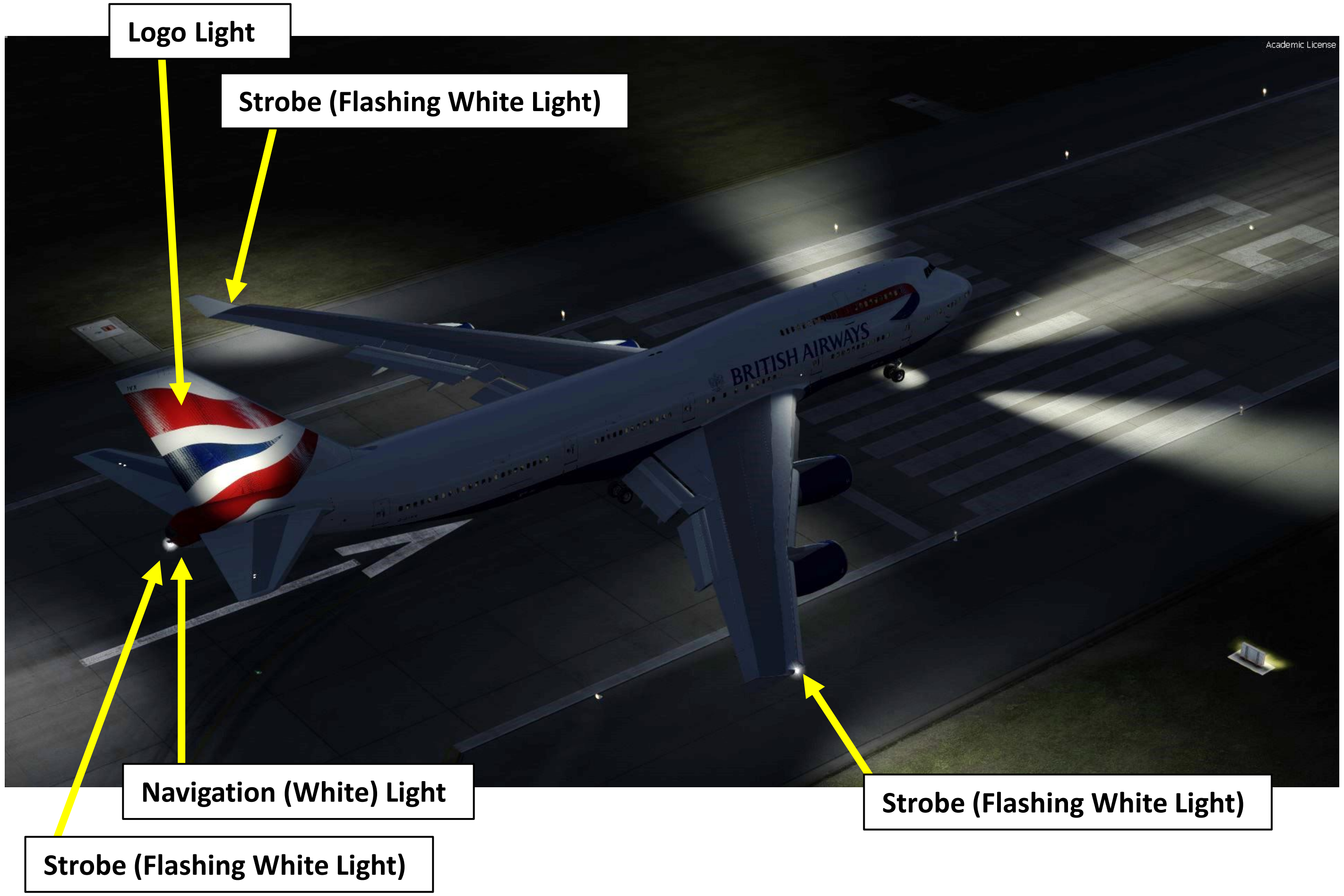
Fun fact: did you know that the 747 could also be fitted with a fifth engine mount? It can carry an engine out on the wing for transport, but it can't be used to power the aircraft per se. A 747 flown by Qantas used this engine transportation method from Sydney to Johannesburg.

Reference:
http://www.dailymail.co.uk/news/article-3392372/The-plane-nervous-flyers-Massive-Qantas-jumbo-jet-flies-Sydney-South-Africa-FIVE-engines-attached-wings-airline-deploys-rarely-used-transportation-method.html





- **Landing** Lights: used to illuminate runway during landing
- **Runway Turnoff** Lights: used to aid the crew in seeing the turn in the taxiway/runway
- **Taxi** Lights: used to illuminate area in front of nosewheel during taxi
- **Beacon (Anti-Collision)** Lights: flashing red light used to prevent collisions and warn others that aircraft is active and engines are running
- **Navigation (Position)** Lights: red, green and white lights help you know the direction of an aircraft (red is on the left, green on the right, white on the tail).
- **Strobe (Anti-Collision)** Lights: pulsating white lights used when aircraft enters a runway in use to increase visibility
- **Wing** Lights: used to check wing at night (i.e. verify if there is ice accumulation on the wing)
- **Logo** Light: used to illuminate the airline's logo painted on the tail


Academic License
Logo Light
Strobe (Flashing White Light)
Navigation (White) Light
Strobe (Flashing White Light)
Strobe (Flashing White Light)
BRITISH AIRWAYS


BRITISH AIRWAYS
Runway Turnoff Lights (Left & Right)


Wing Light

PLANNING THE FLIGHT

In real life, you cannot just fly a 747 wherever and whenever you please. Just like on land, the sky is littered with an intricate network of waypoints and aerial highways. Therefore, it is necessary to plan your flight route and to determine how much fuel you will need to carry in order to reach your destination.

In order to do this, we will use a tool called "Online Flight Planner" available here: http://onlineflightplanner.org/

There are a number of fuel planners available online. These estimates may or may not be very accurate. There are specific charts created by Boeing to come up with accurate fuel estimates which are unfortunately not available to the public. Therefore, for the sake of simplicity we will just use a rule of thumb that's good enough for the purpose of this tutorial.

Airways:
EHAM SID *GORLO* UL980 *LOGAN* STAR *EGLL*

Provided by RouteFinder

METAR:

Departure: EHAM 110225Z 33004KT 8000 NSC 12/11 Q1018 BECMG 7000
Destination: EGLL 110220Z AUTO 03005KT 360V070 9999 OVC009 14/12 Q1023 TEMPO BKN012

Provided by CheckWX API

Fuel quantity for Boeing 747 (PMDG)

	Fuel	Time
Fuel Usage	16726 lbs	00:52
Reserve Fuel	24095 lbs	01:15
Fuel on Board	40821 lbs	02:07

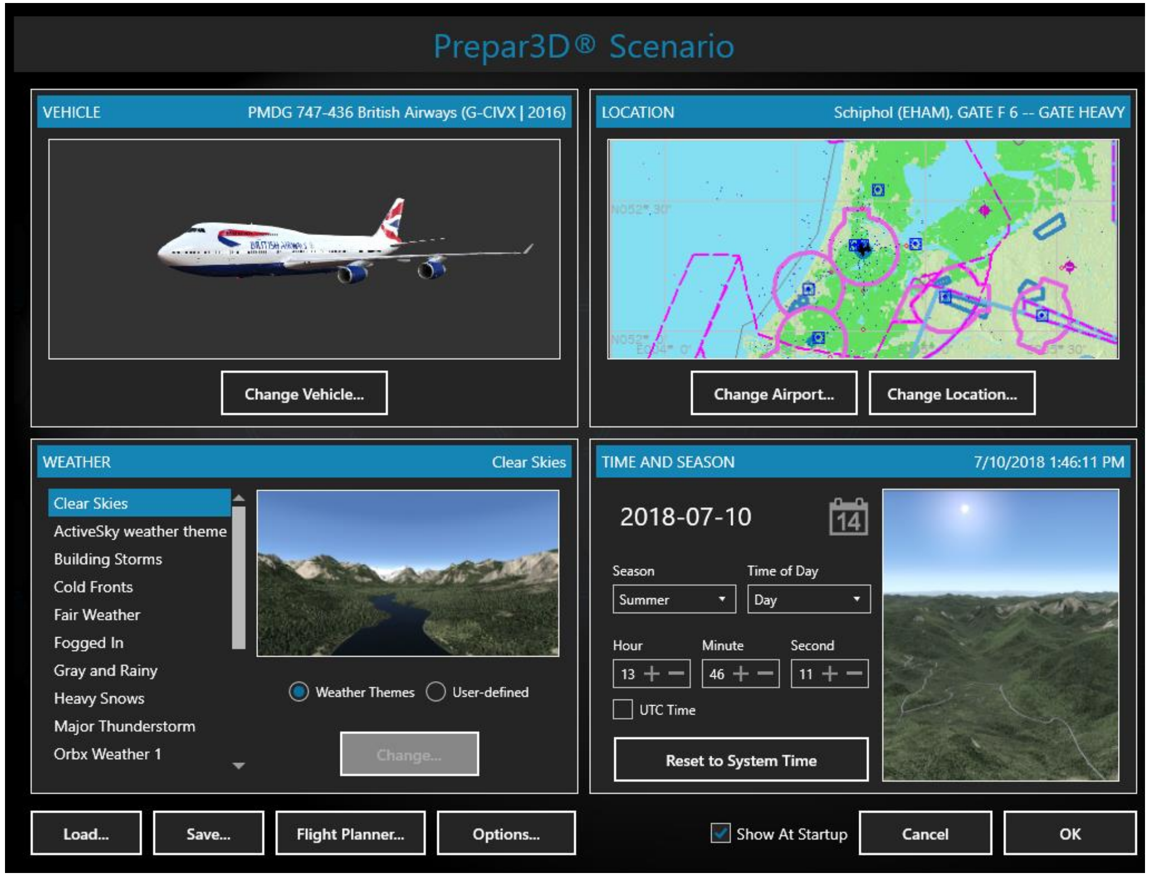
Provided by Fuelplanner.com

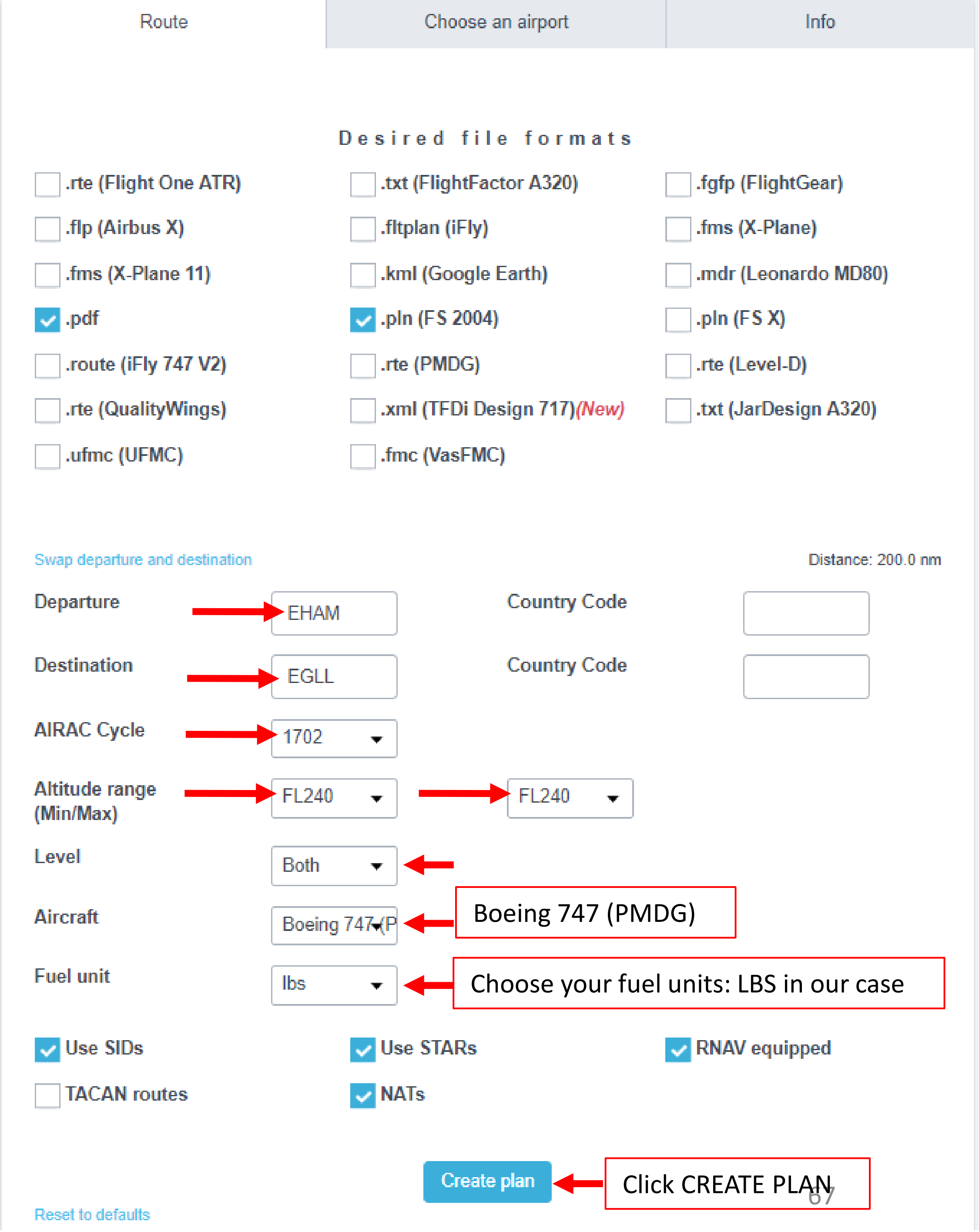
PLANNING THE FLIGHT

Today's flight will start from **AMSTERDAM-SCHIPHOL (EHAM)** and our destination will be **LONDON-HEATHROW (EGLL).**

Using the "Online Flight Planner" available here: http://onlineflightplanner.org/ we will enter the Departure airport (EHAM), the Destination airport (EGLL) and the AIRAC Cycle desired (we will use the **AIRAC cycle 1702** as explained on the next page).

Click on CREATE PLAN to generate a flight plan.





PLANNING THE FLIGHT

In aviation, an **Aeronautical Information Publication** (or **AIP**) is defined by the International Civil Aviation Organization as a publication issued by or with the authority of a state and containing aeronautical information of a lasting character essential to air navigation. It is designed to be a manual containing thorough details of regulations, procedures and other information pertinent to flying aircraft in the particular country to which it relates. It is usually issued by or on behalf of the respective civil aviation administration. AIPs are kept up-to-date by regular revision on a fixed cycle. For operationally significant changes in information, the cycle known as the **AIRAC (Aeronautical Information Regulation And Control)** cycle is used: revisions are produced every 56 days (double AIRAC cycle) or every 28 days (single AIRAC cycle). These changes are received well in advance so that users of the aeronautical data can update their flight management systems (FMS). (Source: https://en.wikipedia.org/wiki/Aeronautical_Information_Publication)

In other words, some Youtube tutorials might show you flight routes with certain waypoints that got changed with more recent AIRAC updates. Some waypoints or even airports may not exist anymore. Therefore, you have two options:

1. Plan your flight using the default AIRAC cycle programmed in the FMC when it was first coded by PMDG during early February, 2017 (period **02**) 20**17** (AIRAC cycle **1702**), which is what we will do for this tutorial. This option is free and simple if you fly alone. However, if you fly with online ATCs in multiplayer that use the latest AIRAC database, you should go for the second option.
2. Plan your flight using the latest AIRAC cycle. You will need to update your AIRAC, SID and STAR database by using a paid subscription service called "Navigraph", which is available here https://www.navigraph.com/FmsDataManualInstall.aspx .

AIRAC effective dates (28-day cycle) [edit]

The current AIRAC cycle is 1605 (effective 28 Apr 2016).

#	2003	2004*	2005	2006	2007	2008*	2009	2010	2011	2012*	2013	2014	2015	2016*	2017	2018	2019	2020*
01	23 Jan	22 Jan	20 Jan	19 Jan	18 Jan	17 Jan	15 Jan	14 Jan	13 Jan	12 Jan	10 Jan	9 Jan	8 Jan	7 Jan	5 Jan	4 Jan	3 Jan	2 Jan
02	20 Feb	19 Feb	17 Feb	16 Feb	15 Feb	14 Feb	12 Feb	11 Feb	10 Feb	9 Feb	7 Feb	6 Feb	5 Feb	4 Feb	2 Feb	1 Feb	31 Jan	30 Jan
03	20 Mar	18 Mar	17 Mar	16 Mar	15 Mar	13 Mar	12 Mar	11 Mar	10 Mar	8 Mar	7 Mar	6 Mar	5 Mar	3 Mar	2 Mar	1 Mar	28 Feb	27 Feb
04	17 Apr	15 Apr	14 Apr	13 Apr	12 Apr	10 Apr	9 Apr	8 Apr	7 Apr	05 Apr	4 Apr	3 Apr	2 Apr	31 Mar	30 Mar	29 Mar	28 Mar	26 Mar
05	15 May	13 May	12 May	11 May	10 May	8 May	7 May	6 May	5 May	03 May	2 May	1 May	30 Apr	28 Apr	27 Apr	26 Apr	25 Apr	23 Apr
06	12 Jun	10 Jun	9 Jun	8 Jun	7 Jun	5 Jun	4 Jun	3 Jun	2 Jun	31 May	30 May	29 May	28 May	26 May	25 May	24 May	23 May	21 May
07	10 Jul	8 Jul	7 Jul	6 Jul	5 Jul	3 Jul	2 Jul	1 Jul	30 Jun	28 Jun	27 Jun	26 Jun	25 Jun	23 Jun	22 Jun	21 Jun	20 Jun	18 Jun
08	7 Aug	05 Aug	4 Aug	3 Aug	2 Aug	31 Jul	30 Jul	29 Jul	28 Jul	26 Jul	25 Jul	24 Jul	23 Jul	21 Jul	20 Jul	19 Jul	18 Jul	16 Jul
09	4 Sep	02 Sep	1 Sep	31 Aug	30 Aug	28 Aug	27 Aug	26 Aug	25 Aug	23 Aug	22 Aug	21 Aug	20 Aug	18 Aug	17 Aug	16 Aug	15 Aug	13 Aug
10	2 Oct	30 Sep	29 Sep	28 Sep	27 Sep	25 Sep	24 Sep	23 Sep	22 Sep	20 Sep	19 Sep	18 Sep	17 Sep	15 Sep	14 Sep	13 Sep	12 Sep	10 Sep
11	30 Oct	28 Oct	27 Oct	26 Oct	25 Oct	23 Oct	22 Oct	21 Oct	20 Oct	18 Oct	17 Oct	16 Oct	15 Oct	13 Oct	12 Oct	11 Oct	10 Oct	8 Oct
12	27 Nov	25 Nov	24 Nov	23 Nov	22 Nov	20 Nov	19 Nov	18 Nov	17 Nov	15 Nov	14 Nov	13 Nov	12 Nov	10 Nov	9 Nov	8 Nov	7 Nov	5 Nov
13	25 Dec	23 Dec	22 Dec	21 Dec	20 Dec	18 Dec	17 Dec	16 Dec	15 Dec	13 Dec	12 Dec	11 Dec	10 Dec	8 Dec	7 Dec	6 Dec	5 Dec	3 Dec
14																		31 Dec

Note: * = leap year containing 29 Feb (2004, 2008, 2012, 2016, etc.)

PLANNING THE FLIGHT

FUEL

For a flight of approx. **200 nm**, fuel planning can be estimated with the following formula:

Imperial Units
Fuel for flight = (Number of 100 nm legs) x (8200 lbs)
= 2 x 8200 lbs = **16400 lbs**
Reserve Fuel = **20500 lbs**
Total Fuel = Fuel for Flight + Reserve Fuel = **36900 lbs**

Metric Units
Fuel for flight = (Number of 100 nm legs) x (3700 kg)
= 2 x 3700 kg = 7400 kg
Reserve Fuel = 9250 kg
Total Fuel = Fuel for Flight + Reserve Fuel = 16650 kg

FLIGHT ROUTE

The flight route we will take is:
EHAM SID **GORLO** UL980 **LOGAN** STAR **EGLL**

Write this route down.

But what does it all mean? Here is a breakdown of this route:

- Depart from Schiphol Airport (EHAM)
- Follow the SID (Standard Instrument Departure) route from EHAM to GORLO
- Navigate to GORLO VOR
- Follow UL980 airway
- Navigate to LOGAN VOR
- Follow the STAR (Standard Terminal Arrival Route) from LOGAN to EGLL
- Land at Heathrow Airport (EGLL)

Amsterdam Airport Schiphol (EHAM) ⇒ London Heathrow Airport (EGLL)

ID	Frequency	Track	Distance (nm)	Coordinates		Name/Remarks
EHAM	-	0	0	N52°18'29.00"	E004°45'51.00"	AMSTERDAM/SCHIPHOL
GORLO	-	249	63	N51°55'26.64"	E003°10'18.61"	GORLO
REFSO	-	250	20	N51°48'34.44"	E002°40'00.87"	REFSO
ULKOK	-	264	10	N51°47'43.62"	E002°24'40.76"	ULKOK
XAMAN	-	264	7	N51°47'05.13"	E002°13'27.22"	XAMAN
LOGAN	-	264	23	N51°44'51.00"	E001°36'43.00"	LOGAN
EGLL	-	258	79	N51°28'39.00"	W000°27'41.00"	LONDON HEATHROW

A waypoint can be enabled/disabled by clicking on it (except first two and last two waypoints).

7 fixes, 202 nm.

Airways:
EHAM *SID* ***GORLO*** *UL980* ***LOGAN*** *STAR* ***EGLL***

WHAT IS A **SID** AND A **STAR**?

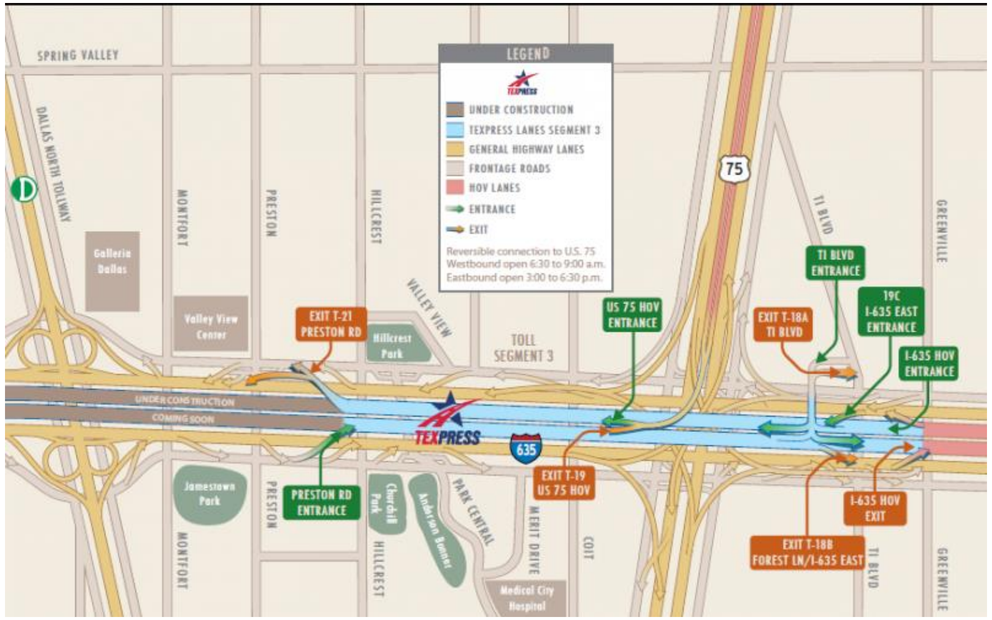
A **SID** (Standard Instrument Departure) is a small initial route which leads an aircraft from the runway they've just taken off from to the first point in his/her intended route. An airport usually has a lot of aircraft departing from it's runways. To save confusion (and for safety), a busy airport will publish standard routes from it's runways to the various routes away from that airport. This way a controller can be sure that even if a steady stream of aircraft is leaving the airport they will all be following in a nice neat line, one behind the other (that's the idea anyhow!).

Standard routes are the preferred method to fly from airport to airport. This is why we use a flight plan generator. Arriving at an airport is just the same. The **STARs** (STandard Arrival Routes) are also published in chart form and allow you to fly into an airport using standard procedures. This way, less communication is again needed with the controllers as (once you have declared your intention or been given a route to fly by name) the controller and you both know exactly how you are going to approach the airport. The end of the STAR route will normally leave your aircraft at a position where controllers can give you final instructions to set you up for a landing.

SIDs and STARs are quite similar to highways; they have speed limits and altitude restrictions at certain waypoints to make sure the air traffic is flying safely and on the same trajectory. The FMC (Advanced Flight Management Computer) will automatically try to respect these restrictions.

In other words, you can see SIDs and STARs like road junctions in the sky that lead to other waypoints and airways from or to your desired airport. One airport has many SIDs and STARs.

Typically, SIDs and STARs are provided by the ATC (Air Traffic Controller). Since we're doing a tutorial, I will just give you the SID and STAR to plug in the FMC.



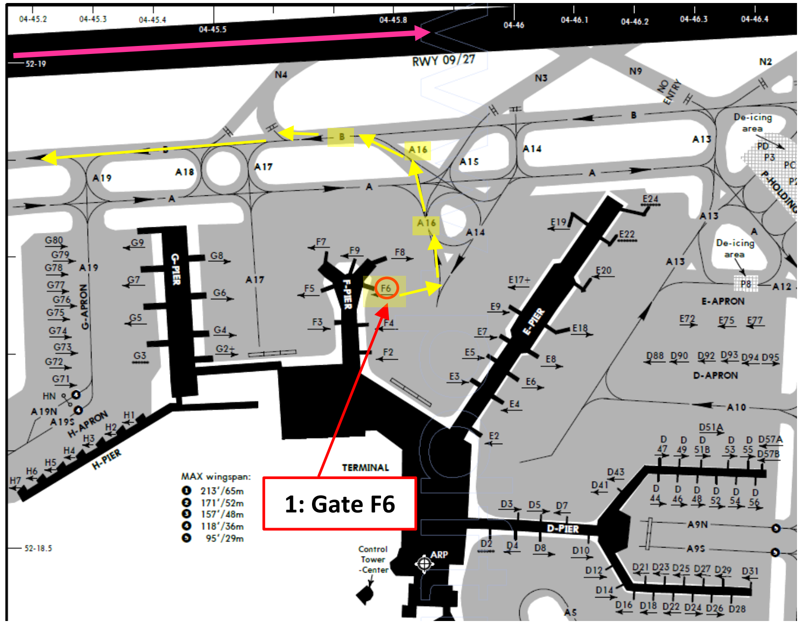
747-400

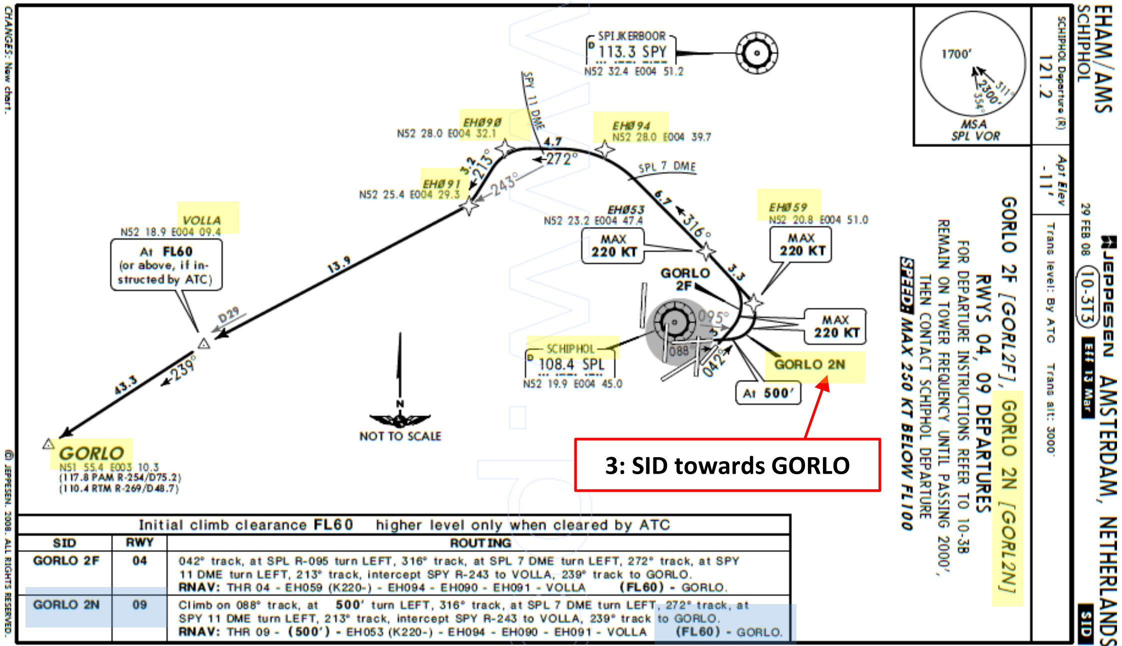
PART 3 – FLIGHT PLAN & PRE-START

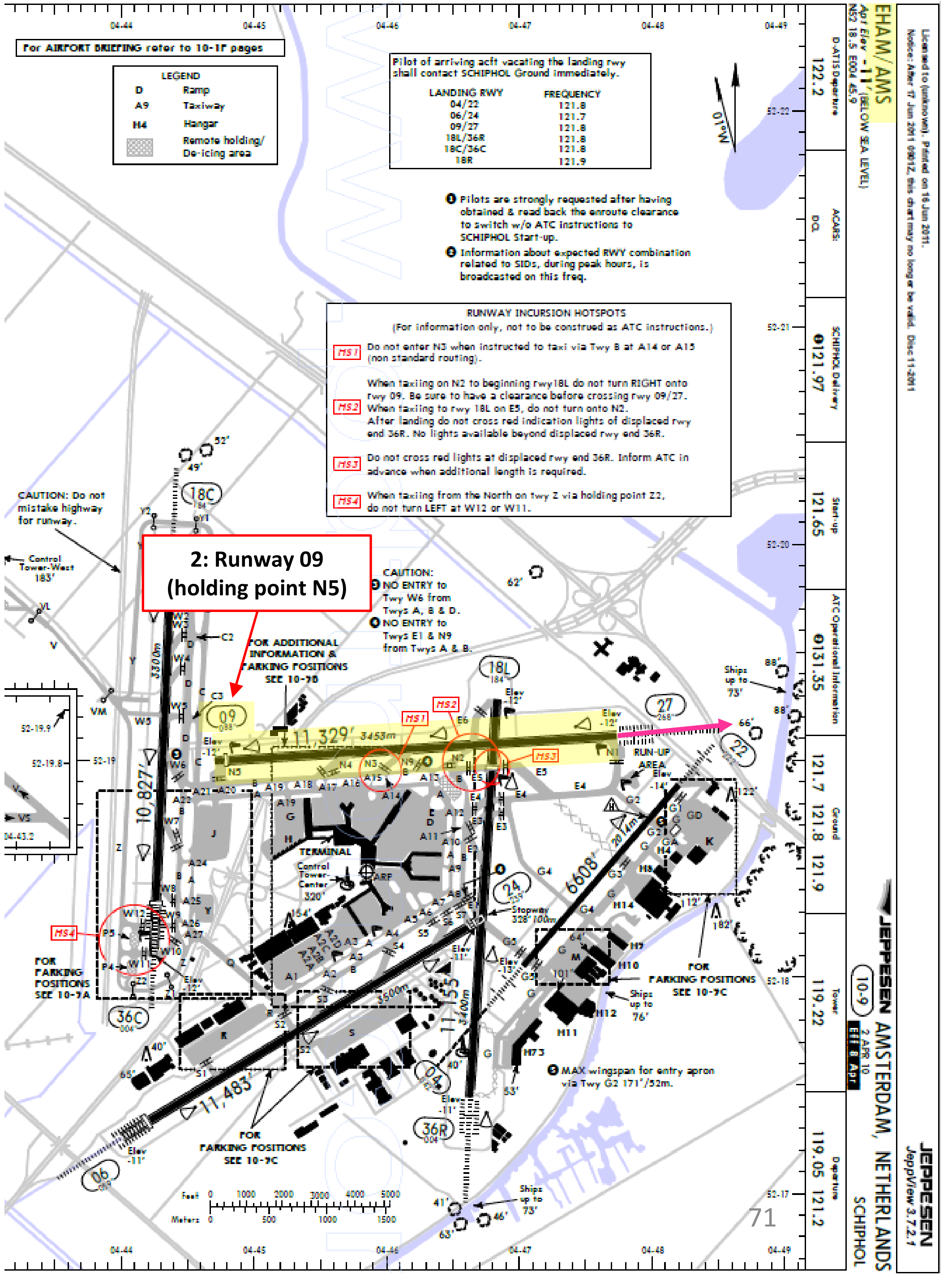
PLANNING THE DEPARTURE - SID

These charts are for the SID (Standard Instrument Departure) from Schiphol (EHAM) to GORLO. We intend to:

1. Spawn at Gate F6 (personal preference)
2. Taxi towards **runway 09** (orientation: 090) using taxiways A16, Bravo (B) and holding point N5.
3. Depart from EHAM using the SID from EHAM to GORLO (GORL2N) to a target altitude of 6000 ft (FL060)
4. Climb to a cruising altitude of 24,000 ft



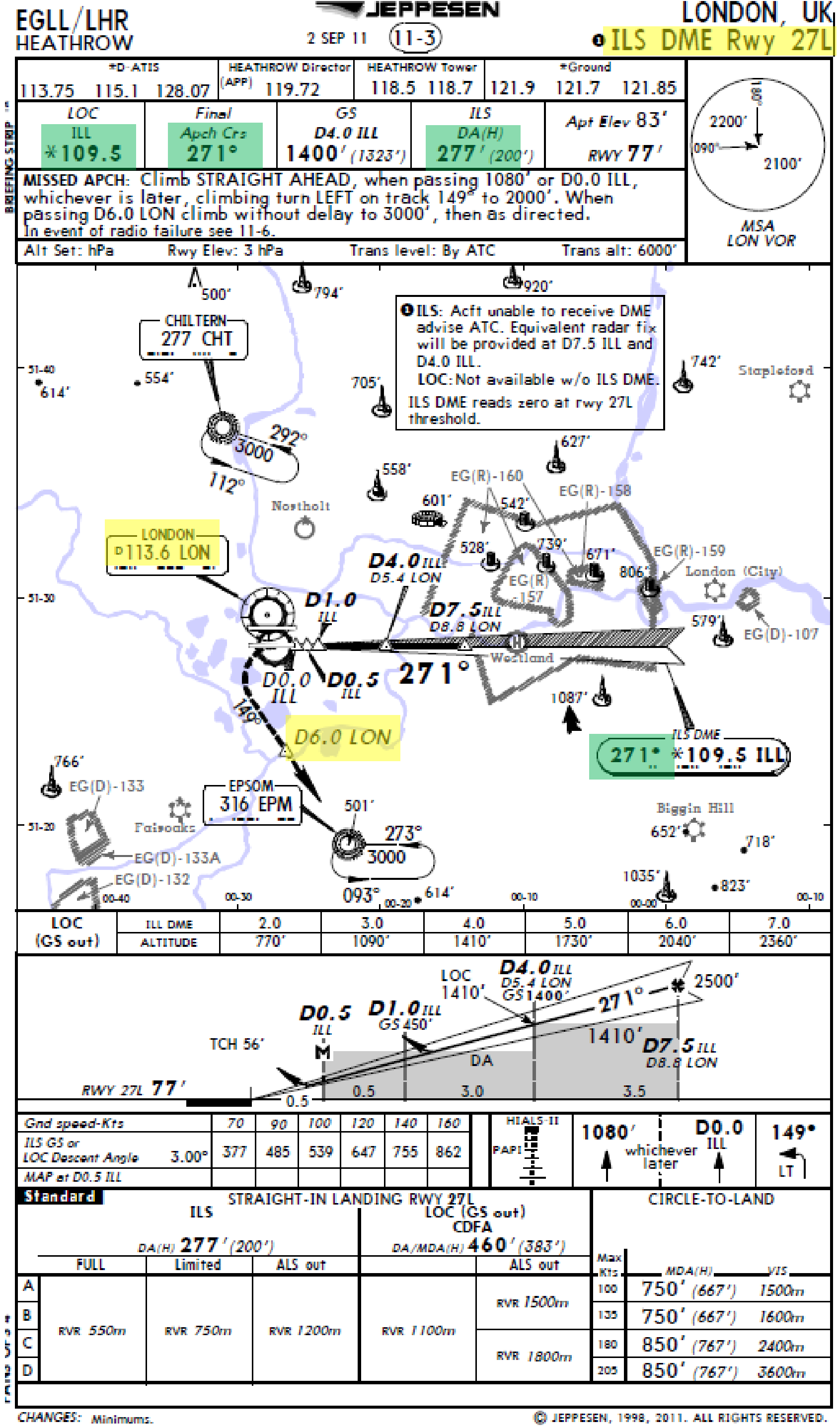


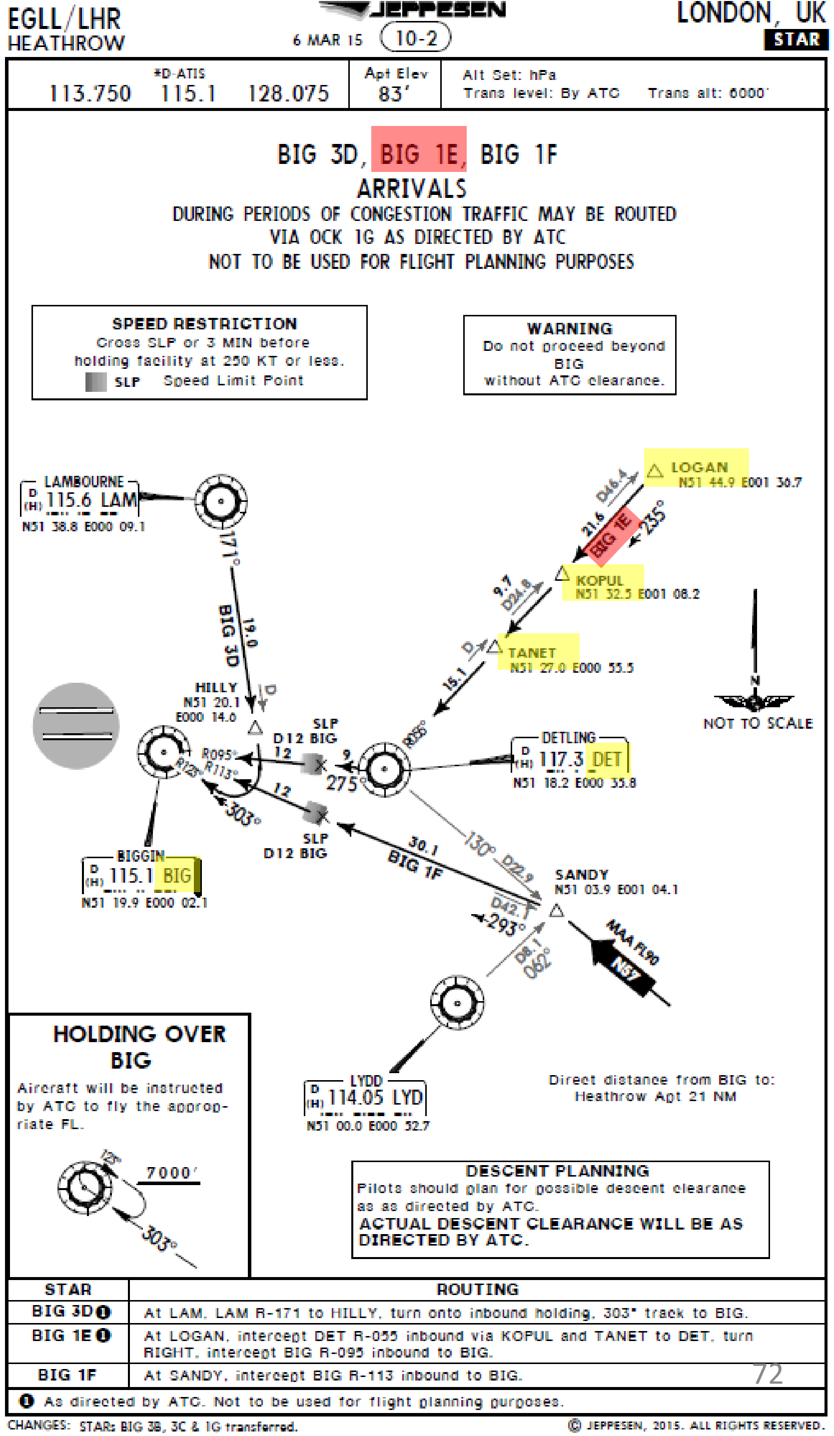


PLANNING THE APPROACH - STAR

These charts are for the STAR (Standard Terminal Arrival Route) from LOGAN to EGLL. We intend to:

1. Come from LOGAN waypoint
2. Fly from LOGAN towards the BIG1E arrival route.
3. Follow the STAR (BIG1E -> KOPUL -> TANET -> DET -> BIG)
4. Select an AIF (Approach Initial Fix) from the FMC database (in our case CI27L) and follow the approach towards the runway, guided by the EGLL airport's ILS (Instrumented Landing System).
5. Land at Heathrow (EGLL) on **runway 27L** (orientation: 270 Left)





PLANNING THE FLIGHT - SUMMARY

So there it is! This is more or less all the information you need to plan your flight!

Flight Plan Input to FMC

Airways:
EHAM SID GORLO UL980 LOGAN STAR EGLL

Provided by RouteFinder

METAR:

Departure: EHAM 110225Z 33004KT 8000 NSC 12/11 Q1018 BECMG 7000
Destination: EGLL 110220Z AUTO 03005KT 360V070 9999 OVC009 14/12 Q1023 TEMPO BKN012

Provided by CheckWX API

Fuel Quantity Input to FMC
(taken from an online fuel planner)

Fuel quantity for Boeing 747 (PMDG)

	Fuel	Time
Fuel Usage	16726 lbs	00:52
Reserve Fuel	24095 lbs	01:15
Fuel on Board	40821 lbs	02:07

Provided by Fuelplanner.com

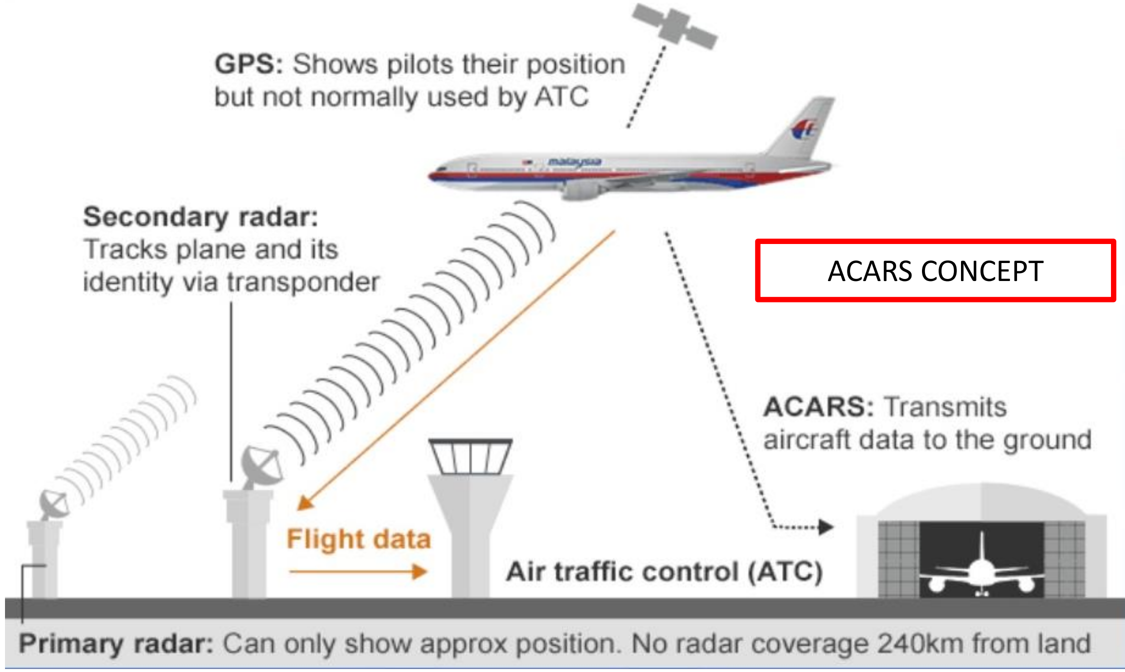
CDU/FMC IN A NUTSHELL

Most of the aircraft setup and flight planning will be done with the help of the CDU, which encompasses various systems such as the FMC system.

CDU: Control Display Unit

MAIN MENU page:

- **FMC** -> Flight Management Computer
  - Fundamental component of a modern airliner's avionics. The FMC is a component of the FMS (Flight Management System), which is a specialized computer system that automates a wide variety of in-flight tasks, reducing the workload on the flight crew to the point that modern civilian aircraft no longer carry flight engineers or navigators. A primary function is in-flight management of the flight plan. All FMS contain a navigation database. The navigation database contains the elements from which the flight plan is constructed. The FMS sends the flight plan for display to the Electronic Flight Instrument System (EFIS), Navigation Display (ND), or Multifunction Display (MFD).
- **ACARS** -> Aircraft Communication Addressing and Reporting System
  - Digital datalink system for transmission of short messages between aircraft and ground stations via airband radio or satellite. Such messages can be METAR weather reports.
- **SAT** -> SATCOM (Satellite Communications)
  - Provides aircraft onboard equipment for SATCOM and includes a satellite data unit, a high power amplifier and an antenna with a steerable beam. A typical aircraft SATCOM installation can support data link channels for ’packet data services’ as well as voice channels.
- **CMC** -> Central Maintenance Computer
  - Maintenance interface to the primary flight control system for the line mechanic. The role of the CMC in the maintenance of the primary flight control system is to identify failures present in the system and to assist in their repair.
- **PMDG SETUP** -> Setup various aircraft options
  - Allows you to configure aircraft equipment installed on your current airframe, customize various parameters like display parameters, unit system, IRS alignment time, setup cold & dark and other panel states, and configuration of aircraft malfunctions/failures.
- **FS ACTIONS** -> Flight Simulation Actions
  - Allows you to change fuel loads, payloads, ground carts for power and air, door controls, cabin lights or pushback controls. This is a fictional custom interface built by PMDG as a tool for you to work with.



ACARS CONCEPT

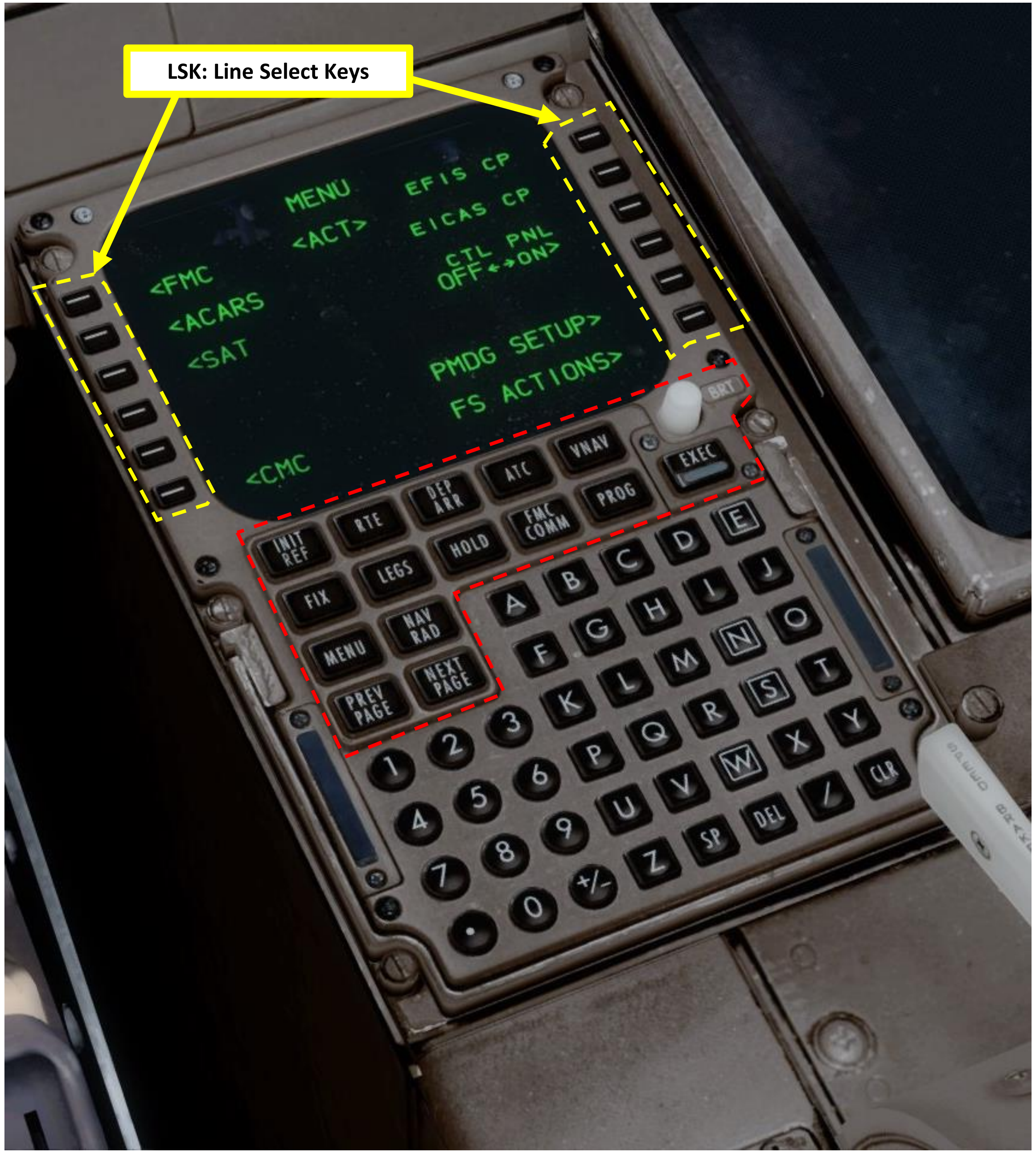
CDU MAIN MENU PAGE

CDU/FMC IN A NUTSHELL

- **FMC** -> Flight Management Computer
    - **INIT REF**: data initialization or for reference data
    - **RTE**: input or change origins, destination or route
    - **DEP ARR**: input or change departure and arrival procedures
    - **ATC**: displays ATC/ADS-B (Air Traffic Controller/Automatic Dependent Surveillance-Broadcast) system status page
    - **VNAV**: input or change vertical navigation path data
    - **FIX**: create reference points (fix) on map display
    - **LEGS**: view or change lateral and vertical data
    - **HOLD**: create and show holding pattern data
    - **FMC COMM**: displays datalink, which is used to send information between aircraft and air traffic controllers when an aircraft is too far from the ATC to make voice radio communication and radar observations possible.
    - **PROG**: shows progression of dynamic flight and navigation data, including waypoint estimated time of arrival, fuel remaining, etc.
    - **RAD NAV**: view or change radio navigation data

    - **MENU**: view the main menu page (see previous page)
    - **PREV PAGE / NEXT PAGE** : Cycles through previous and next page of selected FMC page
    - **BRT**: controls CDU brightness
    - **EXEC**: Makes data modifications active

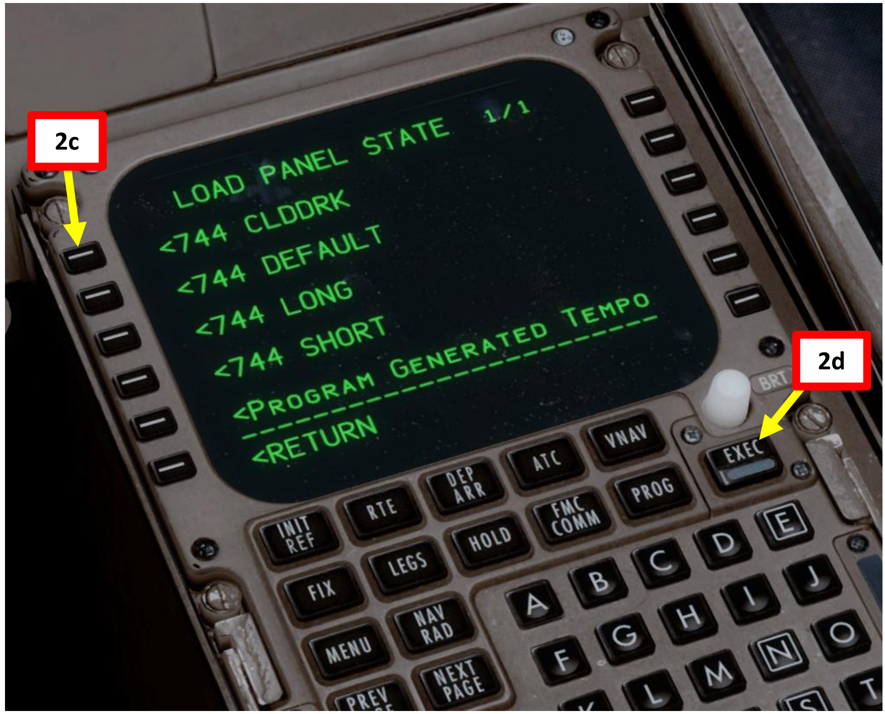
Sounds complicated? Don’t worry, it’s much simpler than it looks. We’ll see how it works in the tutorial section.

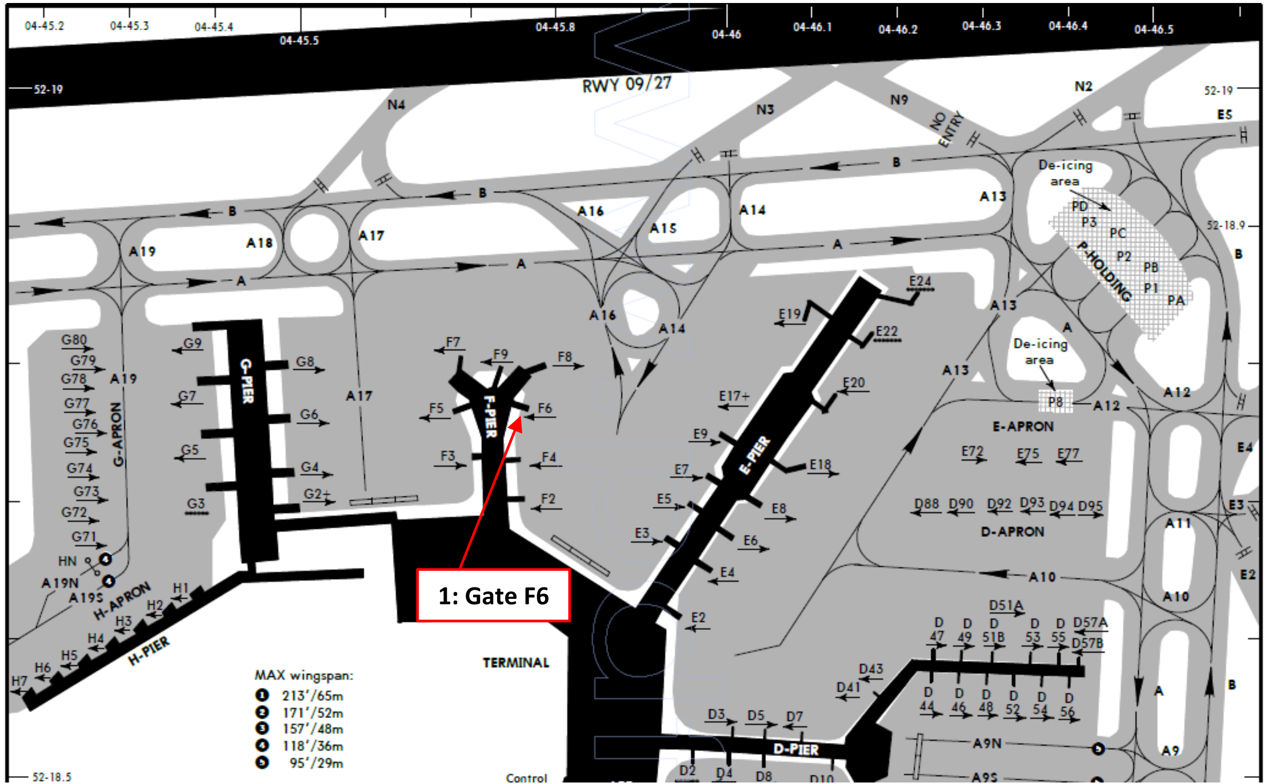


SET COLD & DARK STATE

In Prepar3d or FSX, you will generally spawn with your engines running. A “cold & dark” start-up means that your aircraft is in an unpowered state with engines and every other system off. Here is the procedure to spawn in such a state:

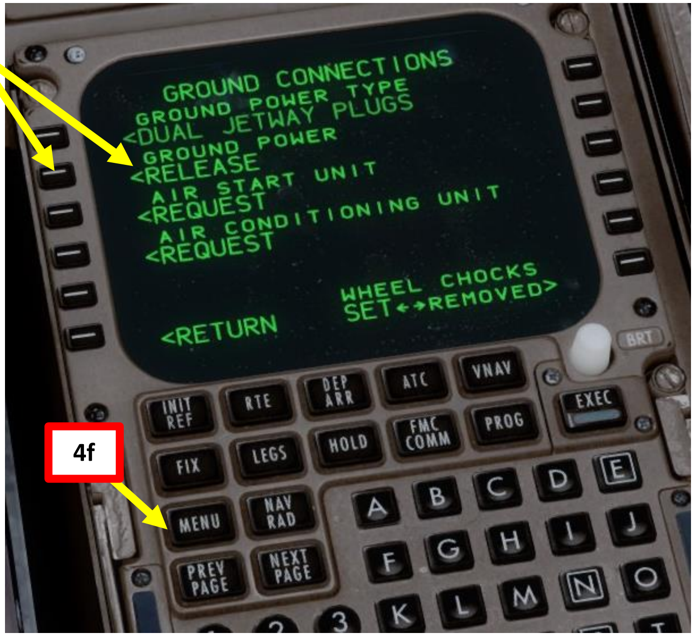
1. Spawn like you normally would at Gate F6 in EHAM (departure airport).
2. Go on CDU main menu and reset aircraft to COLD and DARK configuration.
    a) Select PMDG SETUP
    b) Select PANEL STATE LOAD
    c) Select 744 CLDDRK setup
    d) Click “EXEC” on CDU keypad
    e) Aircraft should be set to Cold and Dark configuration as shown

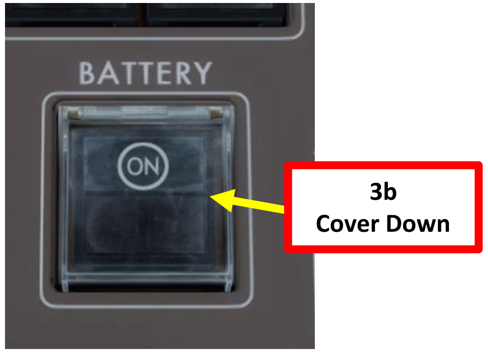


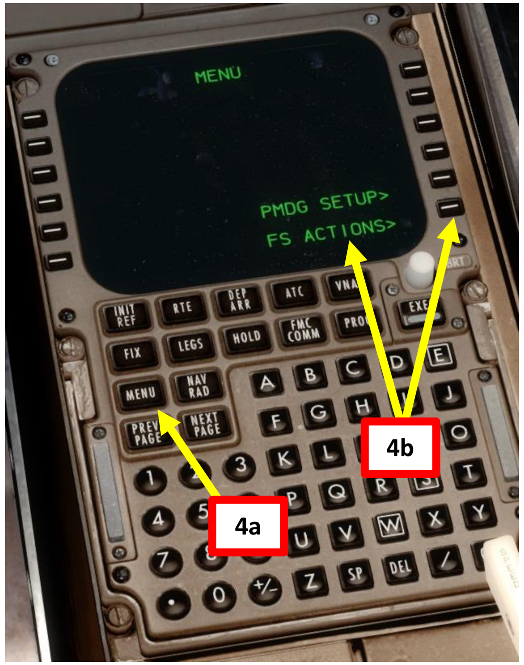


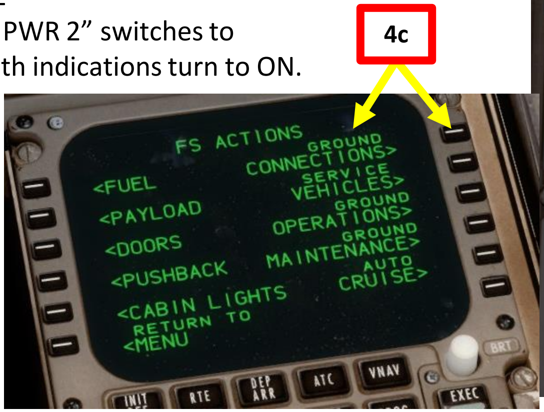
POWER UP AIRCRAFT

3. On Overhead panel, flip the battery cover and set the BATTERY switch to ON. Then, flip the battery cover back down. Then, set the STANDBY POWER switch to AUTO.
4. Turn on FMC, and go on the CDU main menu to install wheel chocks, connect ground power cart to the aircraft
    a) Press and hold the MENU button to turn on the FMC (Flight Management Computer)
    b) Select FS ACTIONS
    c) Select GROUND CONNECTIONS
    d) Click on the “WHEEL CHOCKS” LSK to set wheel chocks to “SET”
    e) Click on the “GROUND POWER” LSK to set ground power to “RELEASE”
    f) Return to main MENU
5. On Overhead panel, confirm that the “EXT PWR 1” and “EXT PWR 2” indications are set to AVAIL
6. Click on the “EXT PWR 1” and “EXT PWR 2” switches to power the aircraft. Confirm that both indications turn to ON.





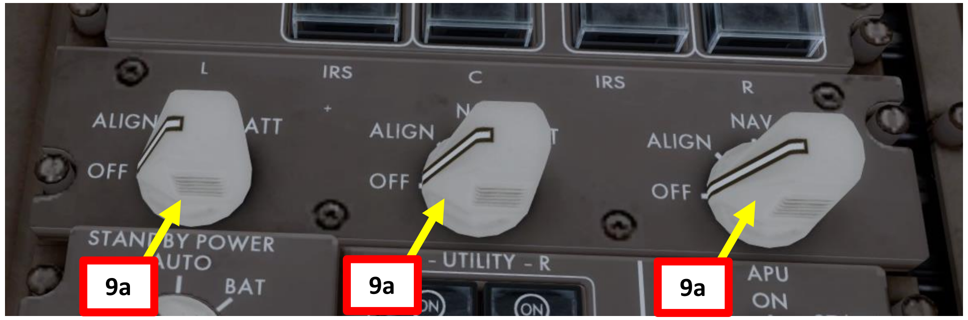


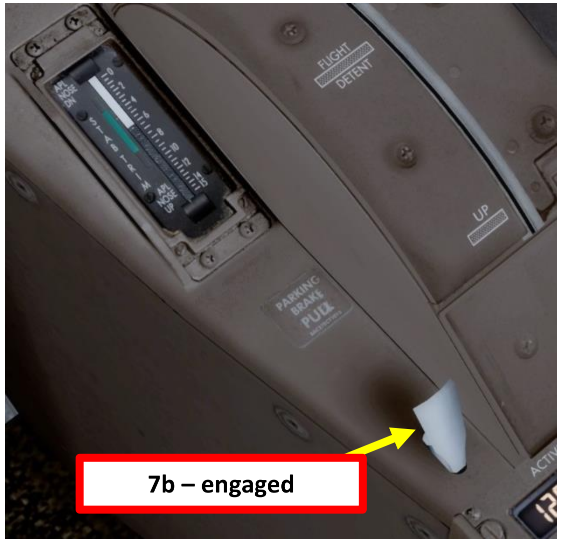


POWER UP AIRCRAFT

START IRS ALIGNMENT

7. Engage Parking Brake (aircraft movement can screw up your navigation system alignment)
8. On Overhead panel, set all three IRS (Inertial Reference System) switches to ALIGN, and then to NAV by right-clicking.
9. This alignment phase usually takes between 6 and 7 minutes. IRS alignment is complete once a full PFD (Primary Flight Display) and ND (Navigation Display) are displayed on your display units.



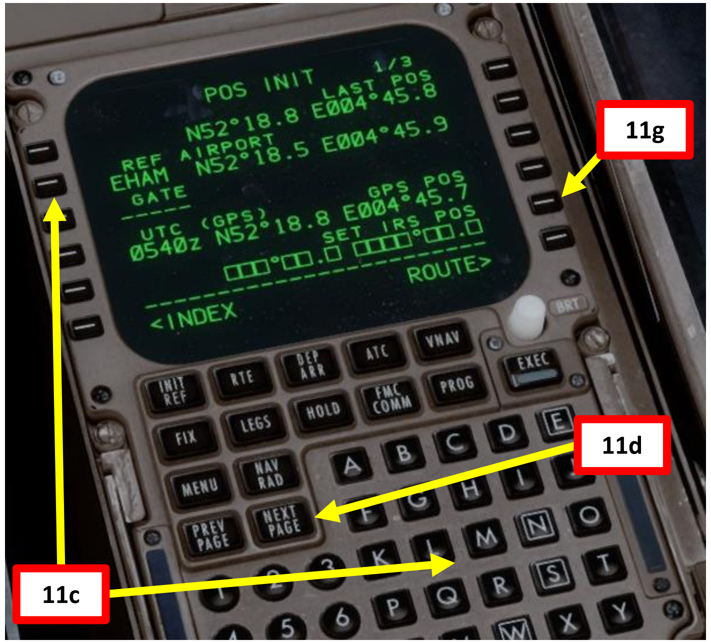


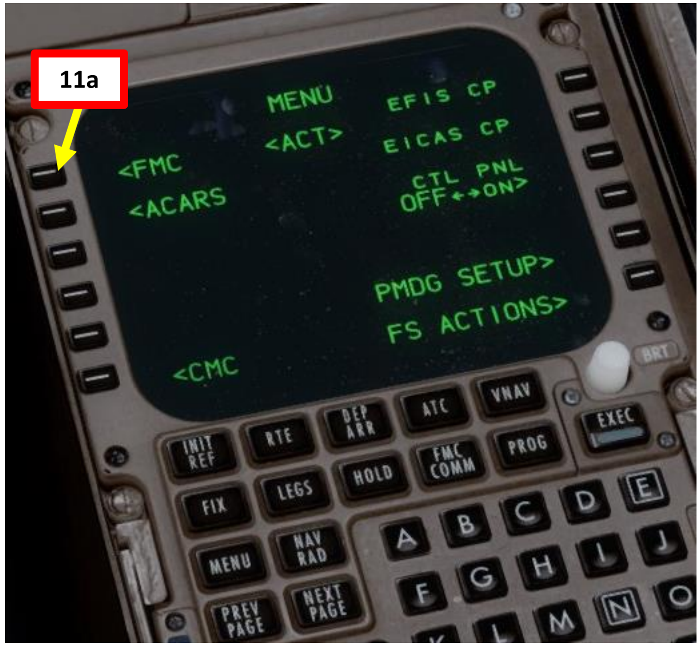
FMC SETUP - UNITS

10. Go on CDU main menu and set aircraft fuel weight units to your desired system (lbs or kg). We will choose Lbs, even though in Europe you would typically use kgs.
    a) Select PMDG SETUP
    b) Select AIRCRAFT
    c) Select DISPLAYS
    d) Set Weight to LBS
    e) Return to main MENU

FMC SETUP - POSITION

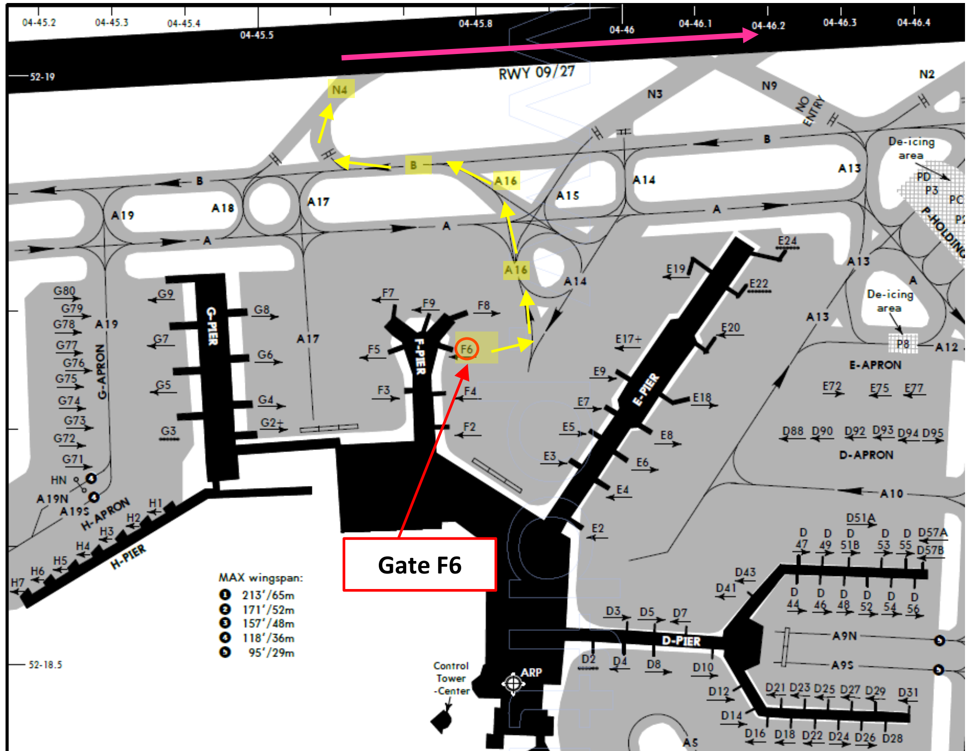
11. Go on FMC (Flight Management Computer) and set initial position for the IRS
    a) Select FMC
    b) Select POS INIT
    c) Type “EHAM” on the CDU keypad and select LSK next to REF AIRPORT since we spawned at Schiphol Airport (EHAM)
    d) Click on “NEXT PAGE” to access the POS REF page (2/3)
    e) Select GPS L line to copy the coordinates to your keypad
    f) Click on “PREV PAGE” to access the POS INIT page (1/3)
    g) Click on the SET IRS POS to paste the coordinates, setting your IRS (Inertial Reference System) your initial reference position.
    h) Congratulations! Your aircraft’s navigation system now knows where you are.

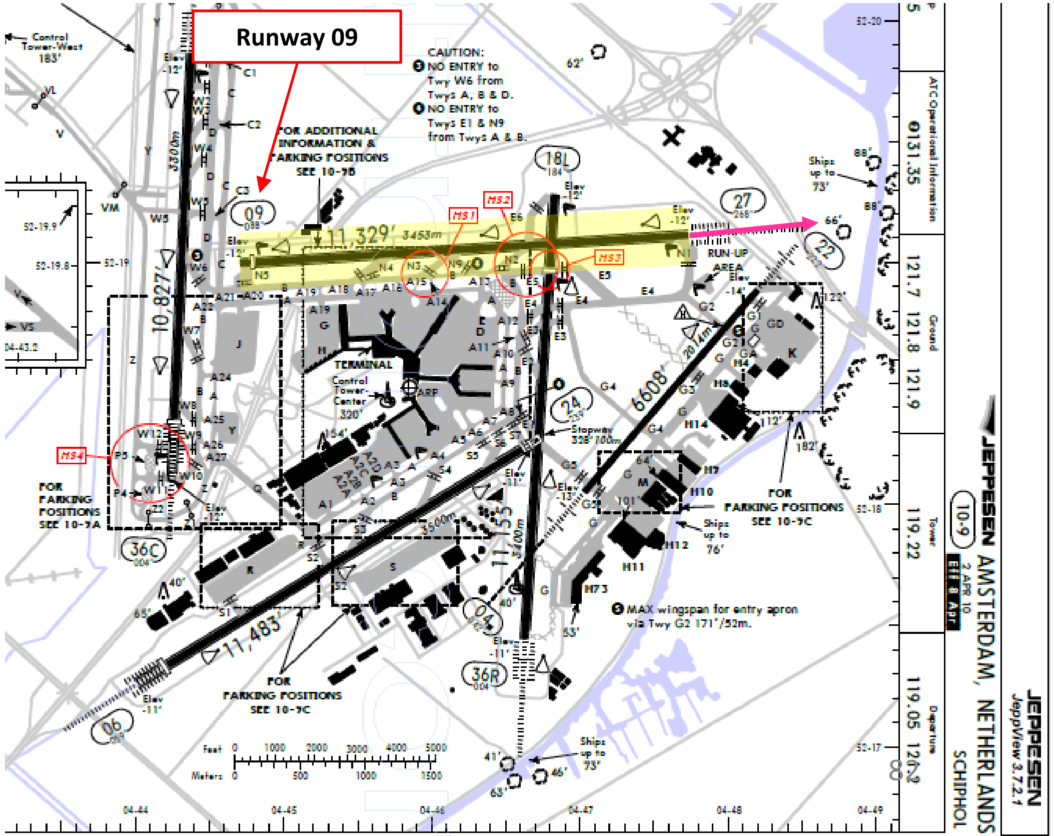




FMC SETUP - ROUTE

12. Go on FMC (Flight Management Computer) and set aircraft route
    a) In POS INIT menu, select ROUTE menu
    b) Type “EHAM” on the CDU keypad and click ‘ORIGIN” to set EHAM (Schiphol) as your takeoff airport.
    c) Consult navigation chart of EHAM (Schiphol) Airport and find runway from which you will takeoff from (Runway 09).
    d) Type “09” (for Runway 090) on CDU keypad and click on RUNWAY.
    e) Type “EGLL” on the CDU keypad and click on “DEST” to set HEATHROW as your destination
    f) Type your flight number (i.e. Flight No. BAW106) on the CDU keypad and click on FLT NO.

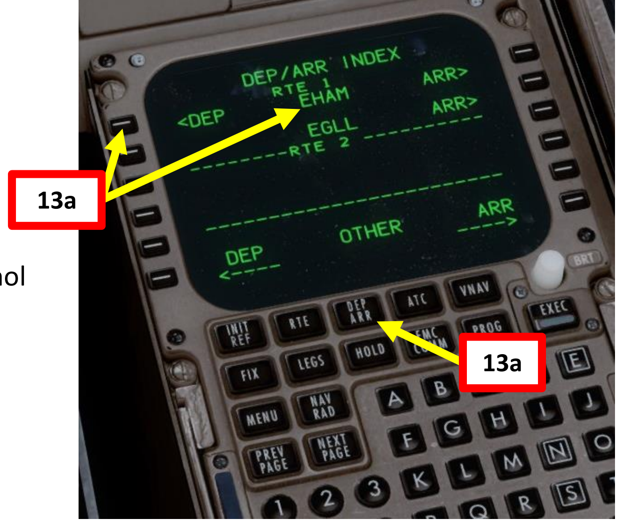


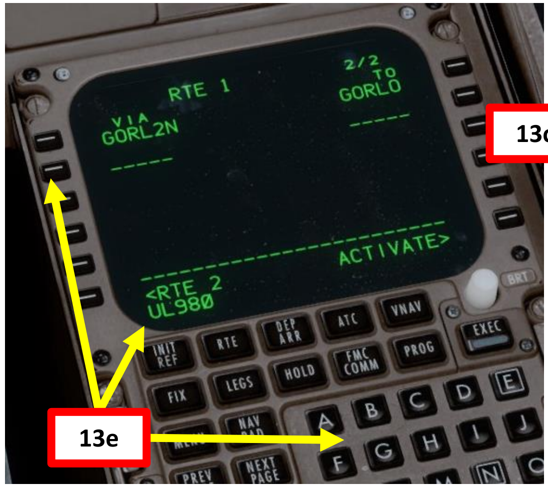


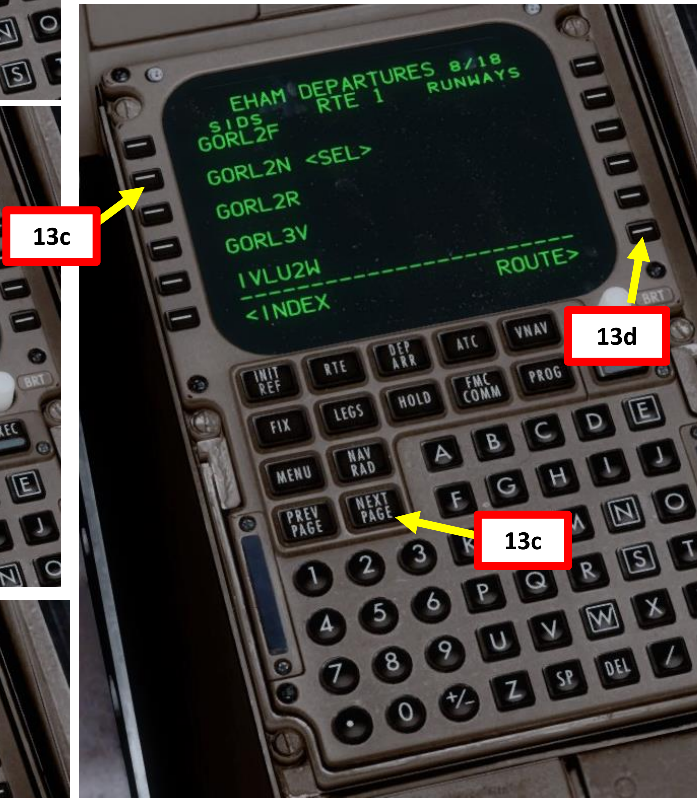
FMC SETUP - WAYPOINTS

NOTE: Flight Plan = **EHAM** SID **GORLO** UL980 **LOGAN** STAR **EGLL**
SID: GORL2N STAR: BIG1E

13. Go on FMC (Flight Management Computer) and set flight waypoints and airways
    a) Click on "DEP ARR" (Departure Arrival) and click on "DEP – EHAM" to set Schiphol as our Departure Point
    b) Select Runway 09
    c) Press the "NEXT PAGE" button until you find GORL2N SID (Standard Instrument Departure). Select SID (Standard Instrument Departure) for GORLO2N as determined when we generated our flight plan.
    d) Select ROUTE menu and click "NEXT PAGE" on the CDU keypad to select the Airway/Waypoint menu.
    e) Type "UL980" on the CDU keypad and click on the LSK next to the dashed line on the left column (VIA/AIRWAYS) to set your next Airway.
    f) Type "LOGAN" on the CDU keypad and click on the LSK next to the squared line on the right column (TO/WAYPOINTS) to set your next Waypoint to LOGAN.
    g) See picture to see the final result. We will enter the approach to Heathrow later while in the air.
    h) Select ACTIVATE and click on EXECUTE







FMC SETUP - WAYPOINTS

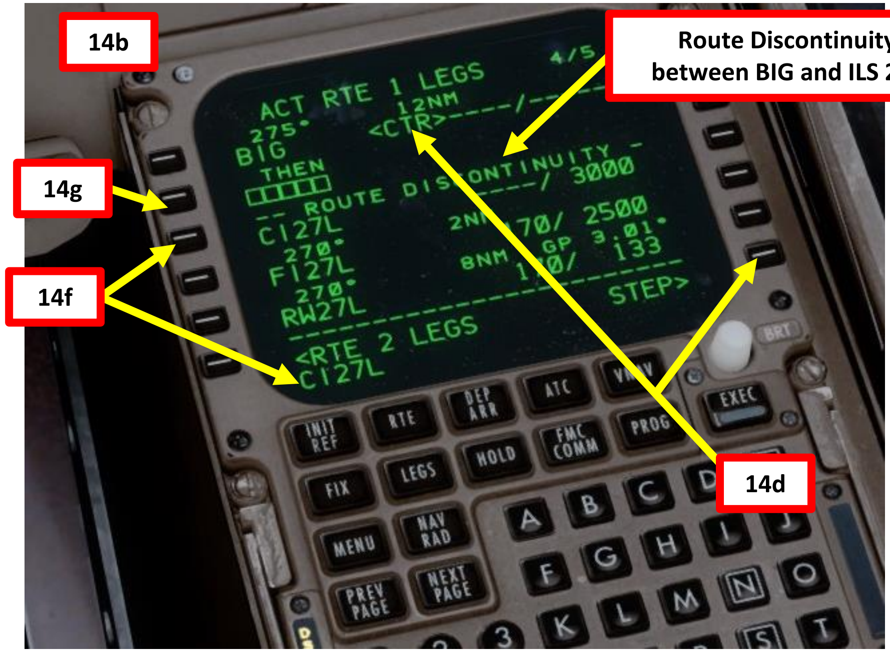
NOTE: Flight Plan = **EHAM** SID **GORLO** UL980 **LOGAN** STAR **EGLL**
SID: GORL2N STAR: BIG1E

13. Go on FMC (Flight Management Computer) and set flight waypoints and airways
    i) Click on "DEP ARR" (Departure Arrival) twice and click on "EGLL – ARR" to set Heathrow as our Arrival Point
    j) Select ILS 27L as our landing runway
    k) Select STAR (Standard Terminal Arrival Route) for BIG1E as determined when we generated our flight plan.
    l) Click on EXECUTE on the CDU keypad to activate your flight plan update

FMC SETUP – WAYPOINT DISCONTINUITIES

NOTE: Flight Plan = **EHAM** SID **GORLO** UL980 **LOGAN** STAR **EGLL**
SID: GORL2N STAR: BIG1E

14. Go on FMC (Flight Management Computer) and verify all waypoints and any look for any discontinuity
    a) Click on "LEGS" and cycle through all different legs pages of the flight using "NEXT" button on FMC.
    b) There is a route discontinuity between the BIG waypoint of our STAR and the ILS 27L runway.
    c) Set ND (Navigation Display) Mode selector to PLAN and adjust ND Display Range as required
    d) Click on STEP until the discontinuity between BIG and CI27L is selected (you should see <CTR> next to BIG).
    e) You can see visually the discontinuity on the Navigation Display
    f) Click on the LSK next to the desired approach fix (in our case "CI27L") to copy it on the FMC screen.
    g) Click on the LSK next to the squared line "THEN" to set approach fix CI27L in order to fix flight plan discontinuity.
    h) Click on EXECUTE to update flight plan



FMC SETUP – WAYPOINT DISCONTINUITIES

NOTE: Flight Plan = **EHAM** SID **GORLO** UL980 **LOGAN** STAR **EGLL**
SID: GORL2N STAR: BIG1E

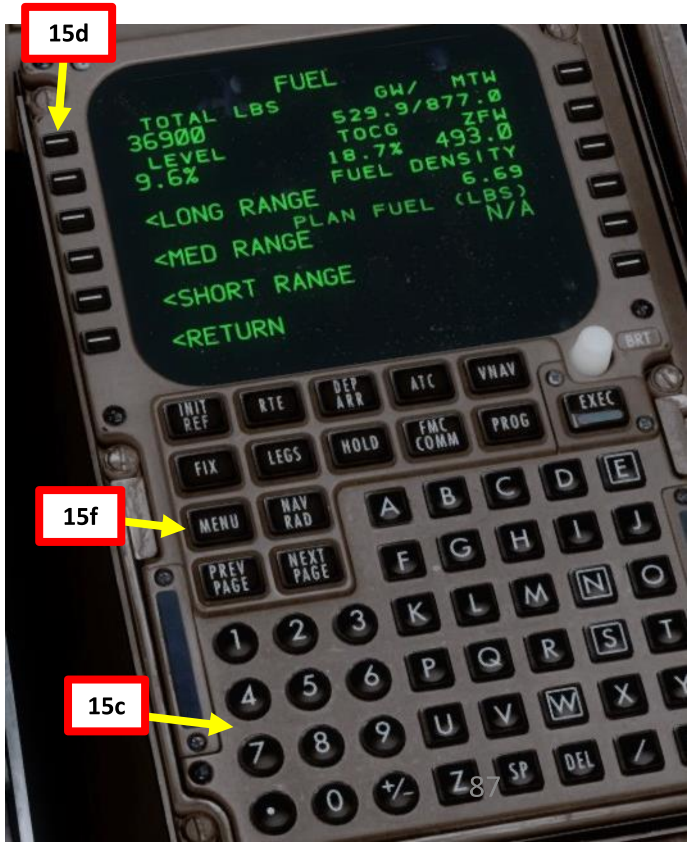
14. Go on FMC (Flight Management Computer) and verify all waypoints and any look for any discontinuity
    i) Your flight plan discontinuity should now be replaced with a link directly from BIG to the CI27L Approach Fix.
    j) Set ND Mode back to MAP

FMC SETUP - FUEL

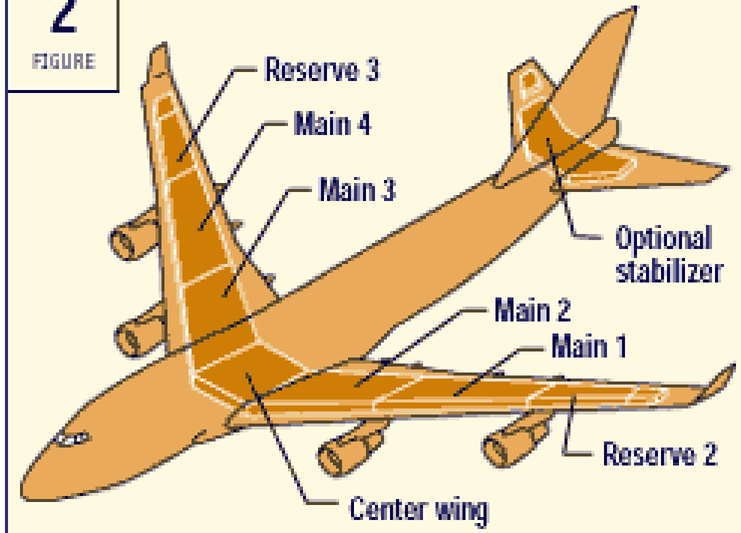
NOTE: Remember our fuel calculations of earlier:
Reserve Fuel = **20500 lbs**
Total Fuel = Fuel for Flight + Reserve Fuel = **36900 lbs**

15. Go to CDU Main Menu and set fuel payload
    a) Select FS ACTIONS
    b) Select FUEL
    c) Type “36900” on the CDU keypad (since we need 36900 lbs)
    d) Click on “TOTAL LBS” menu to set fuel payload
    e) Ta-dah! The aircraft fuel load is now properly set in the sim instead of having to go through the Prepar3d main menu
    f) Click on MENU to return to main menu

NOTE: Normally, there is a whole procedure to set up your payload (passengers + cargo) but since we are short on time, we will simply skip it and assume that we are not overweight and that we are within safe CG (center of gravity) boundaries.



2
FIGURE

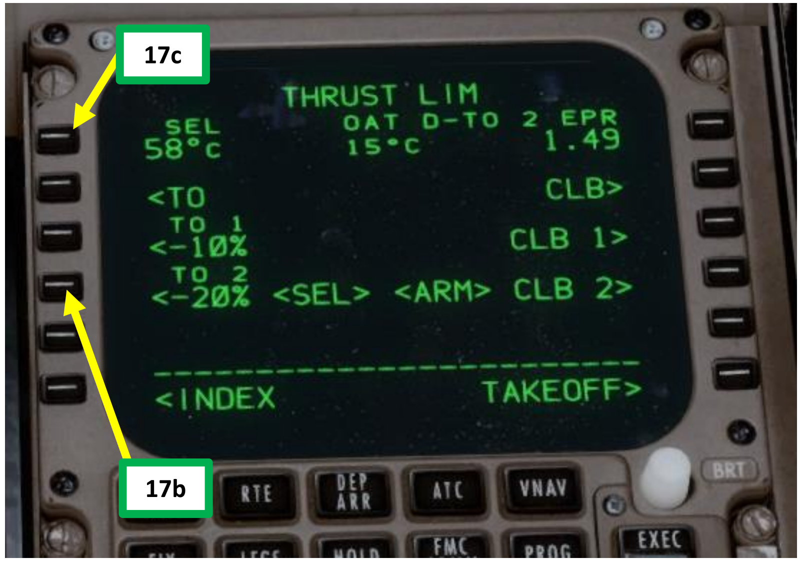


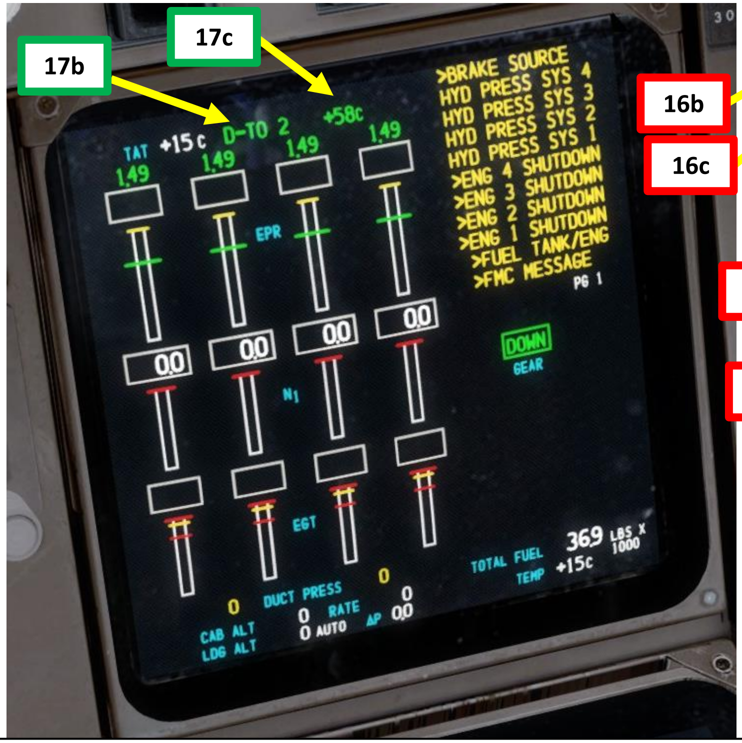
747-400 FUEL CAPACITY

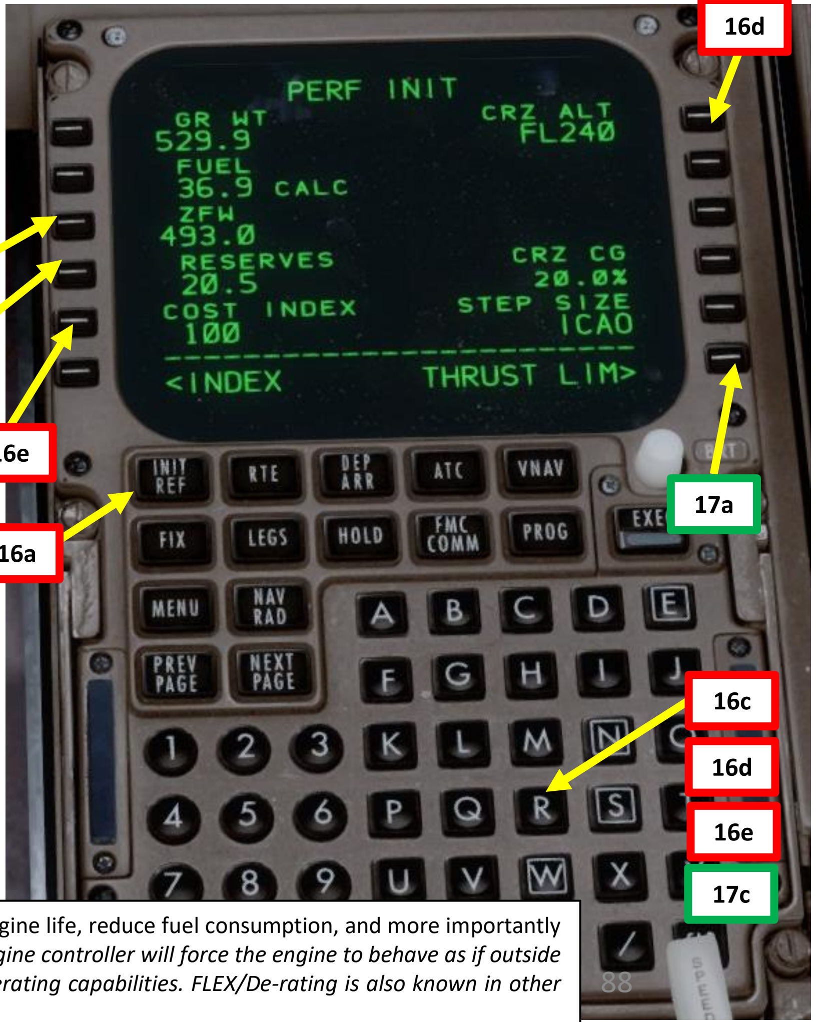
Tanks	Gallons	Liters
Reserve	2,644	10,008
Main 1 and 4	8,964	33,932
Main 2 and 3	25,092	94,984
Center wing	17,164	64,973
Optional stabilizer	3,300	12,492
Total	53,864	203,897
Total with optional tank	57,164	216,389

FMC SETUP – PERF INIT

16. Go on FMC (Flight Management Computer) and set aircraft performance parameters
    a) Select “FMC” menu on the CDU and press the “INIT REF” button to open the PERF INIT page
    b) Double-Click on ZFW (Zero Fuel Weight) button to enter the automatically calculated ZFW
    c) Type “20.5” on CDU keypad and select RESERVES to set reserve fuel weight determined by Fuel Planner tool (20.5 x 1000 for 20500 lbs)
    d) Set cruising altitude to FL240 (24000 ft) by typing “240” on the CDU keypad and selecting CRZ ALT.
    e) Type “100” on CDU keypad and select COST INDEX (cost index is generally given to you by the airline company, so you shouldn’t really care about it within the scope of this simulation)
17. Select required Engine De-Rating limit in order to limit your engines’ thrust.
    a) Select the THRUST LIMIT menu by pressing the LSK next to THRUST LIM
    b) Click on the “TO-2” (-20%) N1 Limit to set engine N1 limit
    c) Set an Assumed Temperature of 58 deg C by typing “58” on the CDU keypad and clicking on the LSK next to SEL.

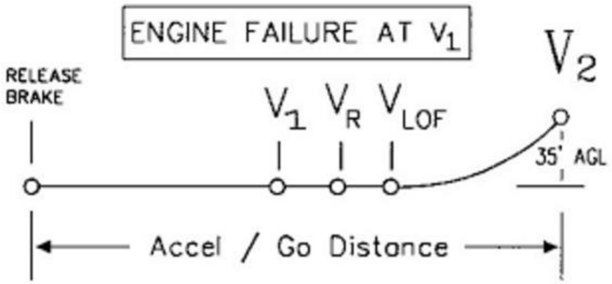




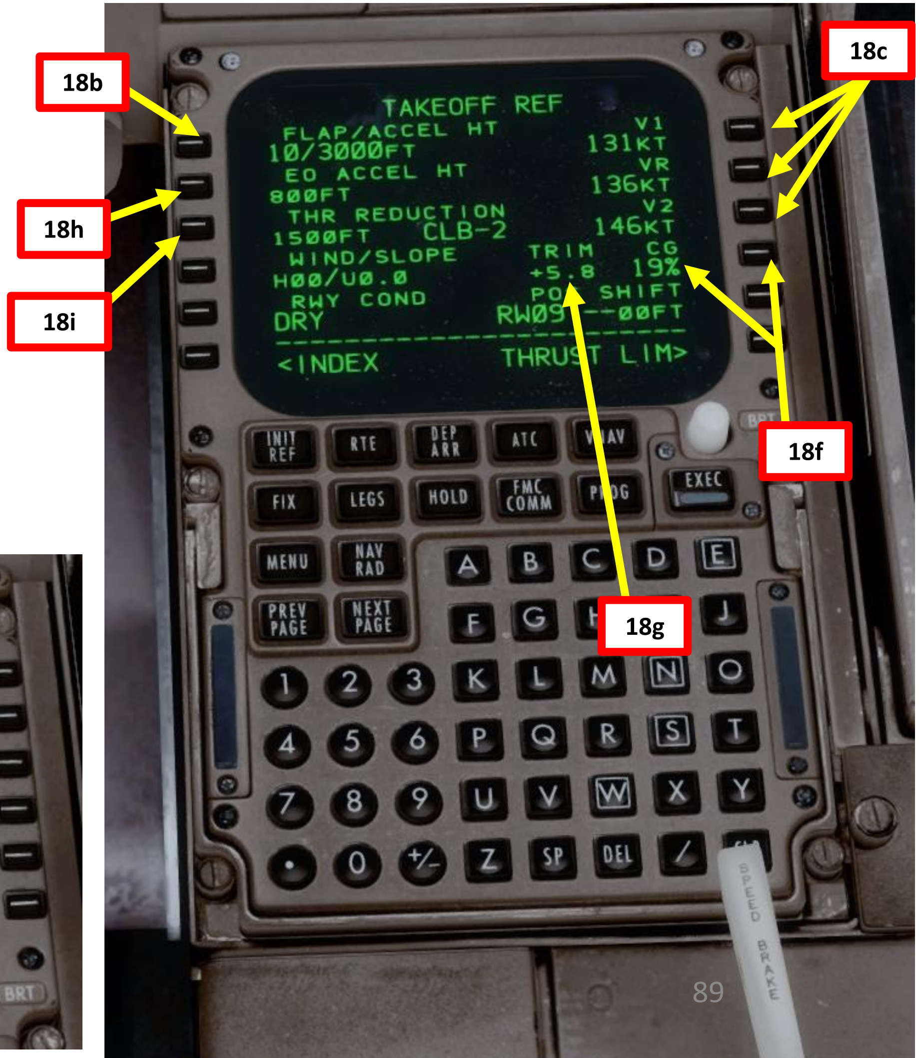


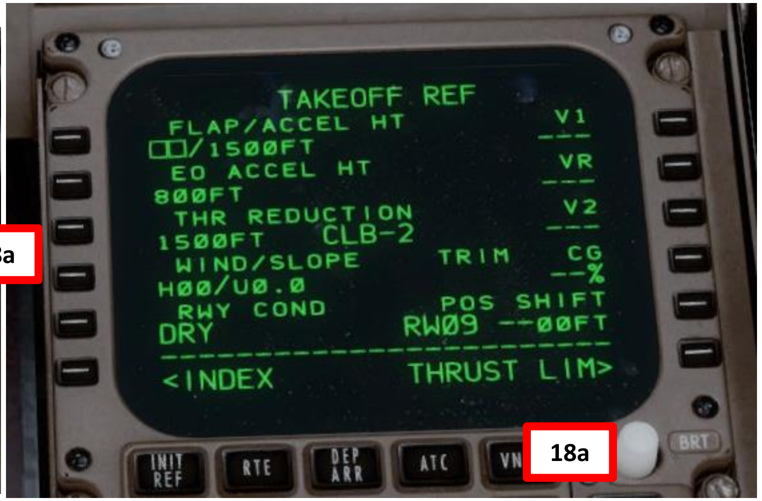
Note: TO, TO-1, and TO-2 are engine de-ratings. De-rating means that the aircraft uses reduced thrust on takeoff in order to reduce engine wear, prolong engine life, reduce fuel consumption, and more importantly comply with noise reduction and runway safety requirements. *Airbus aircraft have a similar concept called “FLEX”. “Flexible temperature” means that the engine controller will force the engine to behave as if outside air temperature was higher than it really is, causing the engines to generate less thrust since higher air temperatures diminish an aero-engine’s thrust generating capabilities. FLEX/De-rating is also known in other companies as “Assumed Temperature Derate”, “Assumed Temperature Thrust Reduction” or “Reduced Takeoff Thrust” or “Factored Takeoff Thrust”.*

FMC SETUP – PERF INIT



18. Go on FMC (Flight Management Computer) and set TAKEOFF parameters
    a) Select TAKEOFF menu
    b) Type "10/3000" on CDU keypad and select LSK next to "FLAPS/ACCEL HT" to set takeoff flaps to 10 degrees and to set your Acceleration Height to 3000 ft AGL.
    c) Click on the LSKs next to V1, VR and V2 to automatically calculate your V speeds.
    d) Observe the resulting V1, VR and V2 speeds resulting of this flap setting and current aircraft weight: **V1** is the Decision Speed (minimum airspeed in the takeoff, following a failure of the critical engine at VEF, at which the pilot can continue the takeoff with only the remaining engines), **VR** is the rotation speed (airspeed at which the pilot initiates rotation to obtain the scheduled takeoff performance), and **V2** is Takeoff Safety Speed (minimum safe airspeed in the second segment of a climb following an engine failure at 35 ft AGL).
    e) V1 Speed is 131 kts
       VR Speed is 136 kts
       V2 Speed is 146 kts
    f) Click on the LSK next to CG twice to automatically calculate the CG position.
    g) Observe the resulting TAKEOFF TRIM setting: +5.8
    h) Type 800 on the CDU keypad and click on the LSK next to EO ACCEL HT to set your Engine Out Acceleration Height to 800 ft AGL.
    i) Type 1500 on the CDU keypad and click on the LSK next to REDUCTION to set your Thrust Reduction Height to 1500 ft AGL.





FMC SETUP – PERF INIT

NOTE:

The Acceleration, Thrust Reduction and Engine Out Acceleration Heights may seem like plugging random numbers in a computer at first, but there is a valid reason for that. Special heights for Thrust Reduction/Acceleration Height, and OEI Acceleration more often than not are dependent on whether there is a NAP (Noise Abatement Procedure), or if there are some company SOP (Standard Operating Procedure) for other factors like terrain clearance. You can consult Jeppesen charts to see what these Noise Abatement procedures are for a particular airport. If no particular procedures are listed, you can follow the standard procedures in the following document:

ICAO Document 8168, Vol 1, Section 7 - Noise Abatement Procedures

Link: http://www.chcheli.com/sites/default/files/icao_doc_8168_vol_1.pdf

Like I said before, the main wear on engines, especially turbine engines, is heat. If you reduce heat, the engine will have greater longevity. This is why takeoff power is often time limited and a height established that thrust is reduced. The difference between takeoff thrust and climb thrust may only be a few percent, but the lowering of EGT (Exhaust Gas Temperature) reduces heat and extends engine life significantly. Acceleration Height is the altitude above ground level (AGL) that a pilot accelerates the aircraft by reducing the aircraft's pitch, to allow acceleration to a speed safe enough to raise flaps and slats, and then reach the desired climb speed. The thrust reduction height is where the transition from takeoff to climb thrust takes place.

Acceleration Height (3,000 ft in our case) is when the nose is to be lowered to allow the aircraft to accelerate. When the aircraft starts accelerating is when the flight crew will retract flaps as per the schedule. Our value was taken directly from the Jeppesen document.

Thrust Reduction Height (1,500 ft in our case) is when the autothrottle will decrease the engine power to the preselected climb thrust; thereby reducing engine wear and tear. Both may occur simultaneously or at differing heights above ground level. Both can be configured in the CDU. Our value was taken directly from the Jeppesen document. If no such value was specified, then we'd have to use 800 ft as the minimal value as per the ICAO document.

EO ACCEL HT (800 ft in our case) is is the safe altitude that you can lower the nose and start accelerating the aircraft in the event of an engine failure. It is based mainly on company SOP or a prescribed procedure (EO SID, as an example), which, unless someone gave you one, you wouldn't know what the SOP value is. For the purposes of the sim, you can just leave it at 800 ft. Some UK pilots add the airport elevation to this value.

EHAM/AMS
SCHIPHOL
23 APR 10 JEPPESEN 10-1P14 Eff 6 May
AMSTERDAM, NETHERLANDS
AIRPORT BRIEFING

3.3. NOISE ABATEMENT PROCEDURES

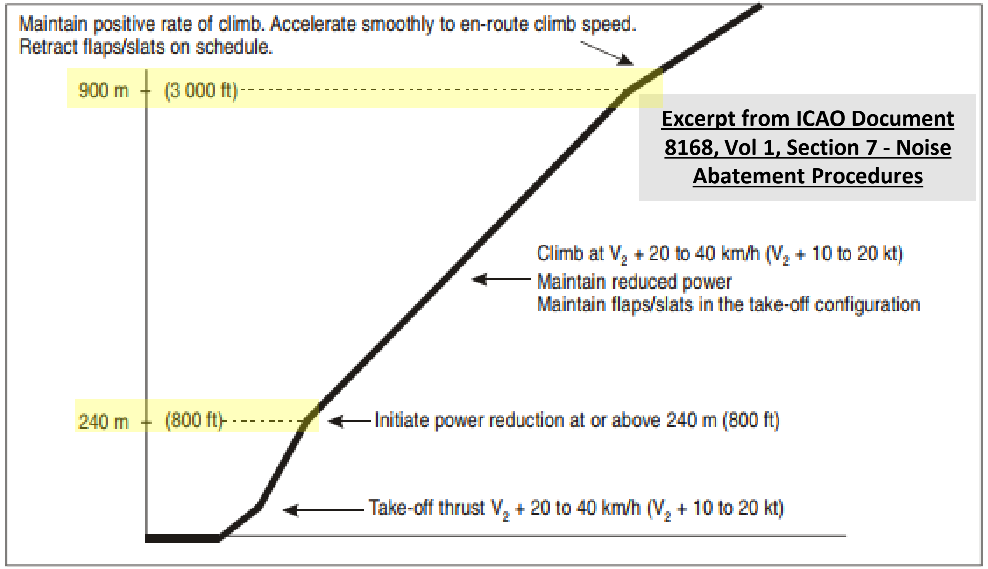
3.3.1. GENERAL

The Standard Instrument Departure routes as shown on Amsterdam SID charts avoid residential areas as much as possible and must be considered as minimum noise routes.

Take-off and climb procedure (jet ACFT only):

Take-off to 1500'	Take-off power Speed at V_2 + 10 KT to 20 KT (or as limited by body angle) Flaps - set as appropriate
1500' - 3000'	Climb power Speed at V_2 + 10 KT to 20 KT Flaps maintain previous setting
After passing 3000'	Retract flaps on schedule and assume normal enroute climb.
3000' - FL 100	MAX 250 KT

Operators/ACFT types unable to comply with the mentioned take-off procedure are requested to inform the APT authority by sending copies of the take-off procedure in use to: Amsterdam Airport Schiphol, Dep. of Capacity Management, P.O. Box 7501, 1118 ZG Schiphol Airport; Fax: +31 (0)20 601 3567.



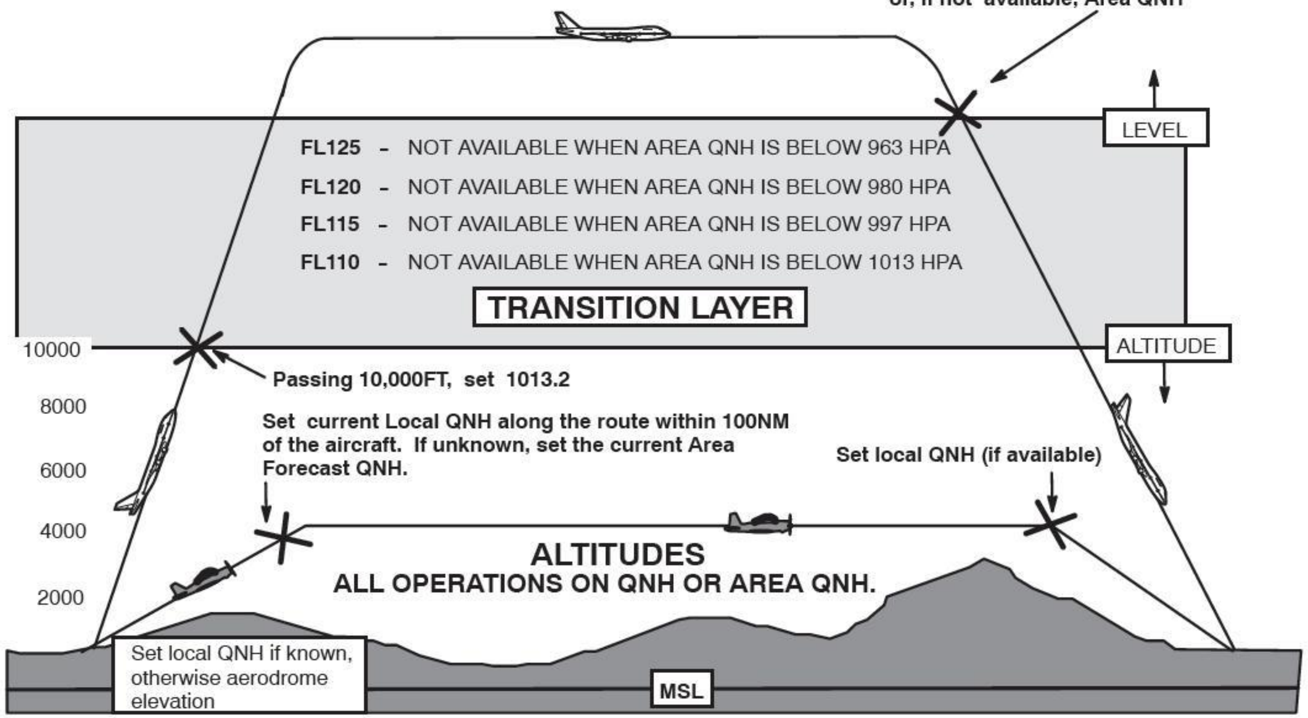
Excerpt from ICAO Document 8168, Vol 1, Section 7 - Noise Abatement Procedures

Figure I-7-3-App-1. Noise abatement take-off climb — Example of a procedure alleviating noise close to the aerodrome (NADP 1)

FMC SETUP – VNAV

19. Go on FMC (Flight Management Computer) and set Transition Altitude
    a) Select "FMC" menu on the CDU and press the "VNAV" button to open the Vertical Navigation page
    b) Set transition altitude to 3000 ft by typing "3000" on the CDU keypad and selecting TRANS ALT (as per Europe norms, but you would use 18000 ft in North America).

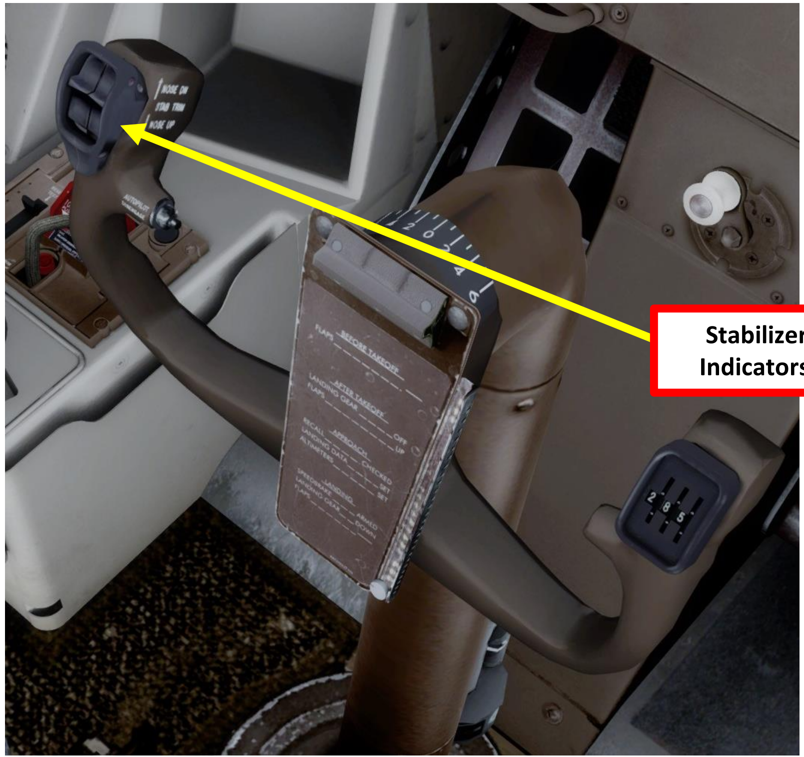
Transition Altitude (U.S. system)

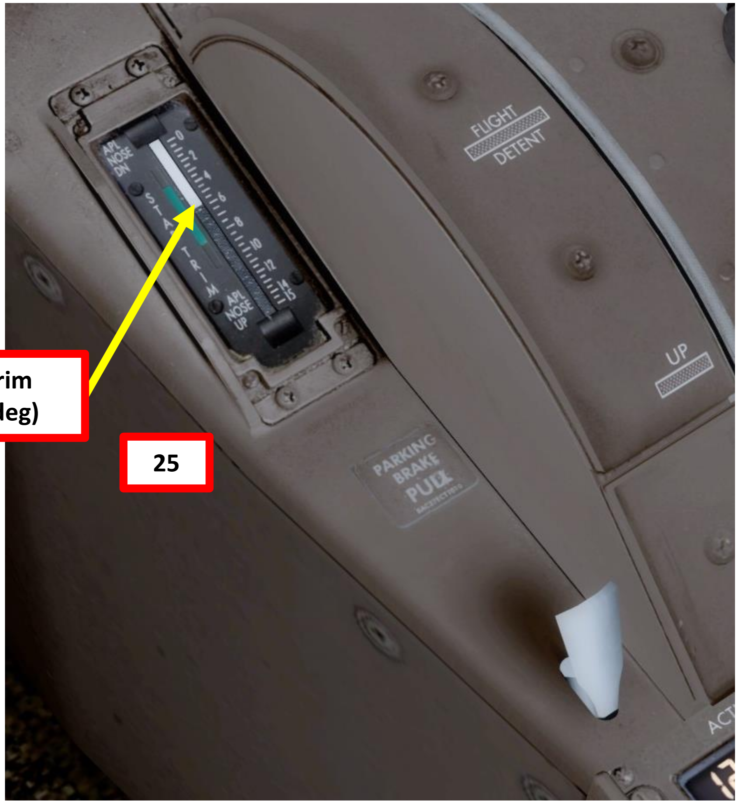


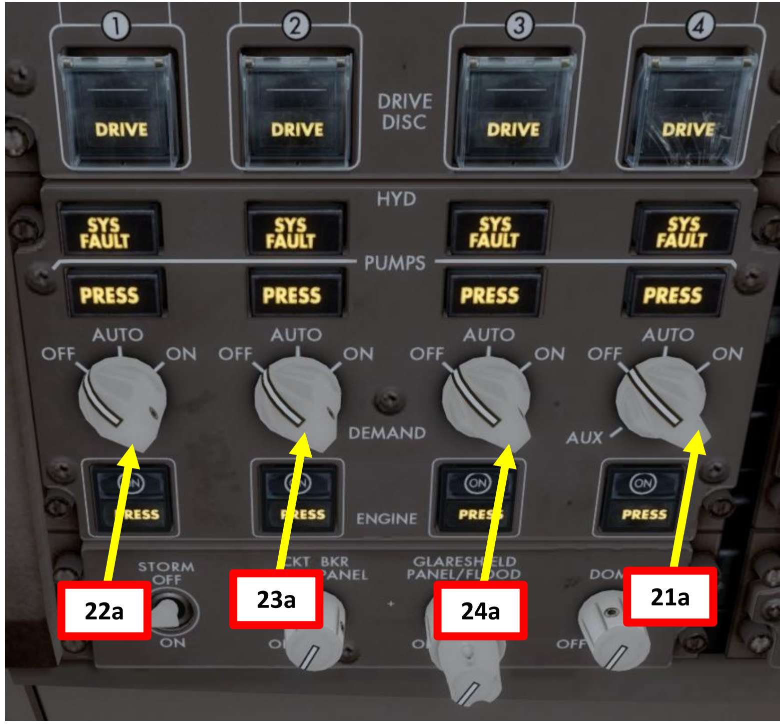
TAKEOFF TRIM & HYDRAULIC POWER SETUP

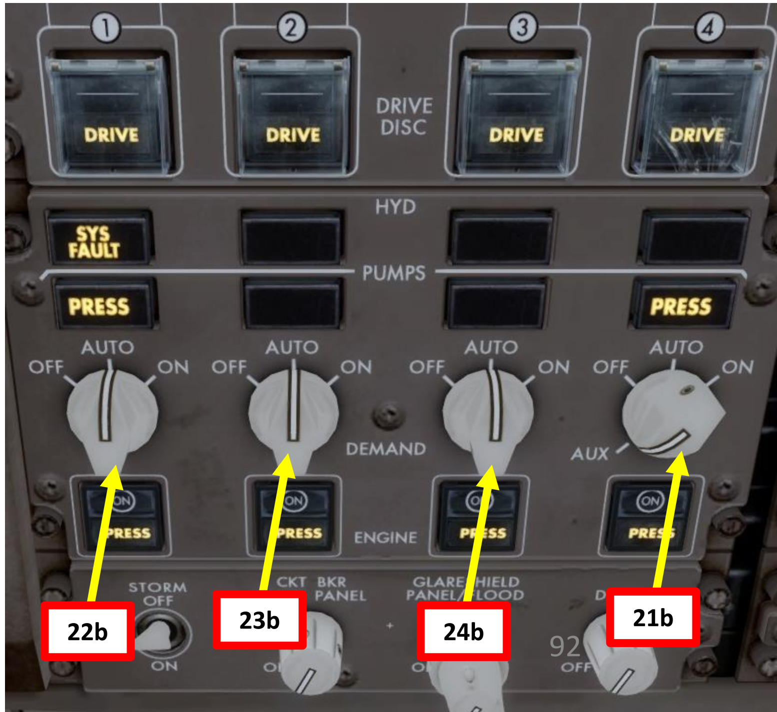
V1 Speed is 131 kts
VR Speed is 136 kts
V2 Speed is 146 kts
Takeoff Trim is +5.8

20. In order to set up our stabilizer takeoff trim, we need hydraulic power. We will use the hydraulic electrically-driven pumps and hydraulic demand pumps for that.
21. Set HYDRAULIC DEMAND PUMP 4 switch to AUX (Auxiliary). Wait for the SYS FAULT message to disappear. This pump is electrically-driven.
22. Set HYDRAULIC DEMAND PUMP 1 switch to AUTO. The SYS FAULT message will still be displayed since this system uses bleed air and no bleed air is available yet (typically the APU (Auxiliary Power Unit) would be turned on before doing this step).
23. Set HYDRAULIC DEMAND PUMP 2 switch to AUTO. Wait for the FAULT message to disappear. This pump is electrically-driven.
24. Set HYDRAULIC DEMAND PUMP 3 switch to AUTO. Wait for the FAULT message to disappear. This pump is electrically-driven.
25. Set Stabilizer Trim to the Takeoff Trim value of +5.8 calculated earlier by the FMC.





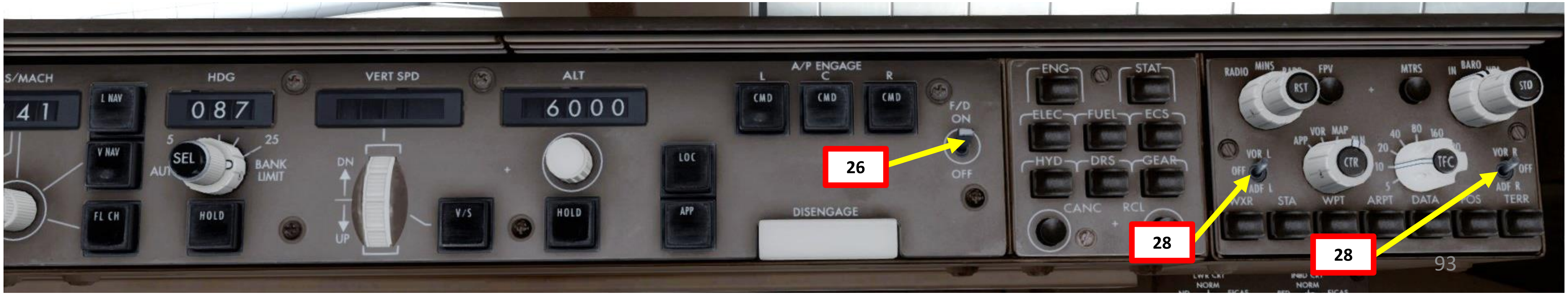




AUTOPILOT SETUP

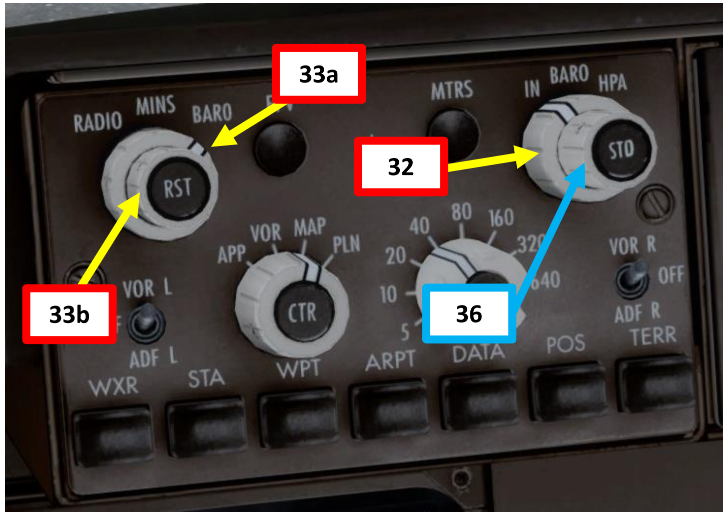
V1 Speed is 131 kts
VR Speed is 136 kts
V2 Speed is 146 kts
Takeoff Trim is +5.8

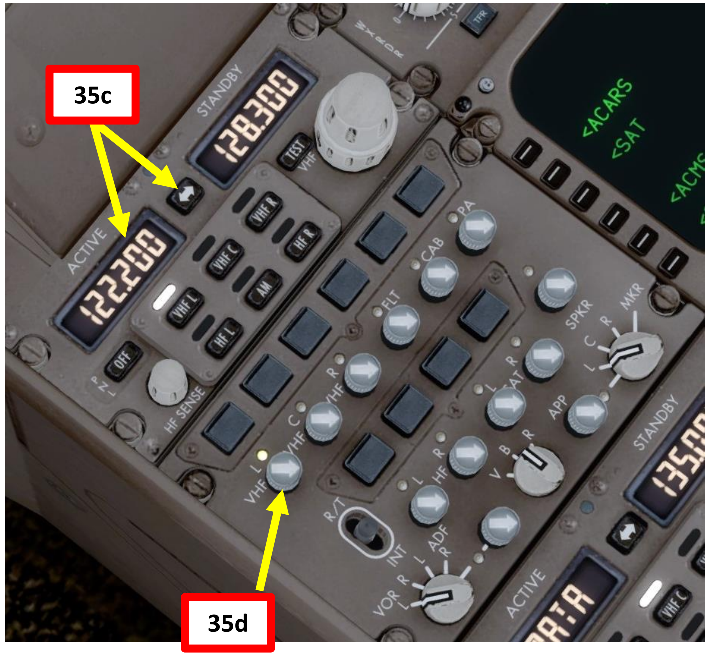
26. Turn on both FD (Flight Director) switches – UP POSITION
27. Turn on both A/T ARM (Autothrottle Arm) switches ON (UP)
28. Turn on all VOR switches – UP POSITION
29. Set V2 Speed on MCP (Mode Control Panel) by rotating MCP IAS knob on the glareshield until IAS is set to 141 kts (V2 speed)
30. Set HEADING knob to runway QDM (Magnetic) heading 087 as per Jeppesen chart.
31. As per EHAM SID Chart, set Initial Altitude (FL060, or 6,000 ft) on MCP (Mode Control Panel) by rotating ALTITUDE knob on glareshield until Altitude is set to 6,000 ft



CABIN PRESSURE & ALTIMETER SETUP

32. Set Altimeter Setting knob to desired unit system by left clicking on outer BARO knob. We will use Hg (inches of Mercury) instead of Hpa (Hectopascals).
33. Set Engine Out Acceleration Height in Baro as a reference by setting BARO (left click outer knob) and tuning the BARO value to 800 ft by right-clicking the inner BARO knob.
34. Click on the Hp/In button on the standby ADI to set the desired unit system (Inches of Hg in our case).
35. You can consult the EHAM ATIS (Automatic Terminal Information Service) system with the radio to get the altimeter setting.
    a) Consult the EHAM chart and find the Schiphol ATIS Frequency (122.200).
    b) Set VHF-1 STANDBY radio frequency ATIS frequency (122.200)
    c) Click on the Transfer button to set the ATIS frequency to the ACTIVE frequency.
    d) Press the L VHF button on the Audio Select Panel to listen on the VHF-1 active frequency.
    e) You should receive the ATIS automated report on the radio for Schiphol Airport. The reported altimeter setting is 29.92 inches of Hg.
    f) Press the L VHF button on the Audio Select Panel to mute the VHF-1 active frequency once you have the information you need.
36. Set altimeter setting and standby altimeter setting to 2992 (29.92 inches of mercury) by rotating the altimeter inner BARO knob.



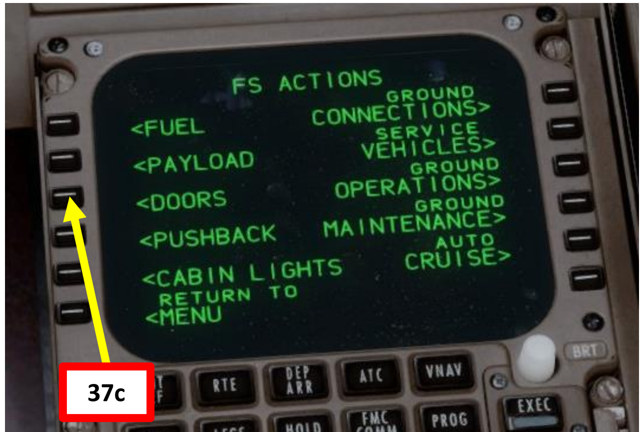


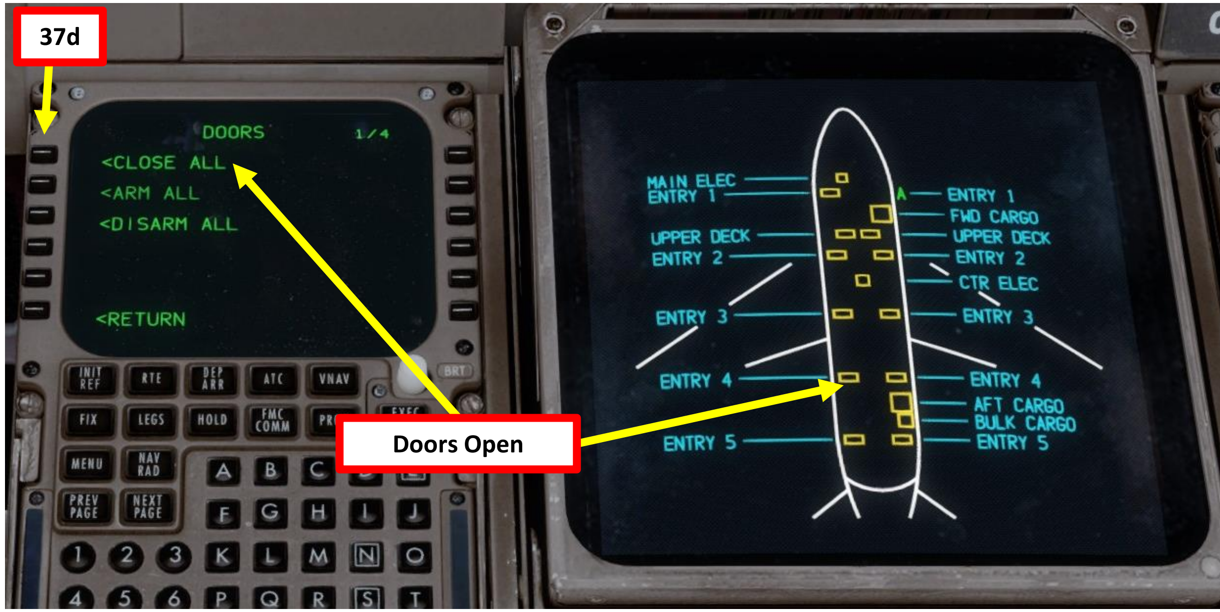
35e

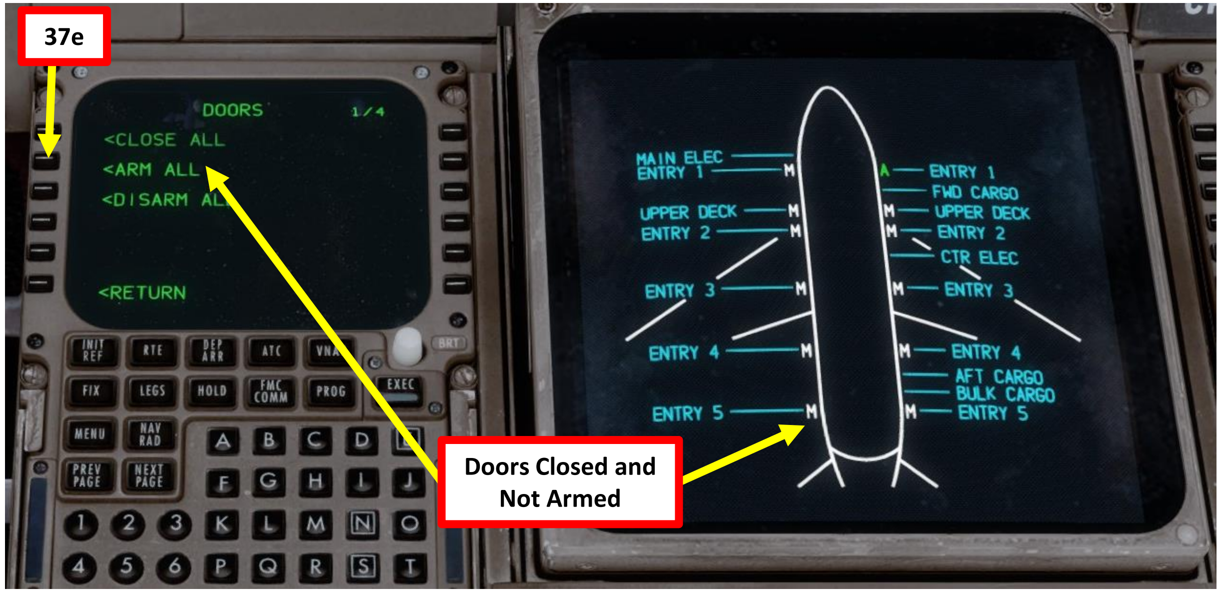
Schiphol airport information Oscar, 0550 zulu. Wind calm. Visibility: greater than 20 miles. Sky condition: few clouds at 5,800. Temperature: 15. Dewpoint: 5. Altimeter 2992.

DOORS

37. Go to CDU Main Menu and close doors
    a) Press the DOOR button on the glareshield to display the DOORS synoptic page
    b) Select FS ACTIONS
    c) Select DOORS page
    d) Click on "CLOSE ALL" to request the flight crew to shut down all doors
    e) Once all doors are closed, click on "ARM ALL" to ask the flight crew to arm all doors.
    f) Click on MENU to return to main menu

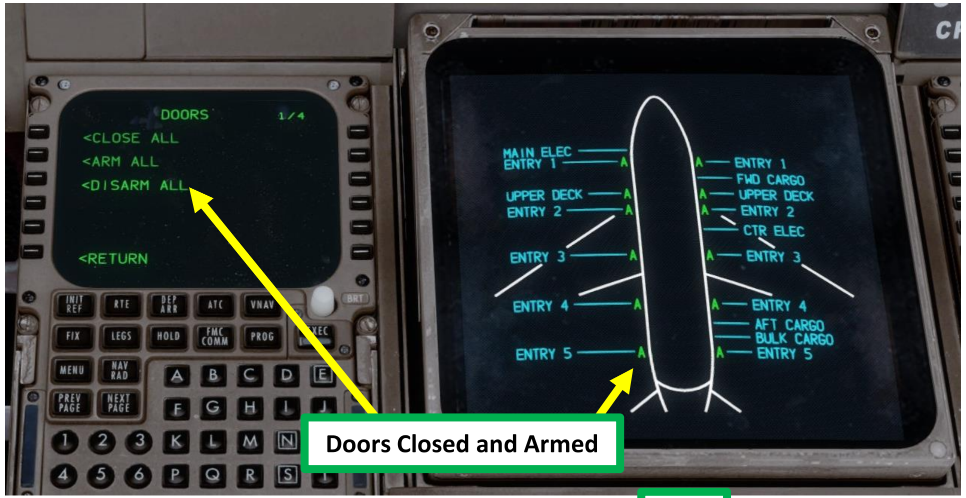






DOORS

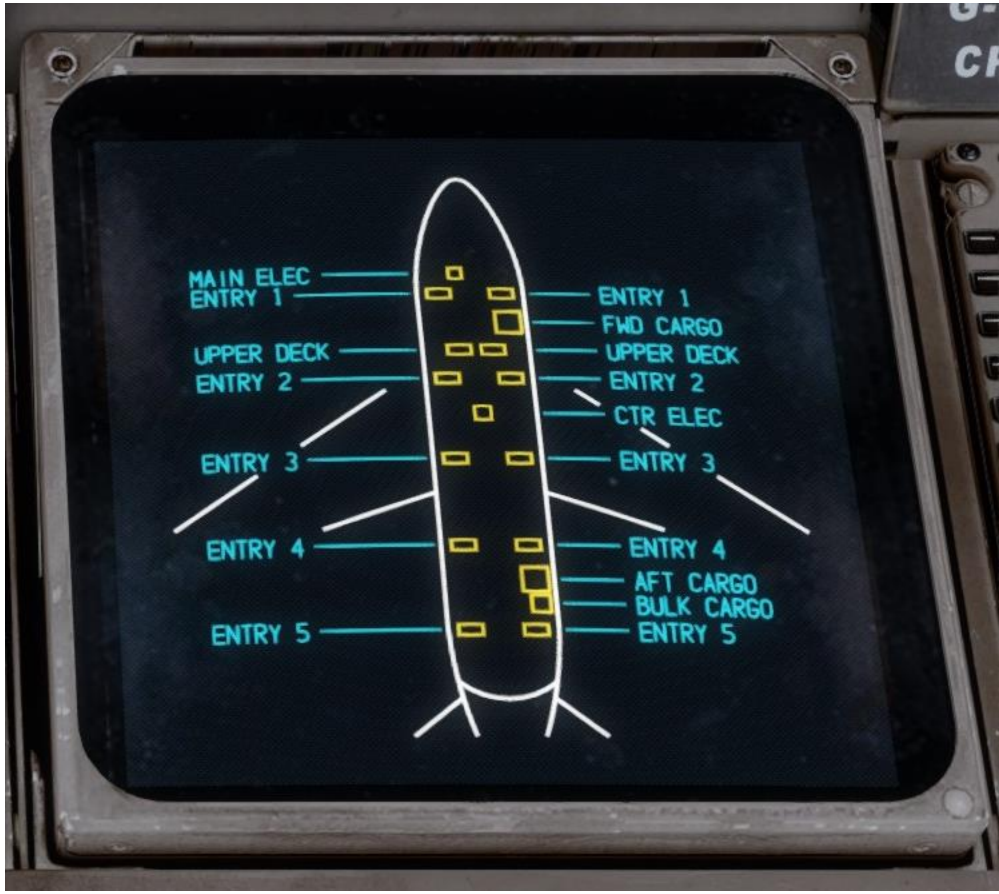
39. Go to CDU Main Menu and close doors
    - d) Click on “CLOSE ALL” to request the flight crew to shut down all doors
    - e) Once all doors are closed, click on “ARM ALL” to ask the flight crew to arm all doors.
    - f) Click on MENU to return to main menu



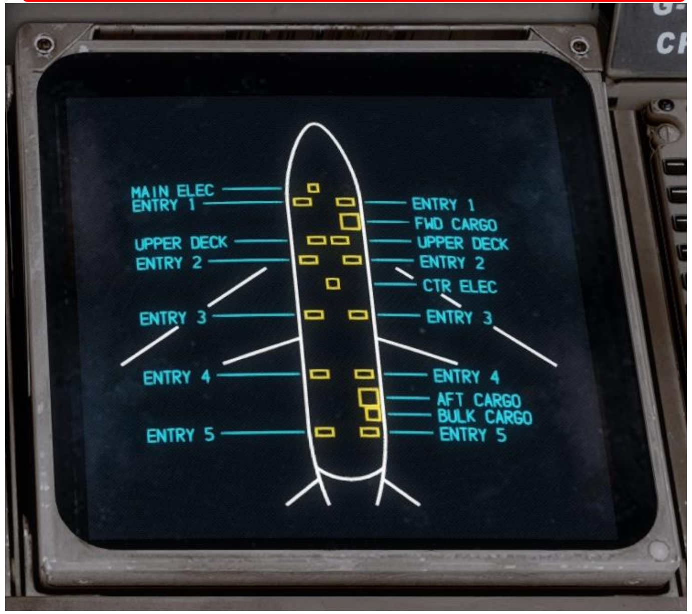
39f

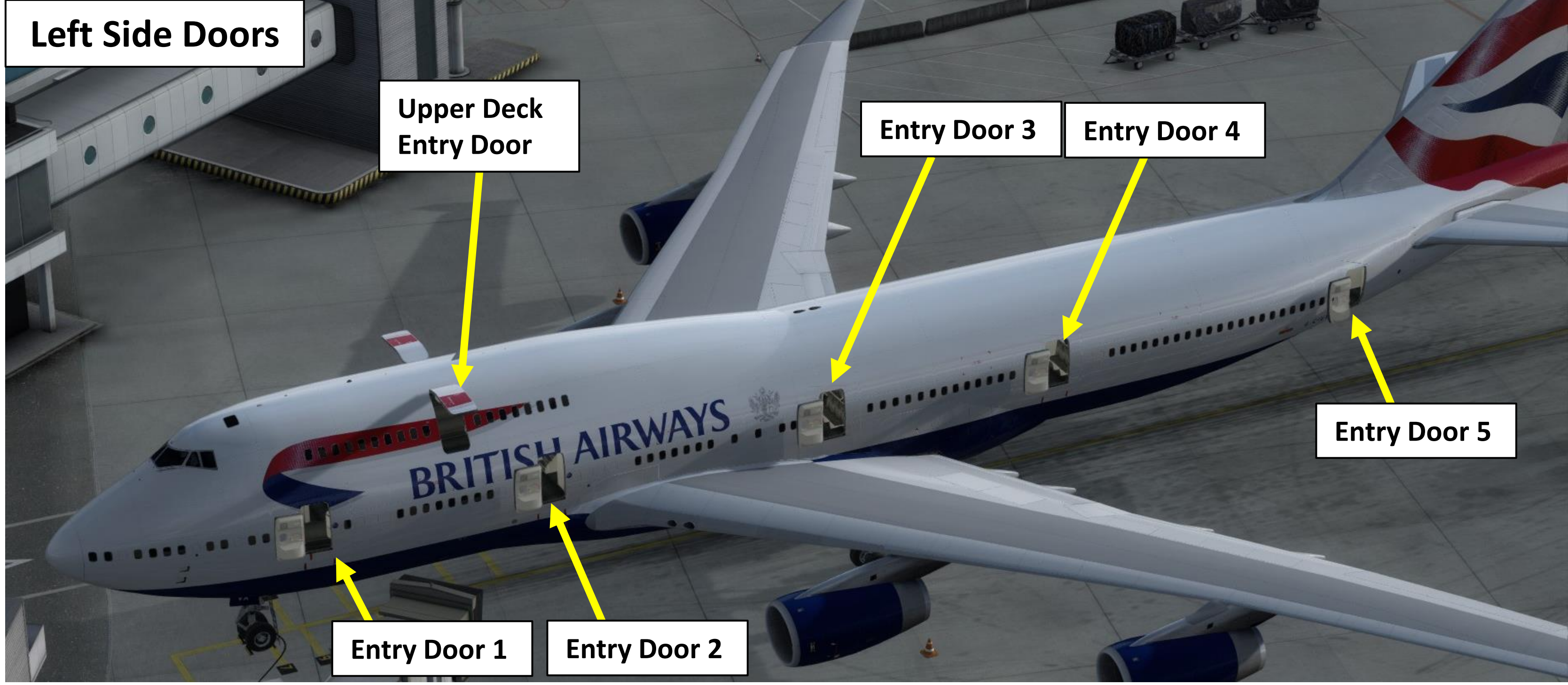
DOORS

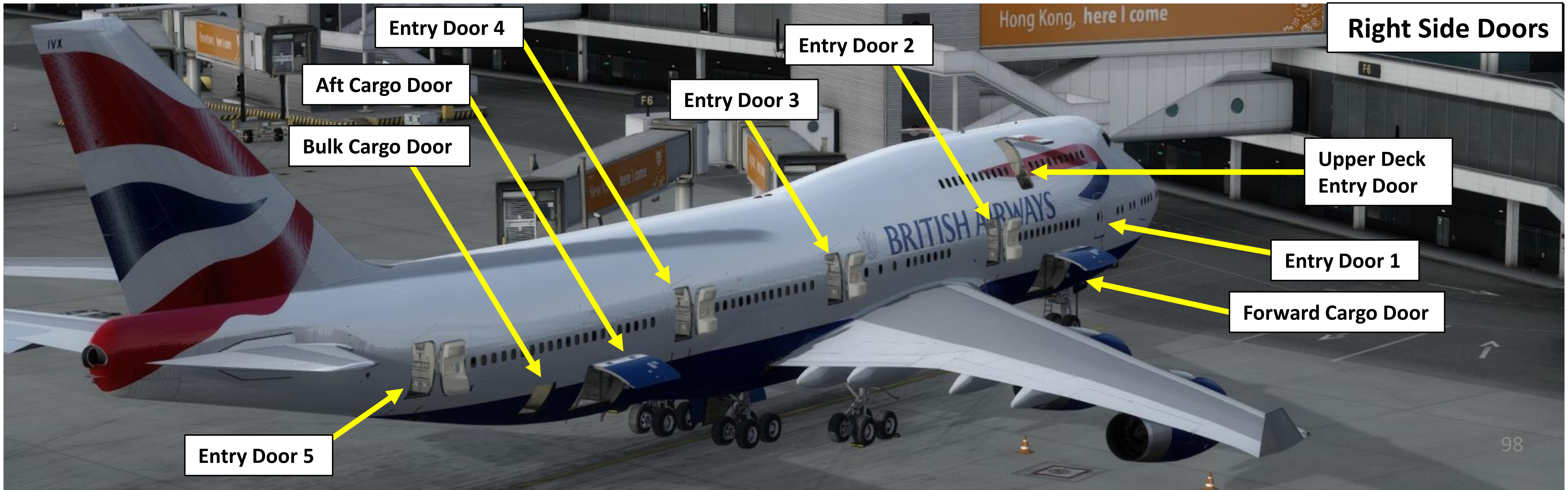
You can access individual door commands in the DOORS pages 2, 3 and 4 via the CDU .



DOORS


MAIN ELEC
ENTRY 1
UPPER DECK
ENTRY 2
ENTRY 3
ENTRY 4
ENTRY 5
ENTRY 1
FWD CARGO
UPPER DECK
ENTRY 2
CTR ELEC
ENTRY 3
ENTRY 4
AFT CARGO
BULK CARGO
ENTRY 5


Left Side Doors
Upper Deck Entry Door
Entry Door 3
Entry Door 4
Entry Door 5
Entry Door 1
Entry Door 2
BRITISH AIRWAYS


Right Side Doors
Entry Door 4
Aft Cargo Door
Bulk Cargo Door
Entry Door 2
Entry Door 3
Upper Deck Entry Door
Entry Door 1
Forward Cargo Door
Entry Door 5
Hong Kong, here I come
BRITISH AIRWAYS

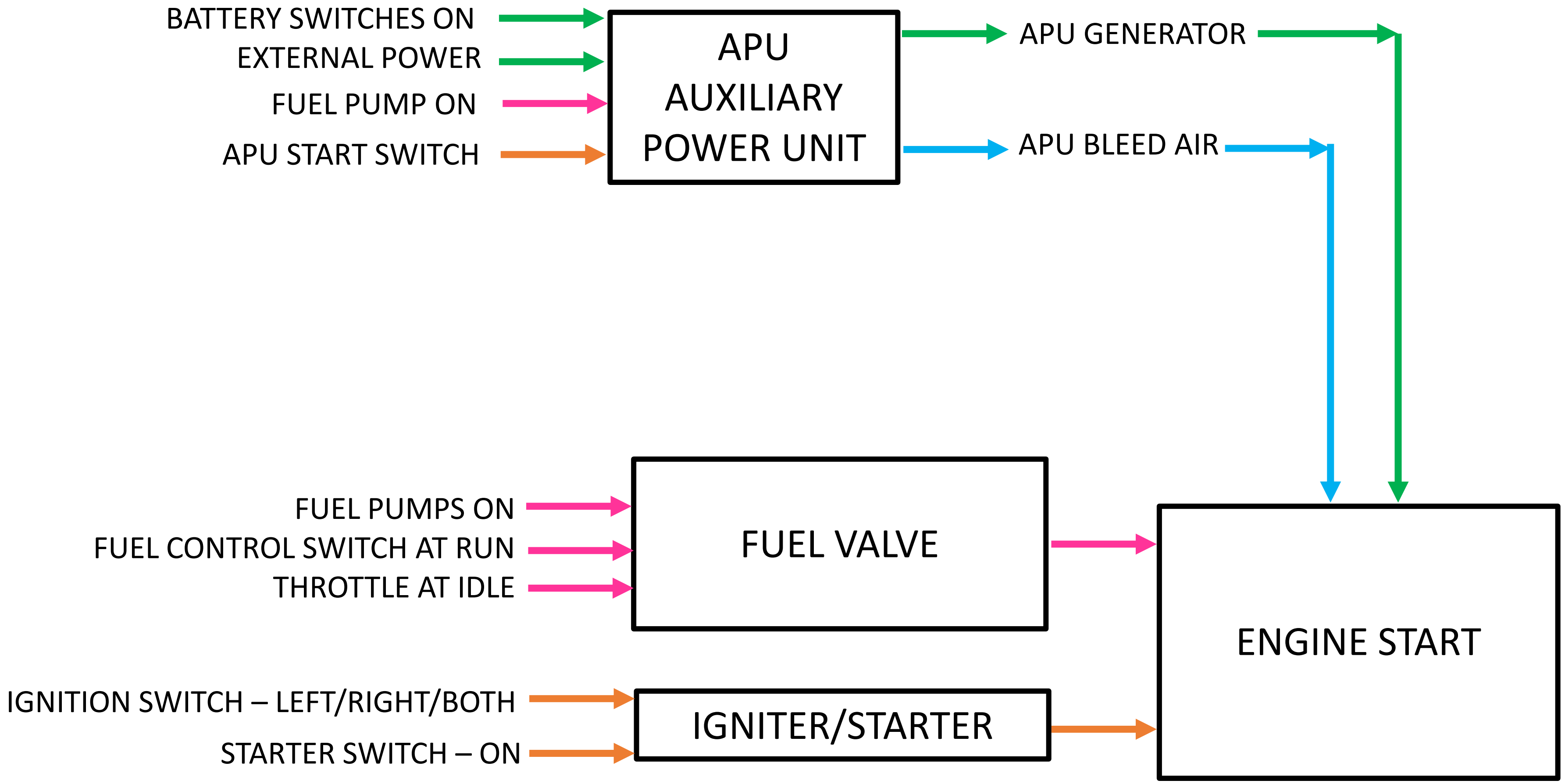
ENGINE START-UP

- APU AUXILIARY POWER UNIT → APU GENERATOR
- APU AUXILIARY POWER UNIT → APU BLEED AIR
- GROUND POWER CART → EXTERNAL POWER
- AIR PRESSURE CART → EXTERNAL AIR
- ENGINE (RUNNING) → ENGINE GENERATOR (ENGINE CROSS-START)
- ENGINE (RUNNING) → ENGINE BLEED (ENGINE CROSS-START)
- FUEL PUMPS → FUEL PUMPS ON
- THROTTLE POSITION → THROTTLE AT IDLE
- FUEL CONTROL SWITCH → FUEL CONTROL SWITCH AT RUN
- IGNITION SWITCH → IGNITION SWITCH – LEFT/RIGHT/BOTH
  IGNITION CONTROLLED BY FADEC (**F**ULL **A**UTHORITY **D**IGITAL **E**NGINE **C**ONTROLLER)
- STARTER SWITCH → STARTER SWITCH – ON

- FUEL → ENGINE START
- IGNITION/STARTER → ENGINE START
- ELECTRICAL POWER → ENGINE START
- AIR PRESSURE → ENGINE START

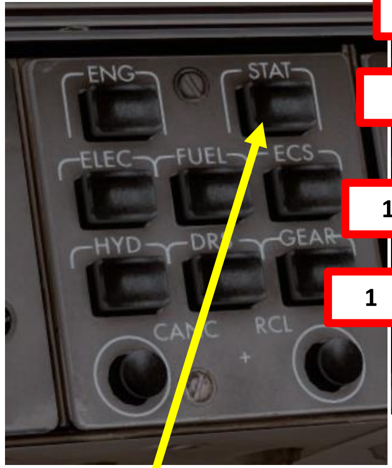
ENGINE START-UP

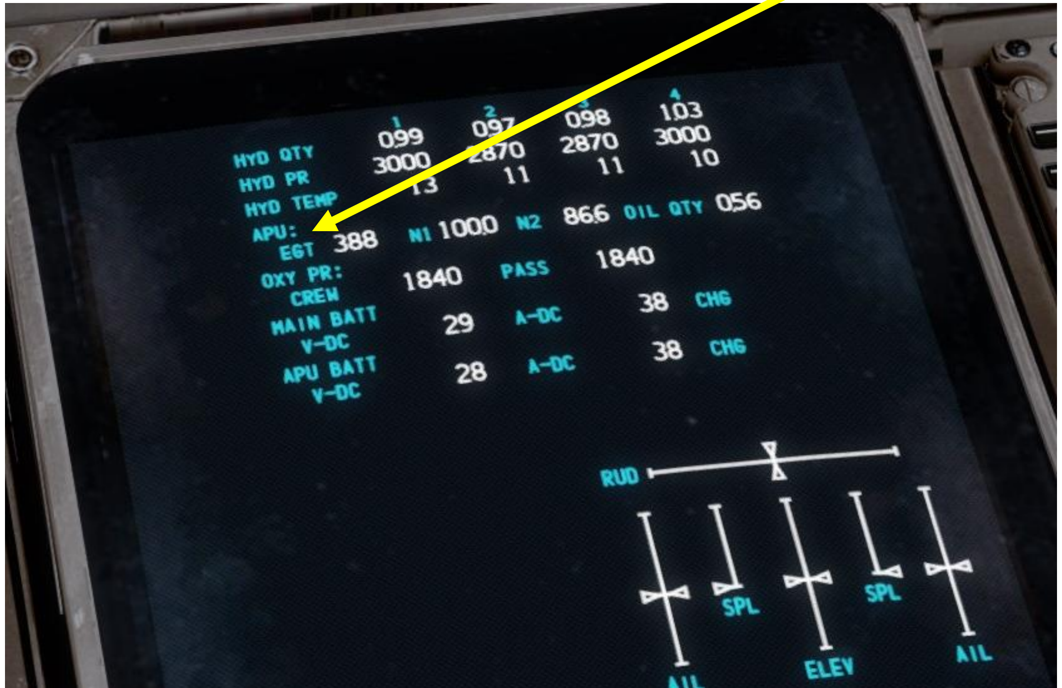
NOTE: It is usually common practice to start your engines during pushback. We will start our engines before that for simplicity.

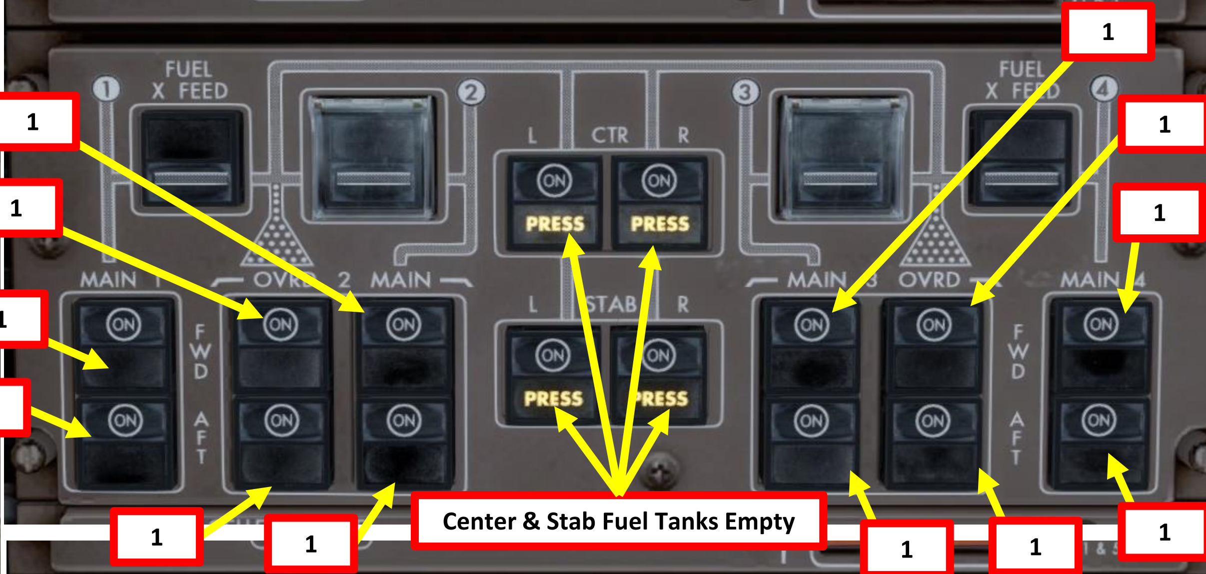


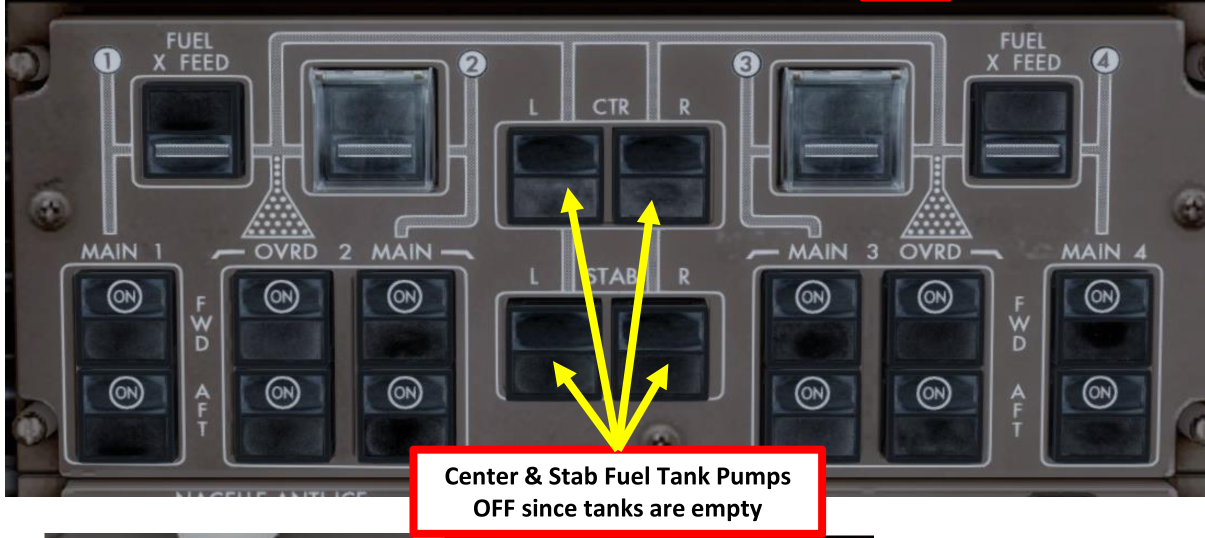
APU (AUXILIARY POWER UNIT) START

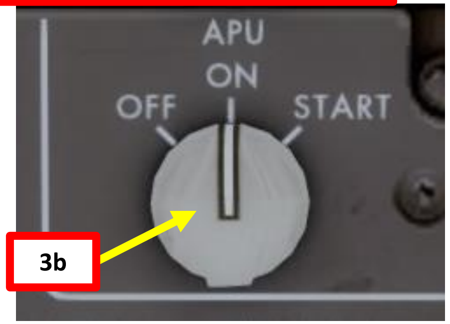
1. On Overhead Panel, turn ON the MAIN 1 FWD, MAIN 1 AFT, MAIN 2 FWD, MAIN 2 AFT, OVRD 2 FWD, OVRD 2 AFT, MAIN 3 FWD, MAIN 3 AFT, OVRD 3 FWD, OVRD 3 AFT, MAIN 4 FWD, MAIN 4 AFT Fuel Pump switches. If you press the Center or Stab Pumps switches, the PRESS caution means that there is no fuel in those tanks and that the switches can remain to OFF. Note: If there is more than 127,000 lbs of fuel, turn on the both FUEL X FEED switches ON.
2. Press the STAT synoptic page button to monitor APU parameters
3. Set APU switch to START to initiate start, then set switch to ON after by right clicking twice on the APU switch, holding the mouse button on the second click until you see the switch spring back to the ON position.





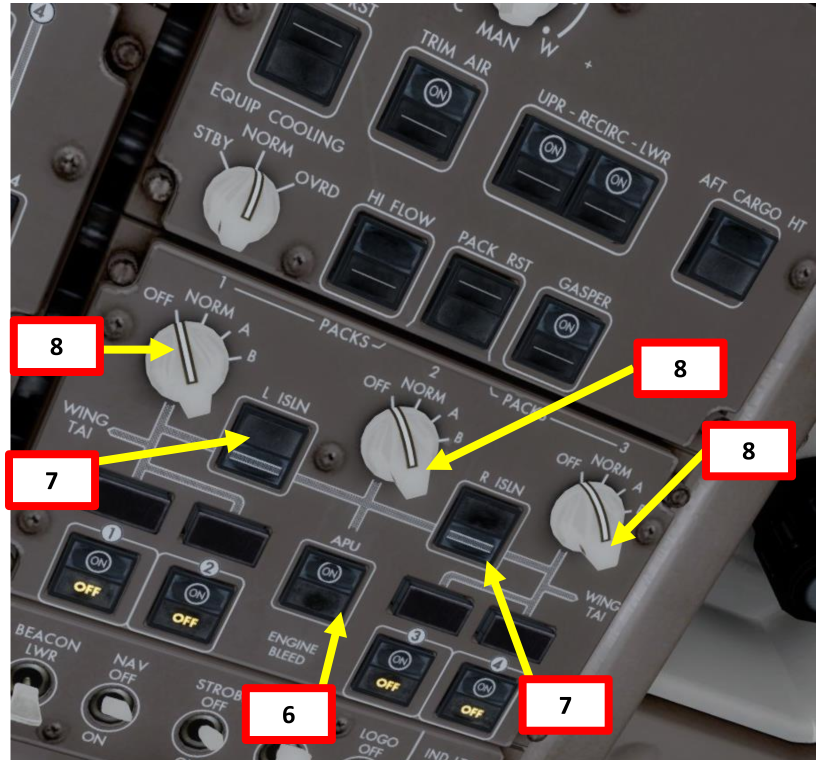


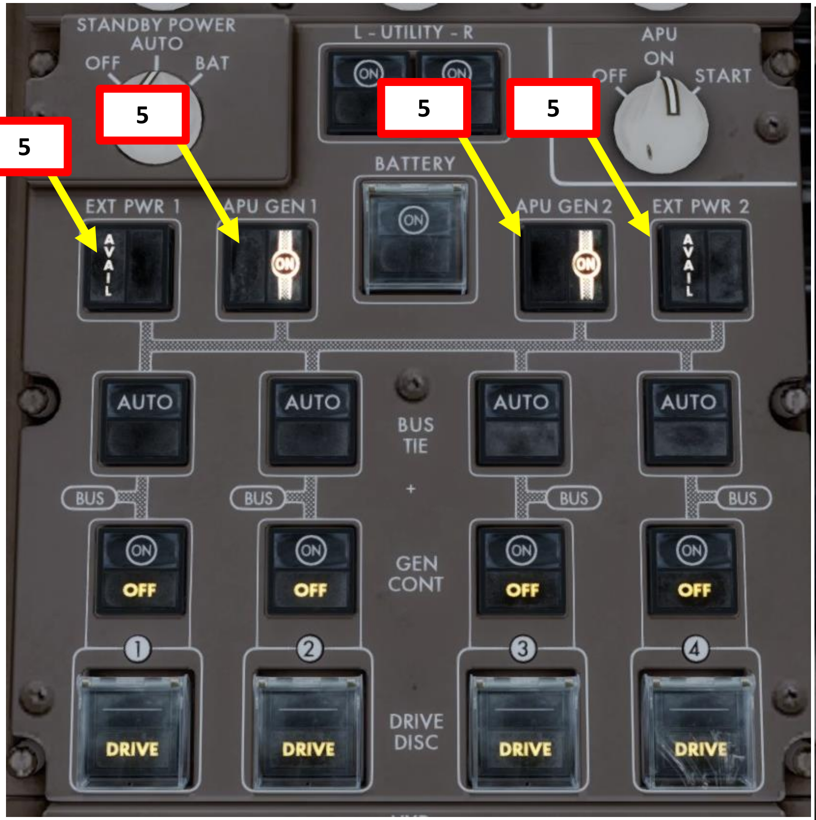


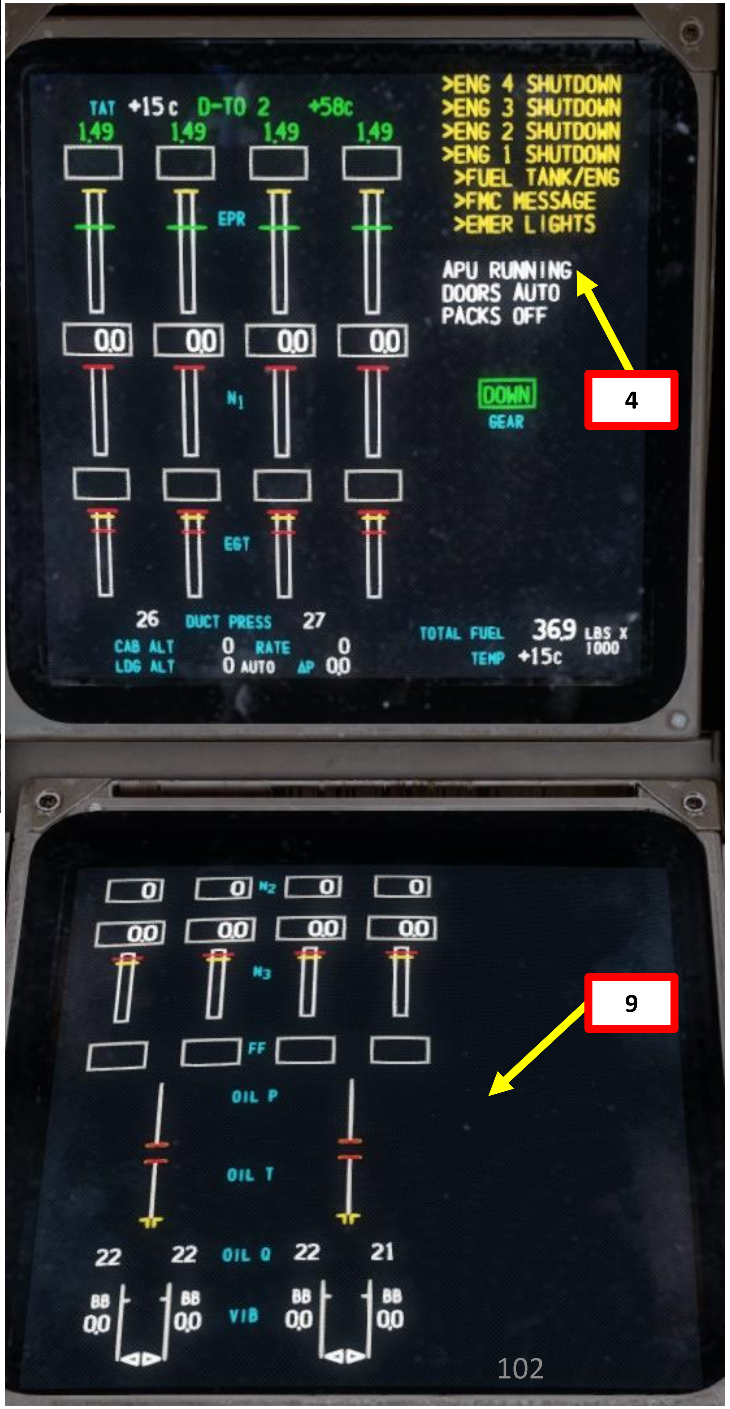


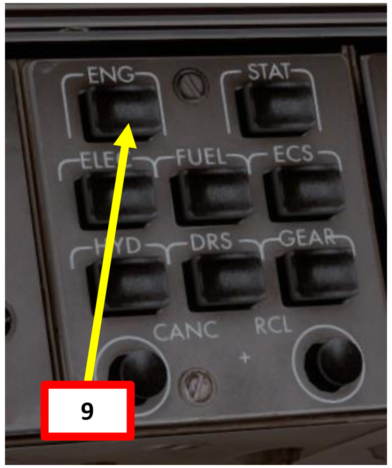
APU (AUXILIARY POWER UNIT) START

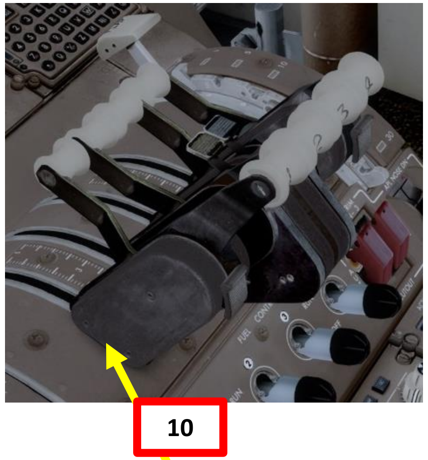
4. Wait until the APU RPM reaches approx. 100.0 %. The messages “APU RUNNING” should appear.
5. Set APU GEN1 and APU GEN2 switches ON and make sure the EXT PWR 1 and EXT PWR 2 indications become AVAIL.
6. Make sure the APU BLEED AIR switch is set to AUTO
7. Make sure the LEFT & RIGHT ISOLATION VALVE switches are all set to ON
8. Set PACK (Pneumatic Air Conditioning Kit) 1, 2 & 3 switches OFF to ensure enough APU bleed air pressure is available for engine start
9. Push “ENG” button to display the Engine synoptic page
10. Set throttle to IDLE (fully aft).



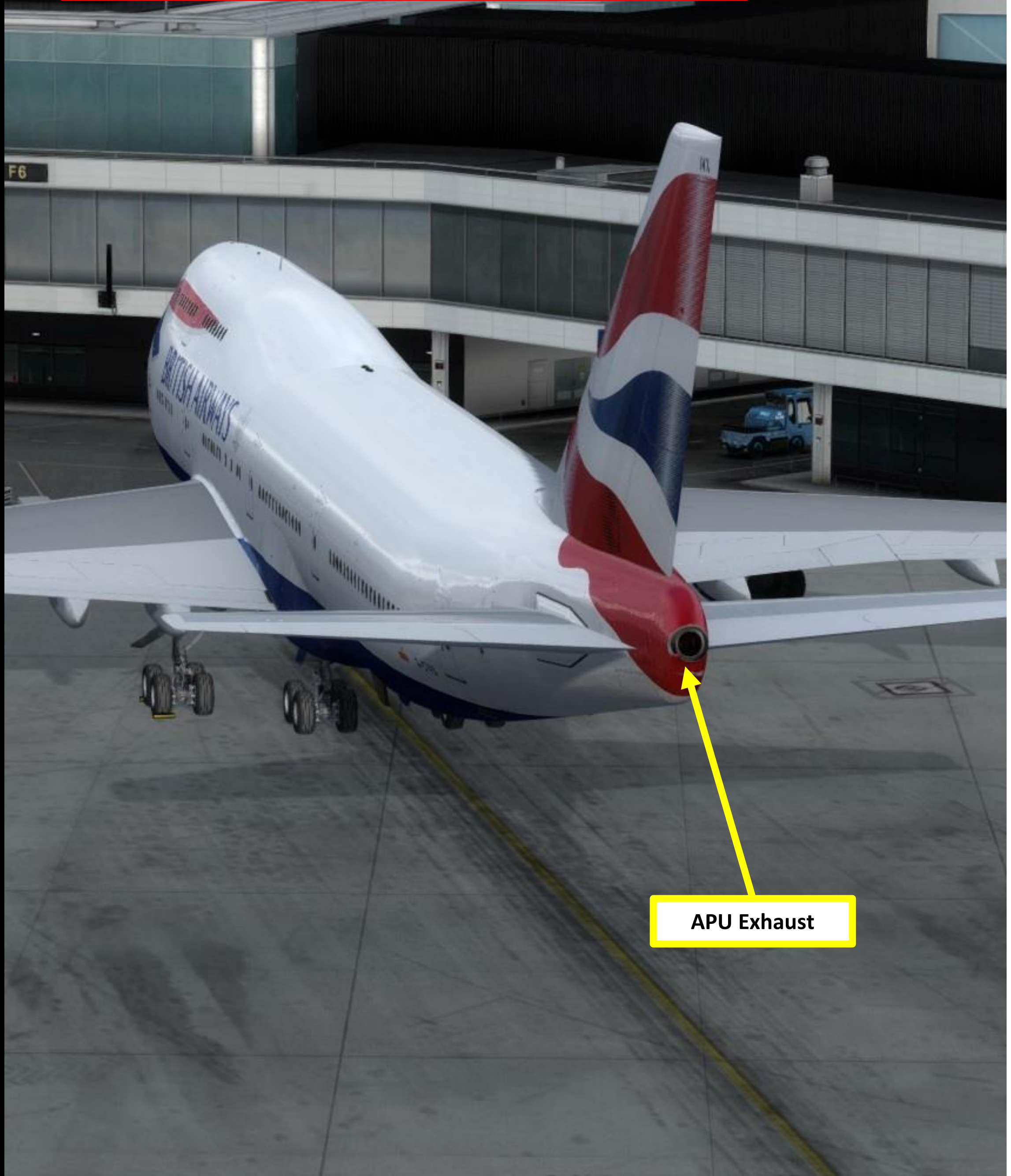






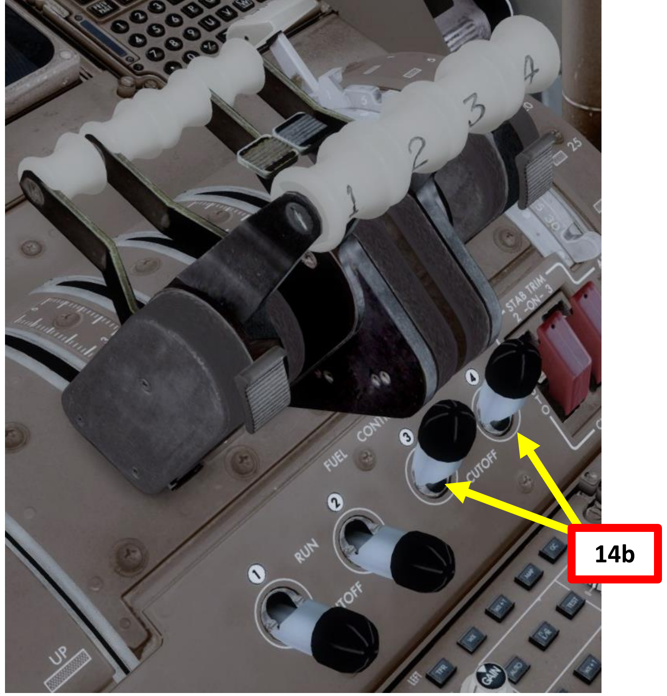


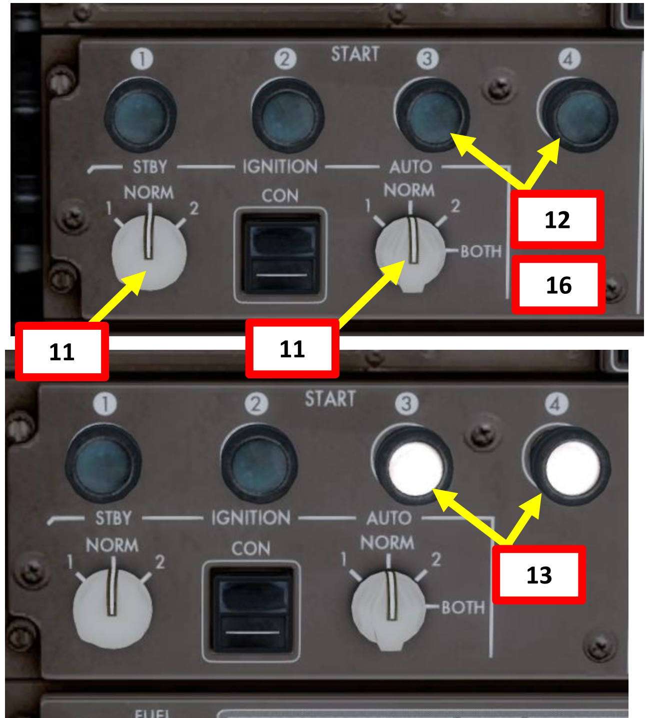
APU RUNNING WITH DOOR OPEN

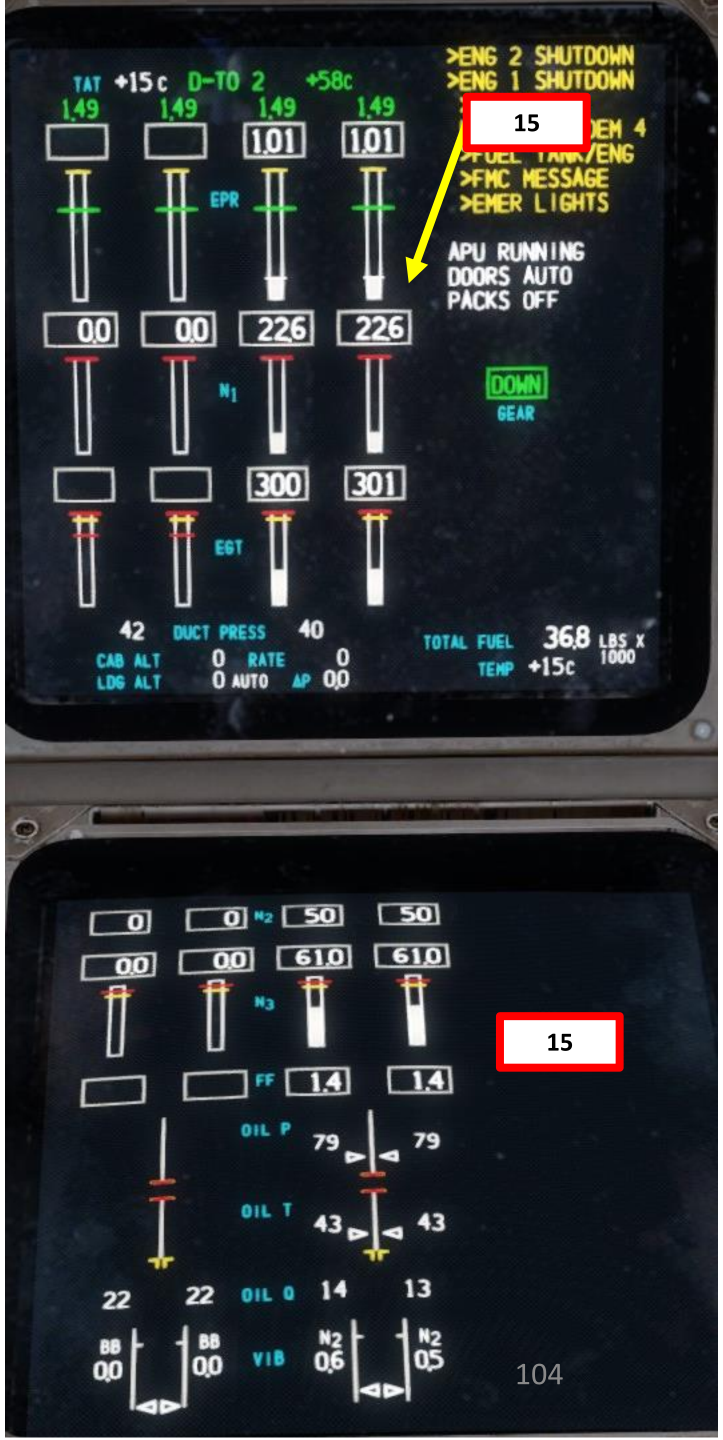


ENGINE START-UP (ROLLS-ROYCE)

11. Set AUTO IGNITION & STBY IGNITION switches to NORM
12. Pull No. 3 and No. 4 STARTER switches to start engines 3 and 4.
13. No. 3 and No. 4 STARTER switches will illuminate while starter is active.
14. When No. 3 and No. 4 Engine N3 indications (High Pressure Compressor Rotation Speed) reach 25 %, set No. 3 and No. 4 FUEL CONTROL switches to RUN (UP).
15. N1 indication (Fan Speed / Low Pressure Compressor Rotation Speed), FF (Fuel Flow) and EGT (Exhaust Gas Temperature), Oil Pressure and Oil Temperature for No. 3 and No. 4 Engine should increase.
16. When No. 3 and No. 4 Engine parameters stabilize at about 20% N1 and 60 % N3, No. 3 and No. 4 STARTER knobs will automatically extinguish and reset

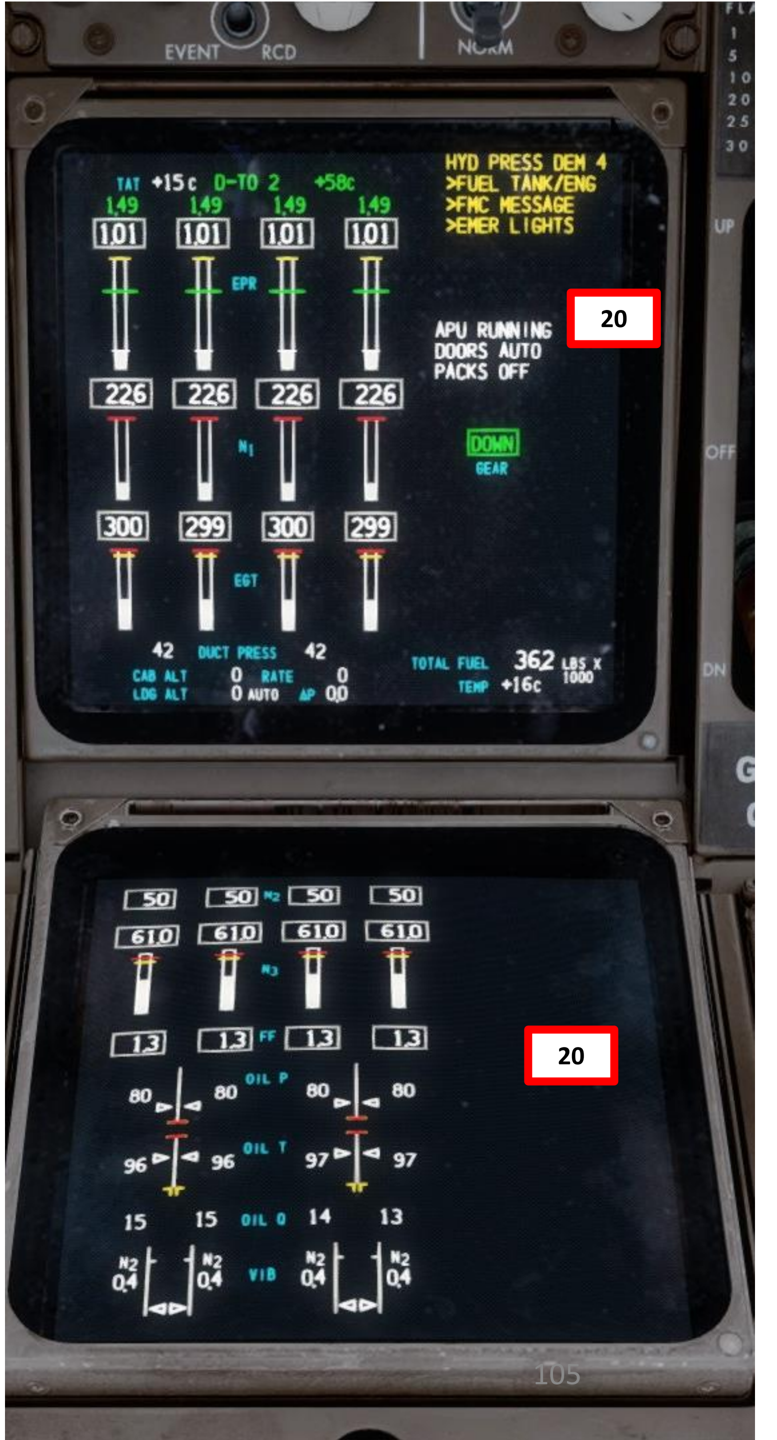


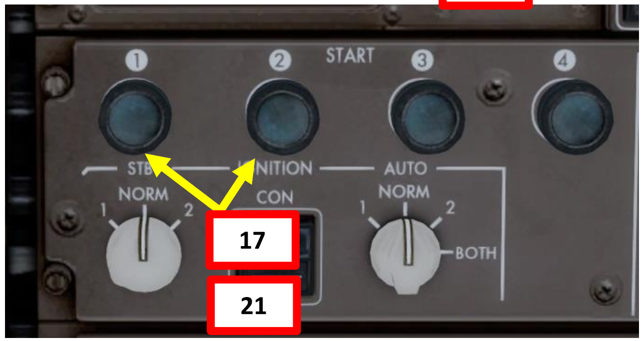


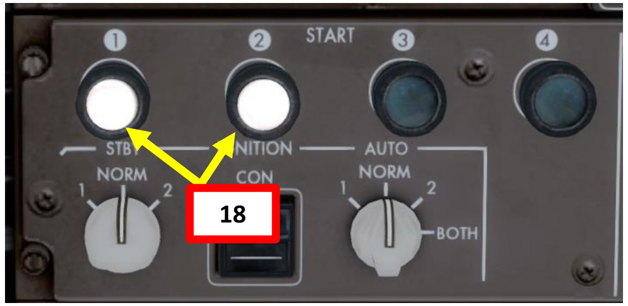


ENGINE START-UP (ROLLS-ROYCE)

17. Pull No. 1 and No. 2 STARTER switches to start engines 1 and 2.
18. No. 1 and No. 2 STARTER switches will illuminate while starter is active.
19. When No. 1 and No. 2 Engine N3 indications (High Pressure Compressor Rotation Speed) reach 25 %, set No. 1 and No. 2 FUEL CONTROL switches to RUN (UP).
20. N1 indication (Fan Speed / Low Pressure Compressor Rotation Speed), FF (Fuel Flow) and EGT (Exhaust Gas Temperature), Oil Pressure and Oil Temperature for No. 1 and No. 2 Engine should increase.
21. When No. 1 and No. 2 Engine parameters stabilize at about 20% N1 and 60 % N3, No. 1 and No. 2 STARTER knobs will automatically extinguish and reset







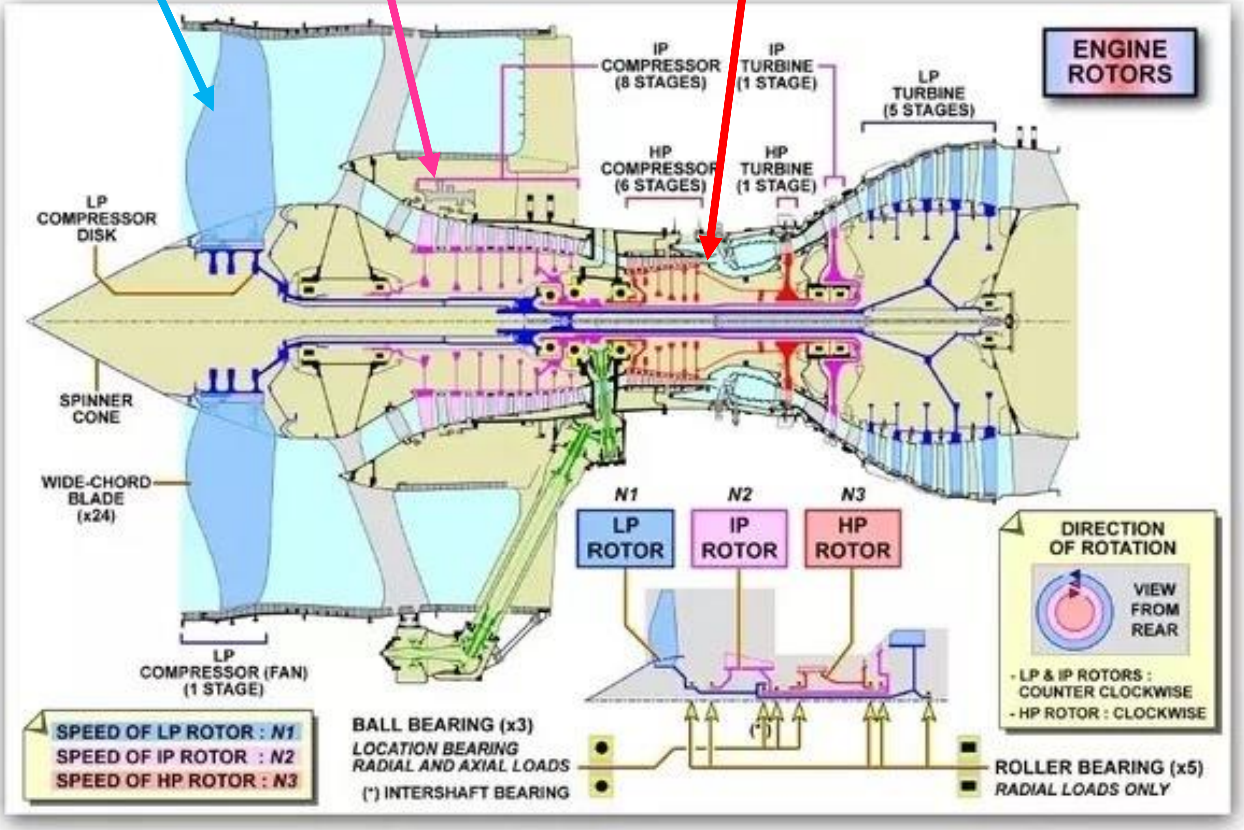
ENGINE START-UP (ROLLS-ROYCE / PRATT & WHITNEY 3-SPOOL ENGINE)

High-pressure compressor and high-pressure turbine are driven by the same shaft. This is N3 speed in percentage of maximum RPM.

N1

N2

N3



N1

N2

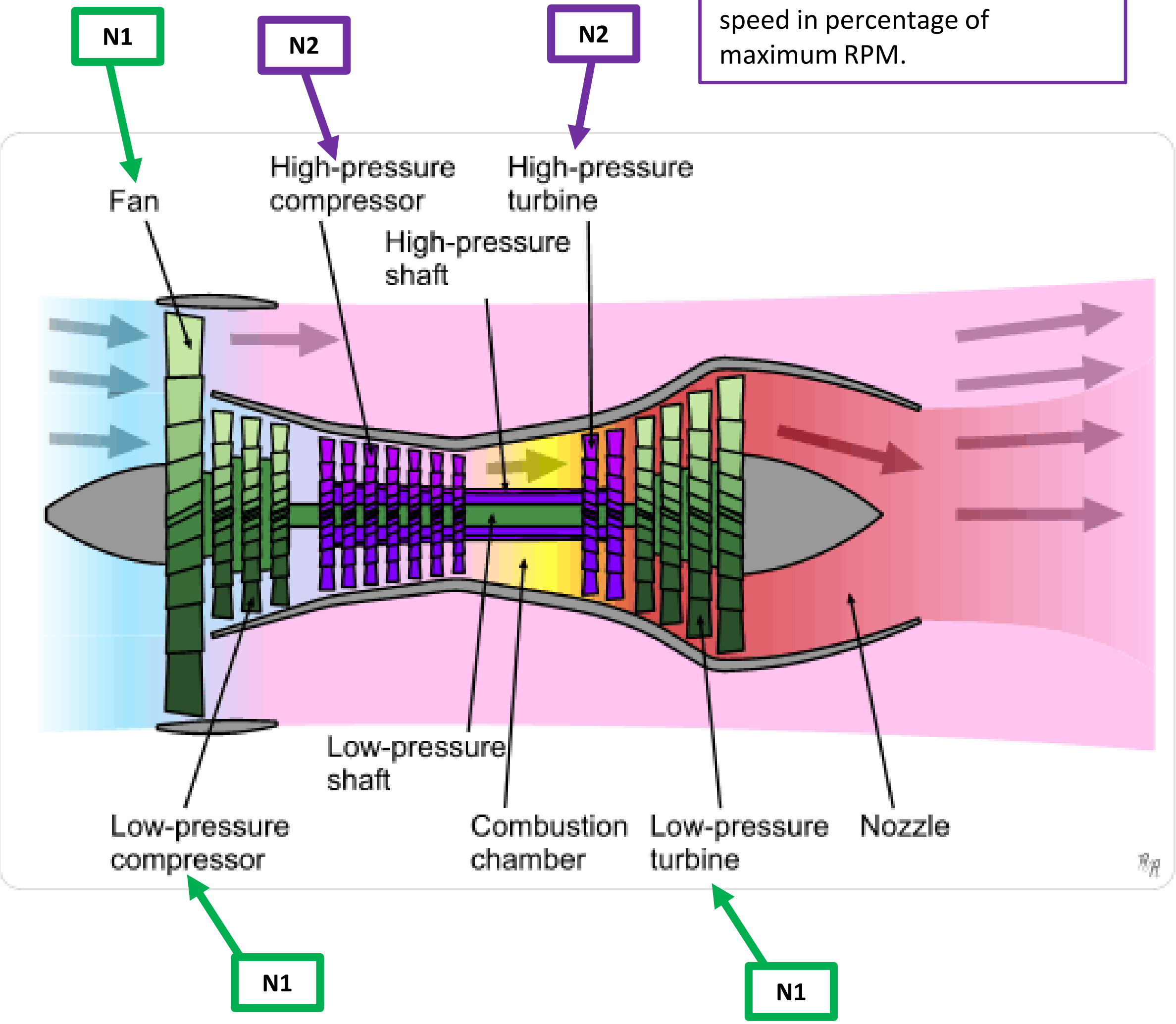
N3

Intermediate-pressure compressor and intermediate-pressure turbine are driven by the same shaft. This is N2 speed in percentage of maximum RPM.

Fan, low-pressure compressor and low-pressure turbine are driven by the same shaft. This is N1 speed in percentage of maximum RPM.

ENGINE START-UP
(GE 2-SPOOL ENGINE)

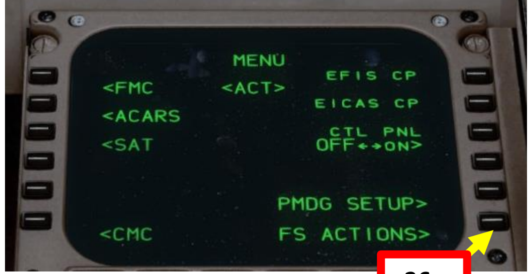
High-pressure compressor and high-pressure turbine are driven by the same shaft. This is N2 speed in percentage of maximum RPM.

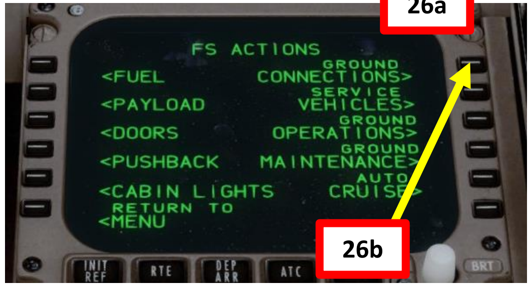


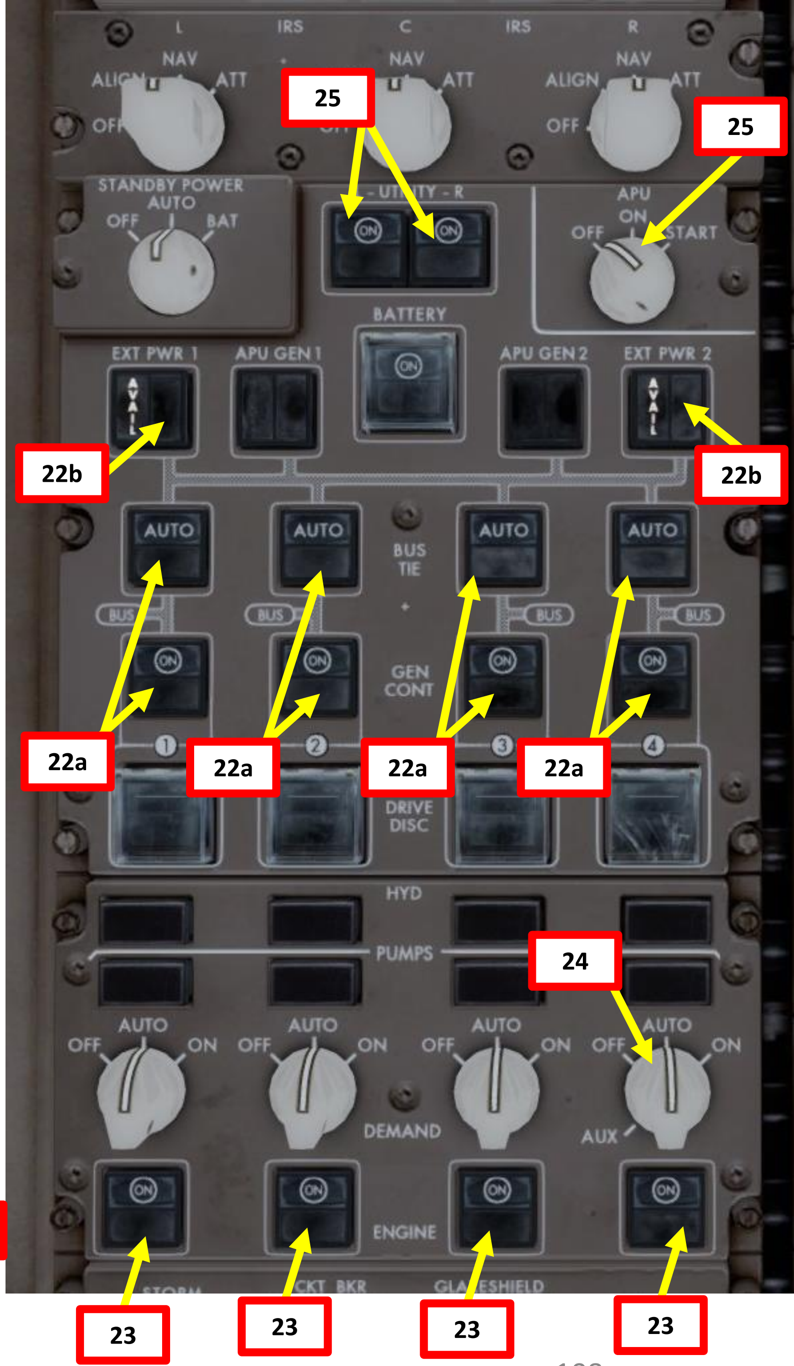
Fan, low-pressure compressor and low-pressure turbine are driven by the same shaft. This is N1 speed in percentage of maximum RPM.

ENGINE START-UP (ROLLS-ROYCE)

22. Verify that MAIN GENERATOR 1, 2, 3 & 4 switches are ON and their respective BUS TIEs are set to AUTO. Then, confirm that the EXT PWR 1 and EXT PWR 2 indications are AVAIL
23. Verify that all ENGINE-DRIVEN HYDRAULIC PUMP switches are ON
24. Set HYDRAULIC DEMAND PUMP 4 switch to AUTO.
25. Verify that the LEFT & RIGHT UTILITY BUS switches are ON
26. Turn OFF ground Power and remove chocks via the CDU
    - FS ACTIONS -> GROUND CONNECTIONS -> GROUND POWER RELEASE
    - Confirm that both EXT PWR 1 and EXT PWR 2 indications are extinguished
    - FS ACTIONS -> GROUND CONNECTIONS -> WHEEL CHOCKS REMOVED
25. Set APU switch – OFF
    APU cooldown sequence will begin and shutdown will occur automatically once cooldown sequence is complete.

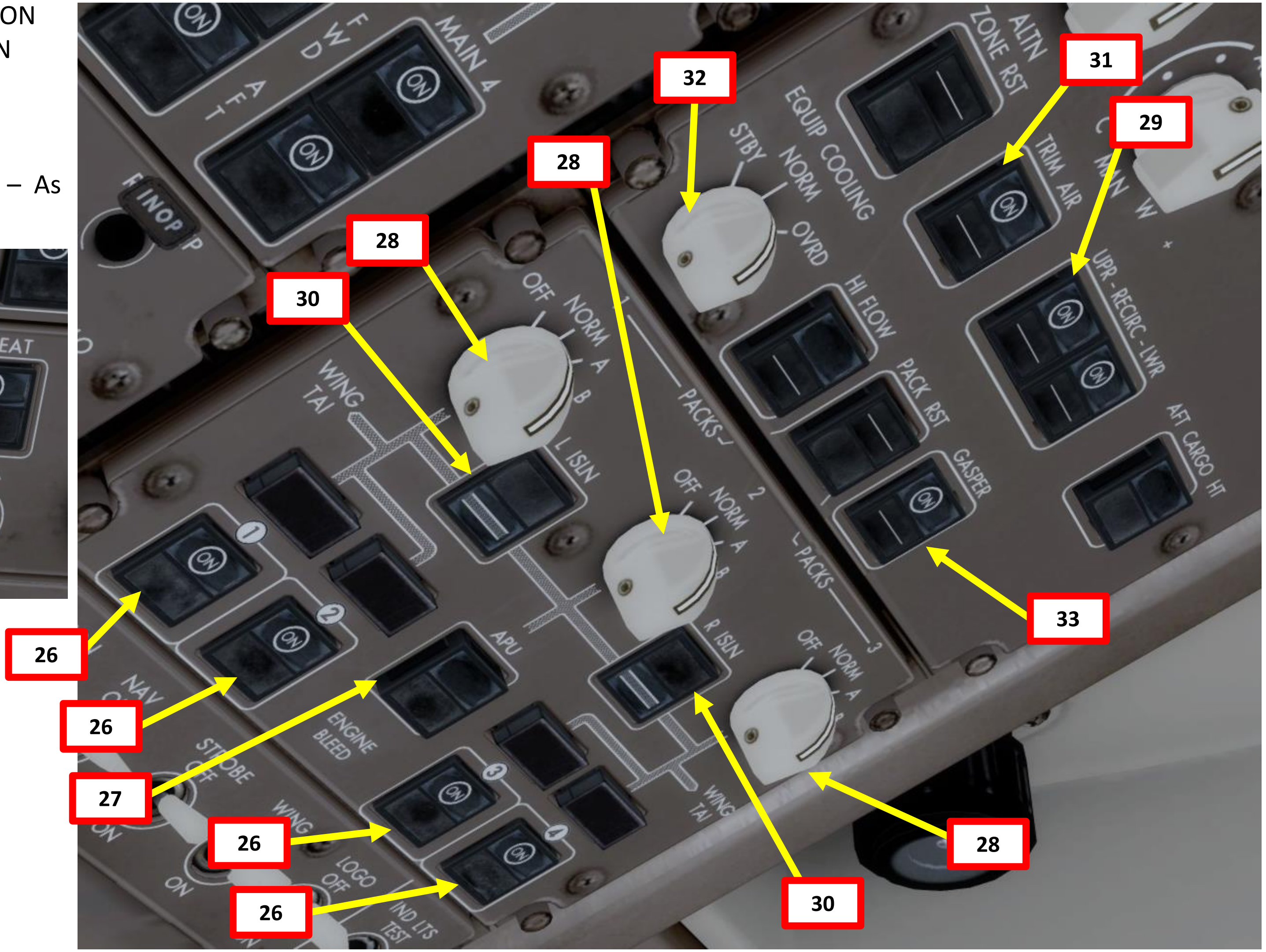






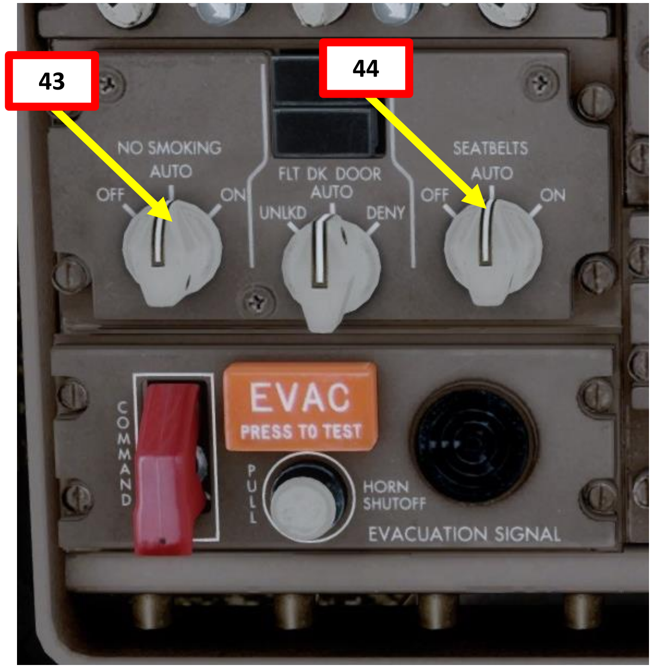
ENGINE START-UP (ROLLS-ROYCE)

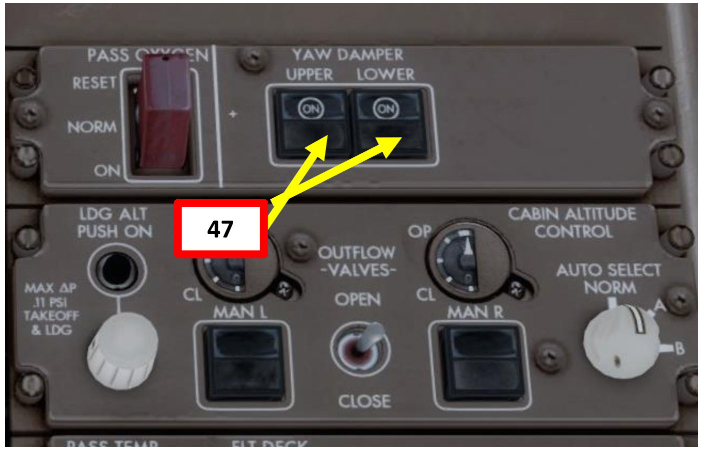
26. Verify that ENGINE BLEED 1, 2, 3 & 4 switches are ON
27. Set APU BLEED switch – OFF
28. Set PACK (Pneumatic Air Conditioning Kit) 1, 2 & 3 switches – NORM
29. Verify that UPPER and LOWER RECIRCULATION FAN switches are ON
30. Verify that LEFT & RIGHT ISOLATION VALVE switches are set to ON
31. Verify that TRIM AIR switch is set to AUTO
32. Verify that EQUIPMENT COOLING switch is set to NORM
33. Verify that GASPER FAN switch is ON
34. Set Engine Anti-Ice / Wing Anti-Ice / Window Heat switches – As Required

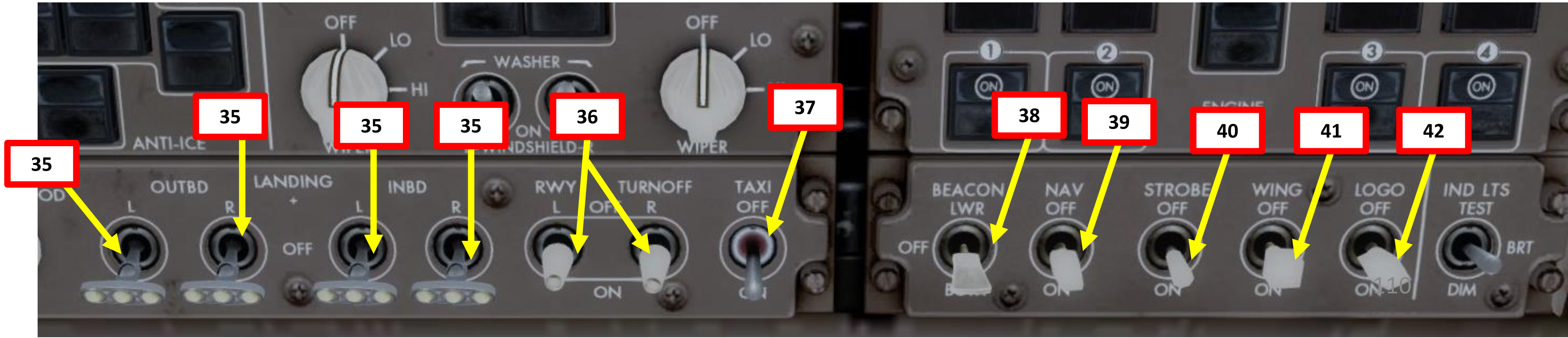


COMPLETE PRE-FLIGHT

35. Landing Lights switch – ON
36. Runway Turnoff Lights switches – ON
37. Taxi Light switch – ON
38. Beacon Light switch – BOTH
39. Navigation Position Lights switch – ON
40. Strobe Light switch – ON
41. Wing Lights switch – ON
42. Logo Light switch – ON
43. Set No Smoking Switch – AUTO
44. Set Seat Belts switch – AUTO
45. Emergency Lights – set switch to ARMED and close cover
46. Set Service Interphone Switch – ON
47. Set Upper & Lower Yaw Damper switches – ON

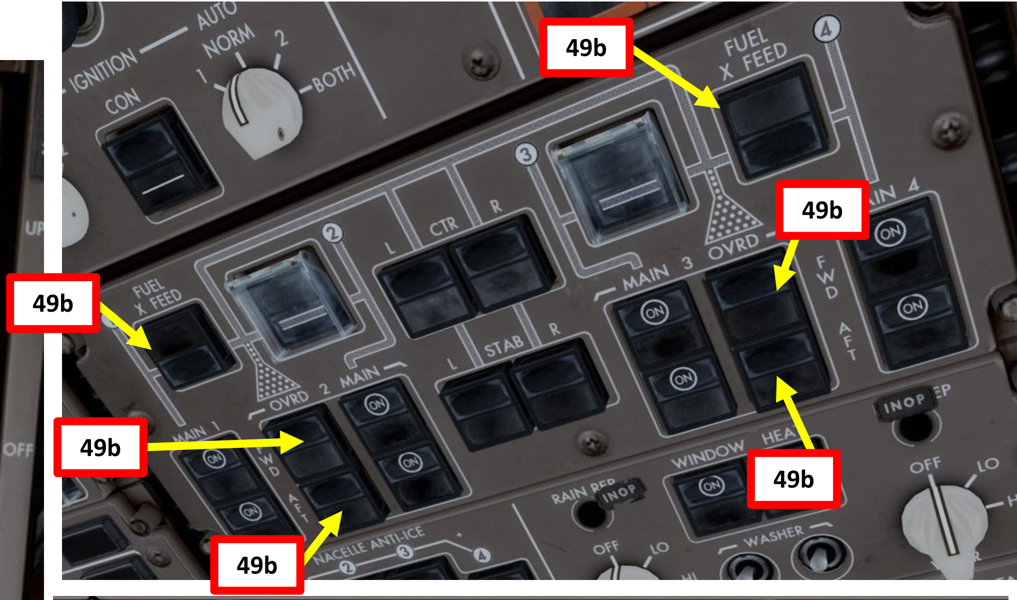


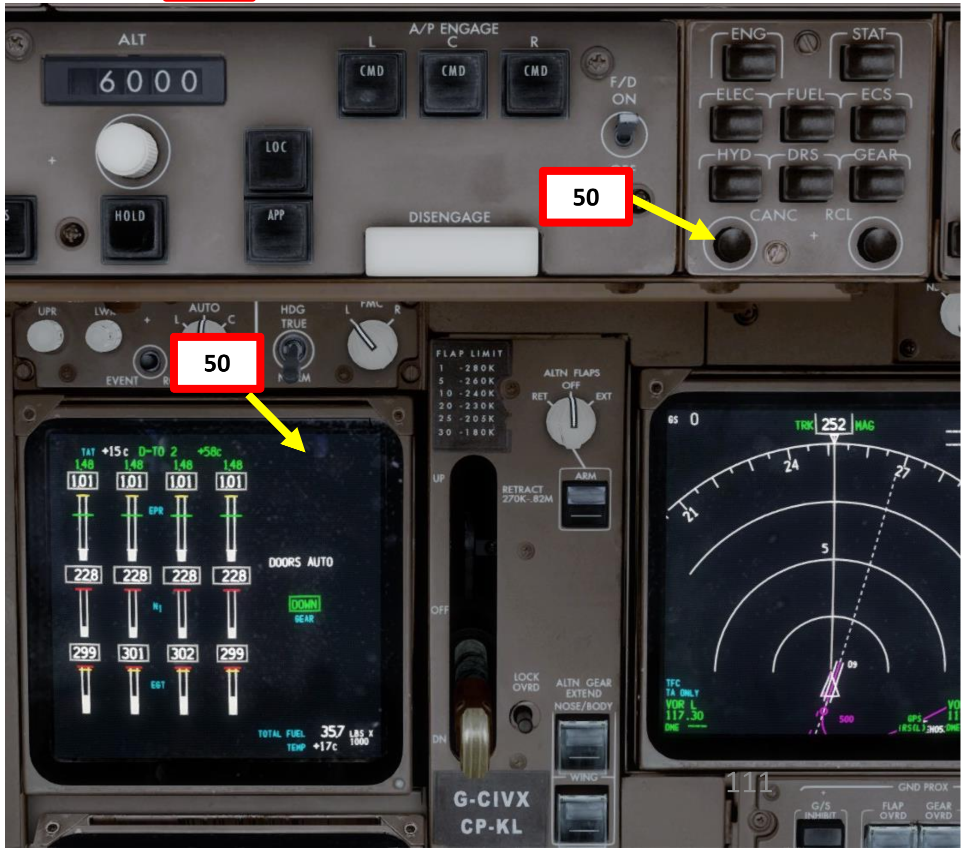




COMPLETE PRE-FLIGHT

48. If the >FUEL TANK/ENG message pops up, it is to notify you that you need to configure the tanks such that each TANK is fueling an ENGine (TANK per ENG, or TANK/ENG). If you look at the FUEL page, you will see that the only pumps running all four engines up to this point are the OVRD pumps in MAIN 2 and MAIN 3. These pumps are heaving fuel out of these tanks to keep all four engines running, and the reason you're running all of the engines off of these tanks is that they can hold a lot more fuel than the outboards (think of the profile of the wing here). Once the inboard and outboard tanks are all at the same level, though, there's no longer a reason to be heaving fuel out of the tanks, so you turn the OVRD pumps off, and then set the engines up in a way that they all draw from their own tank (this also ensures that if there's a leak in a line between one of the tanks and an engine, you're not going to affect more than one engine
49. In this tutorial, FUEL TANK/ENG should happen when all tanks get down to being even, below 30.0. Since the FUEL TANK/ENG message has popped up, we will close the FUEL CROSSFEED VALVE switches and all OVERRIDE FUEL PUMP switches to remove this caution.
50. To remove the remaining FMC MESSAGE caution, press the CANC button.



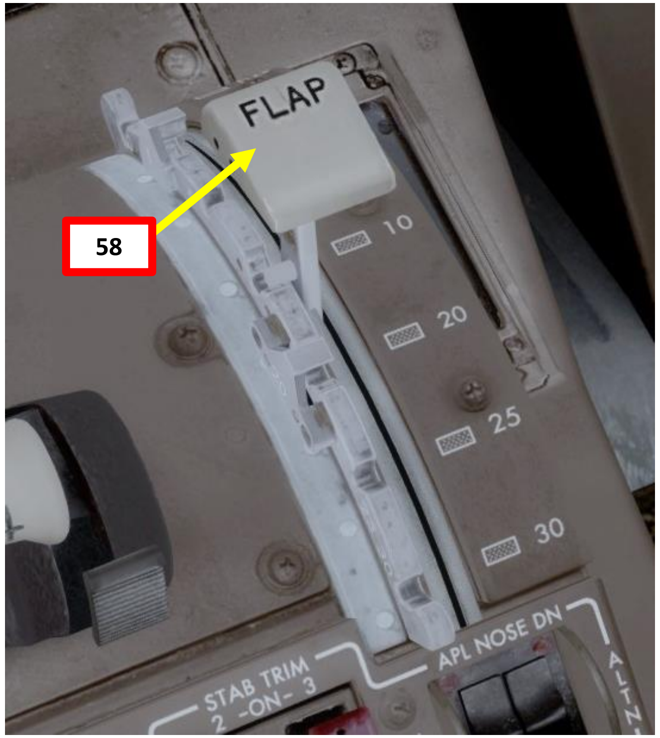


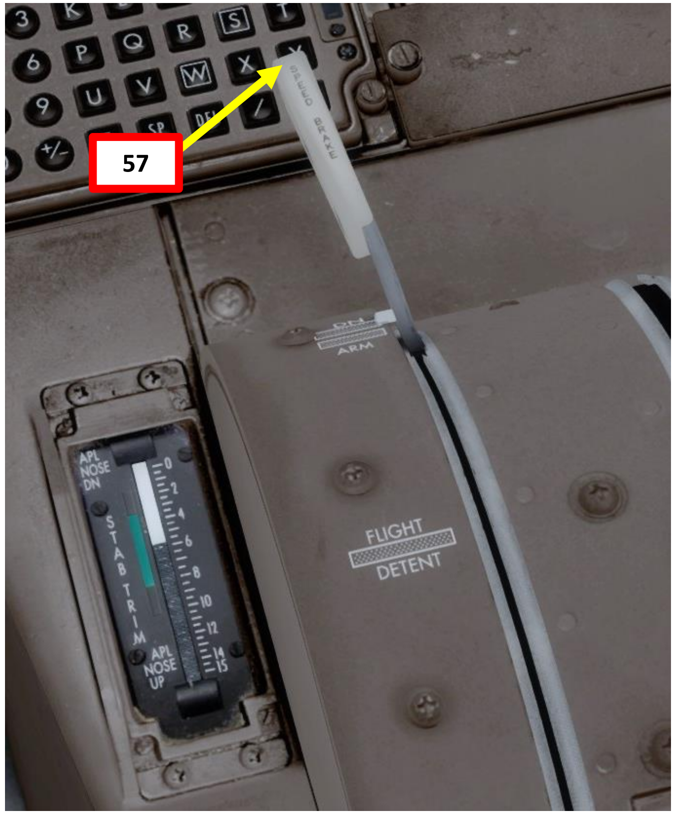
COMPLETE PRE-FLIGHT

51. Set Transponder frequency to 2200 (IFR standard squawk code). 7000 is used for VFR in most of European airspace and 1200 for VFR in North America.
52. Set TCAS (Traffic Collision and Avoidance System) selector to TA/RA (Traffic Advisory/Resolution Advisory)
53. Push TCAS switch to initiate TCAS test by left-clicking and holding (pushing) the selector switch.
54. Confirm that TCAS test is performed correctly (aural warning « TCAS TEST PASSED » and caution on Navigation Display page)

COMPLETE PRE-FLIGHT

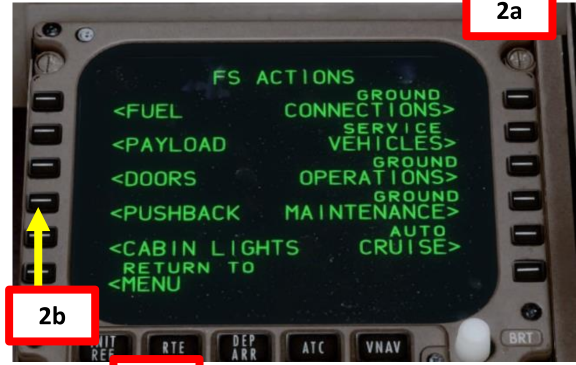
55. In real life, you would set PACK 1 and PACK 2 switches to OFF to ensure maximal engine performance during takeoff and prolong engine life, but we don't need to in this tutorial.
56. Set Autobrake selector to RTO (Rejected Takeoff)
57. Make sure Speed Brake is OFF (NOT ARMED)
58. Set Flaps lever to 10 as specified in the FMC
59. Set Weather Radar to AUTO and press the WXR button if you want to display the weather radar on the Navigation Display.

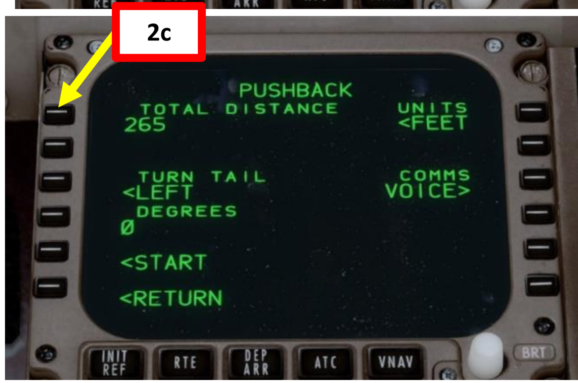




PUSHBACK

1. Release parking brake
2. Begin Pushback via the CDU
    - FS ACTIONS -> PUSHBACK
    - Set STRAIGHT LENGTH to 375 ft by typing 375 on the keypad and clicking on the LSK next to STRAIGHT LENGTH
    - Set TURN NOSE to RIGHT (does not matter in our case since we will pushback in a straight line at 0 degree)
    - Set DEGREES to 0 degrees
    - Click on START
3. Alternatively, you can simply use "LSHIFT+P" to start and stop pushback procedure since we are in a very tight spot.





PUSHBACK

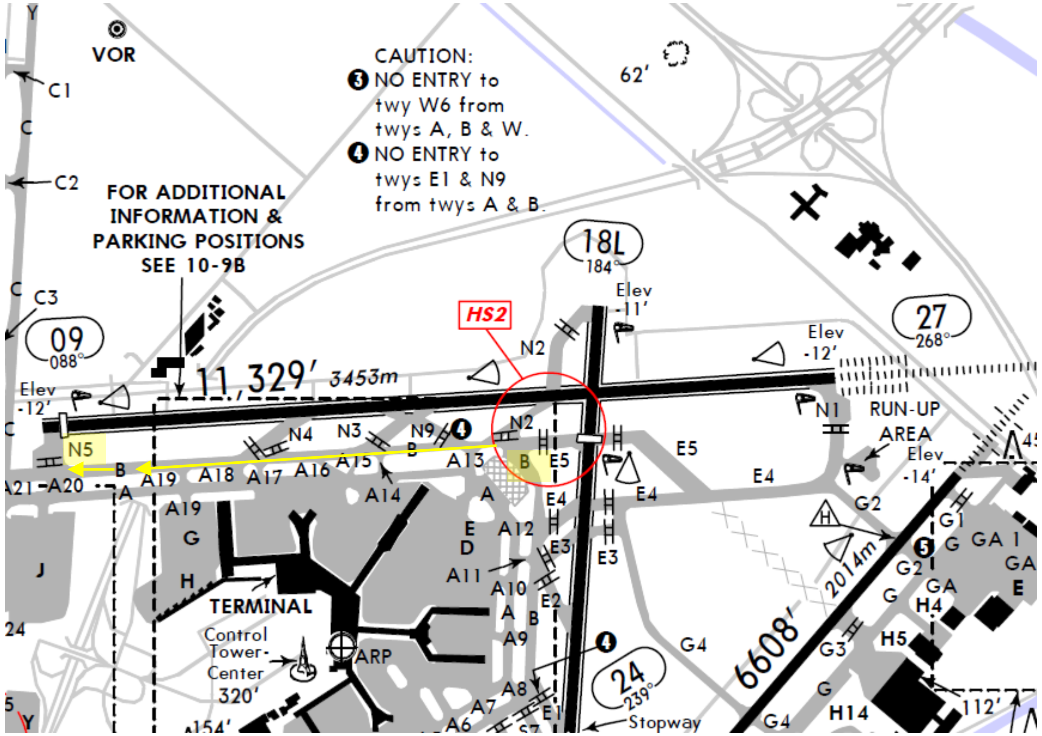
TAXI

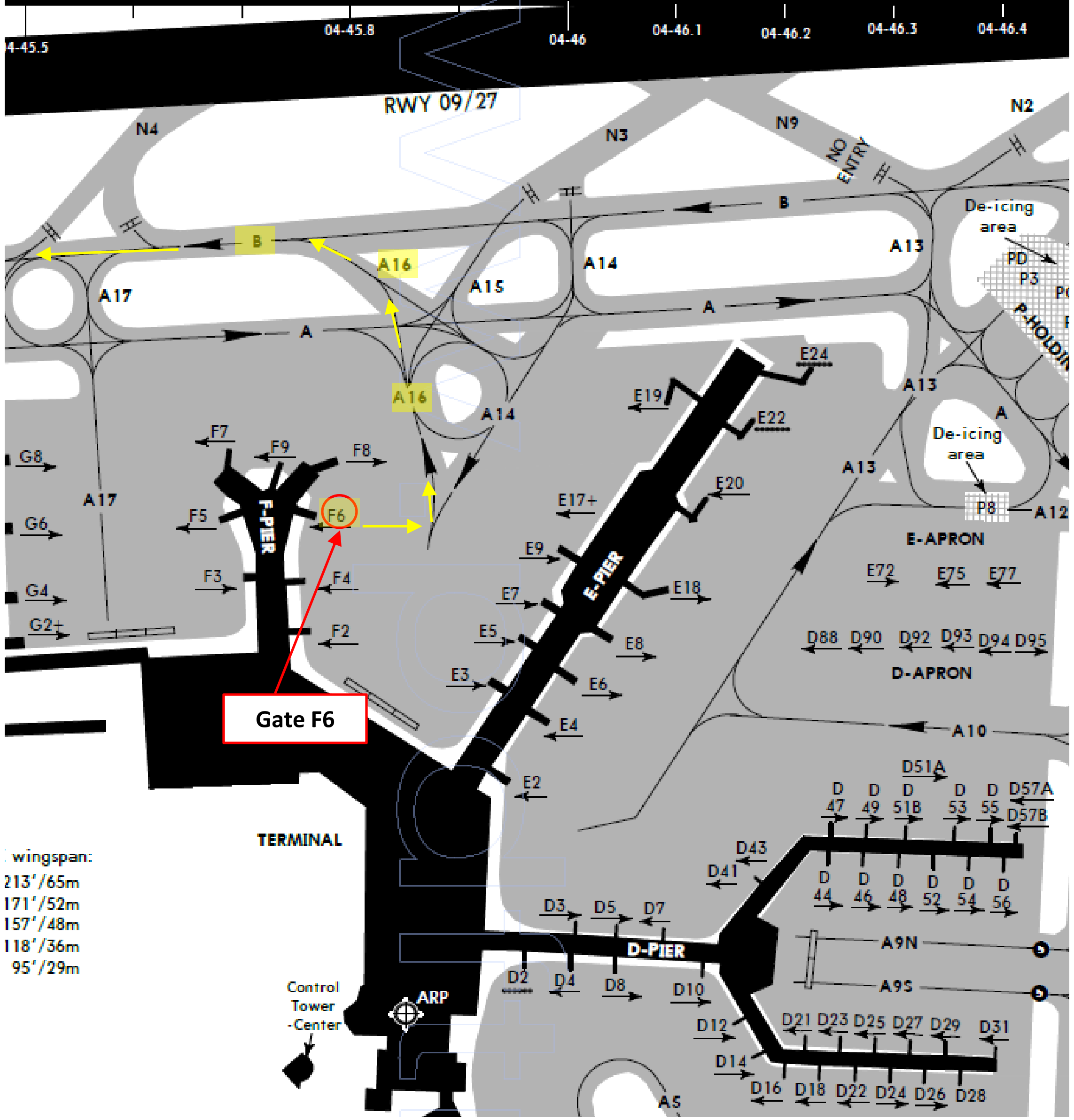
The 747 is steered on the ground by using a Nose Gear Steering Tiller.

However, in FSX or Prepar3d you cannot map a joystick axis to your tiller: it's a limitation of the sim itself. In order to steer the aircraft, PMDG mapped the tiller axis directly on the rudder axis. If you move your rudder pedals while on the ground, the aircraft will have its full steering range as if you were using the tiller.

TAXI

- Our Flight Number is BAW106 and we spawned at gate F6.
- After we performed pushback from Gate F6, we would typically contact the tower for guidance by saying “BAW106, requesting taxi.”
- The tower would then grant you taxi clearance by saying “BAW106, taxi to holding position N5 Runway 09 via taxiways Alpha 16 (A16), Bravo (B).
- This means that we will follow the A16 line, then go to B, then turn right to N5 and hold there until we get our clearance for takeoff.
- Throttle up to maintain a taxi speed of 15 kts maximum. Slow down to a maximum of 10 kts before making a 90 deg turn.






Check signs to follow the taxi route towards the holding point (N5)
←A20 N5 →
Academic License


N509
36C
36C
09 N5
G-CIVX
CP-KL

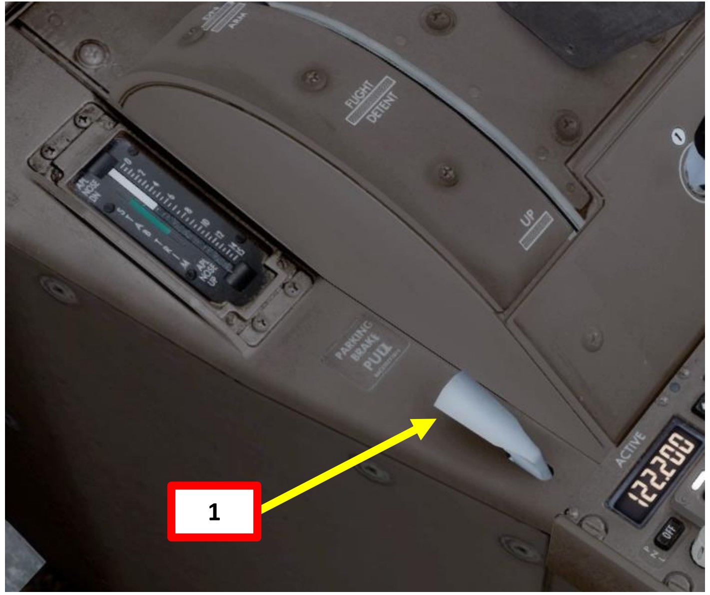
TAKEOFF

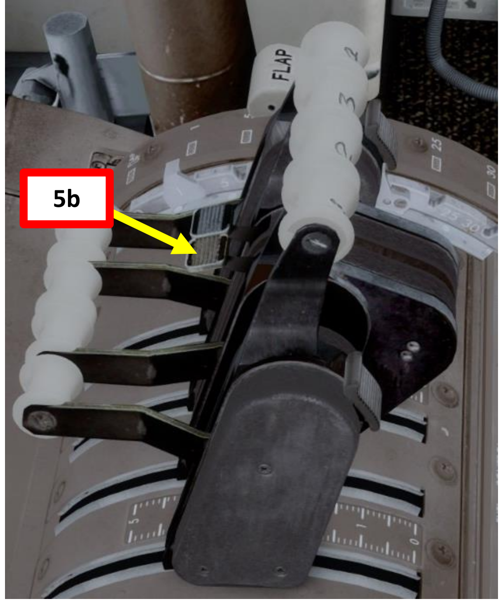
TAKEOFF

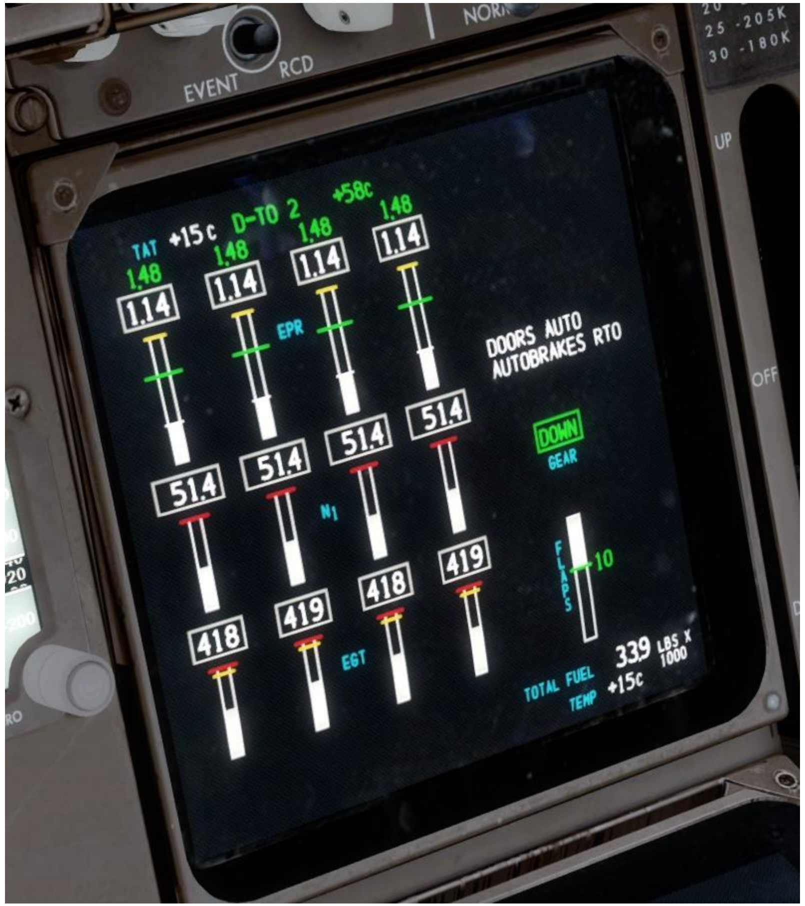
1. Arm the LNAV (Lateral Navigation) and VNAV (Vertical Navigation) autopilot modes

TAKEOFF

2. Line up on the runway and make sure parking brake is disengaged
3. Press and hold pedal brakes
4. Throttle up until engines reach 50 % N1 (or 1.10 EPR) and stabilize
5. Press the TO/GA (Takeoff/Go Around) paddles on the throttle to engage autothrottle and release brakes (alternatively, you can just throttle to max power)

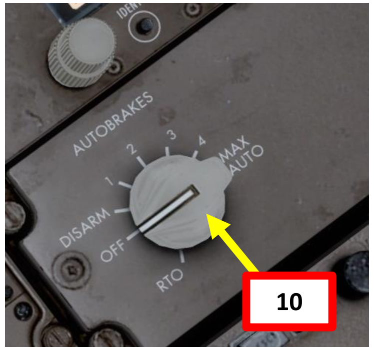






TAKEOFF

6. Rotate smoothly and continuously when reaching VR (136 kts) until reaching 15 degrees of pitch angle
7. Follow the Flight Director (15 deg pitch)
8. Raise landing gear (right click) by setting landing gear lever to UP (up position)
9. Once landing gear has been fully retracted, set landing gear lever to OFF (middle position) by left-clicking
10. Autobrake switch – OFF



TAKEOFF

CLIMB

1. When reaching an altitude of 400 ft, engage autopilot by pressing either the CMD LEFT, CMD CENTER or CMD RIGHT button on the MCP. Your aircraft will now follow the “magenta line” on your navigation display automatically since we already armed the VNAV and LNAV modes.
2. Make sure the VNAV (Vertical Navigation) and LNAV (Lateral Navigation) autopilot mode buttons on the MCP (Mode Control Panel) are engaged
3. Always synchronize your heading using the HEADING knob on the MCP. This will not steer the aircraft, but it is good practice in case you need to engage other autopilot modes quickly.

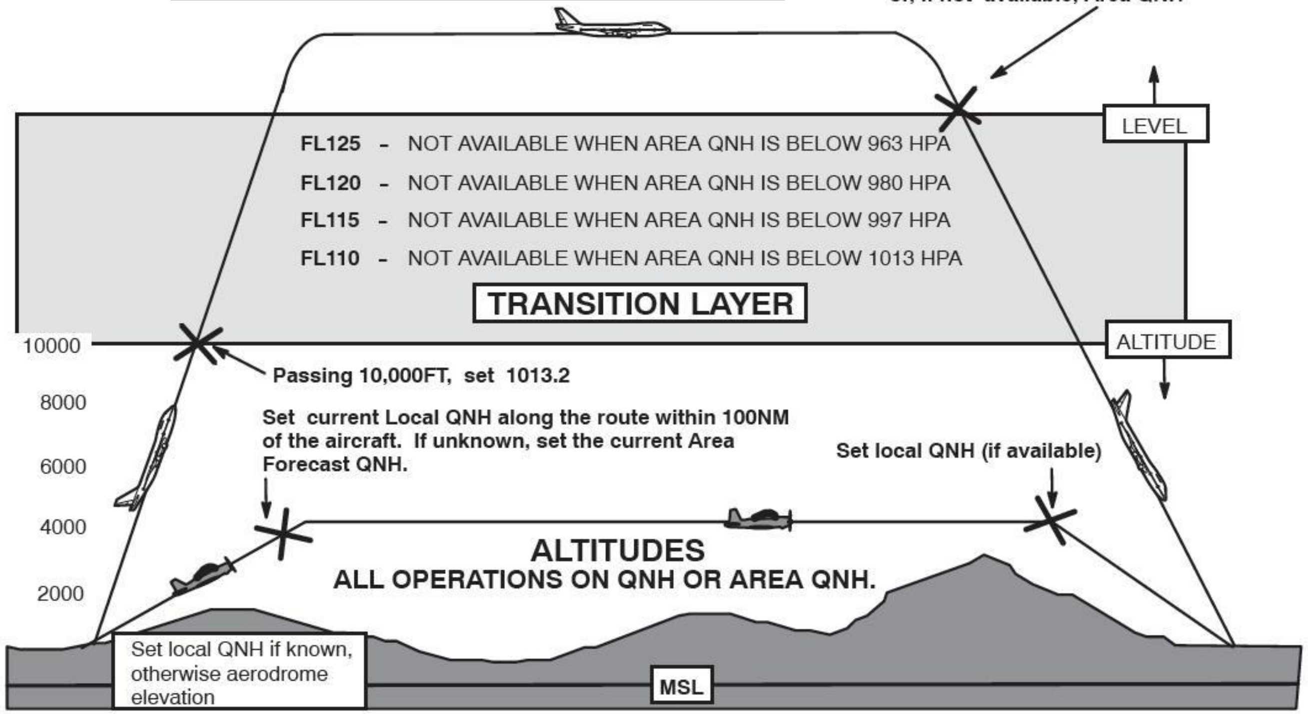
Autopilot HEADING not aligned with actual flight path

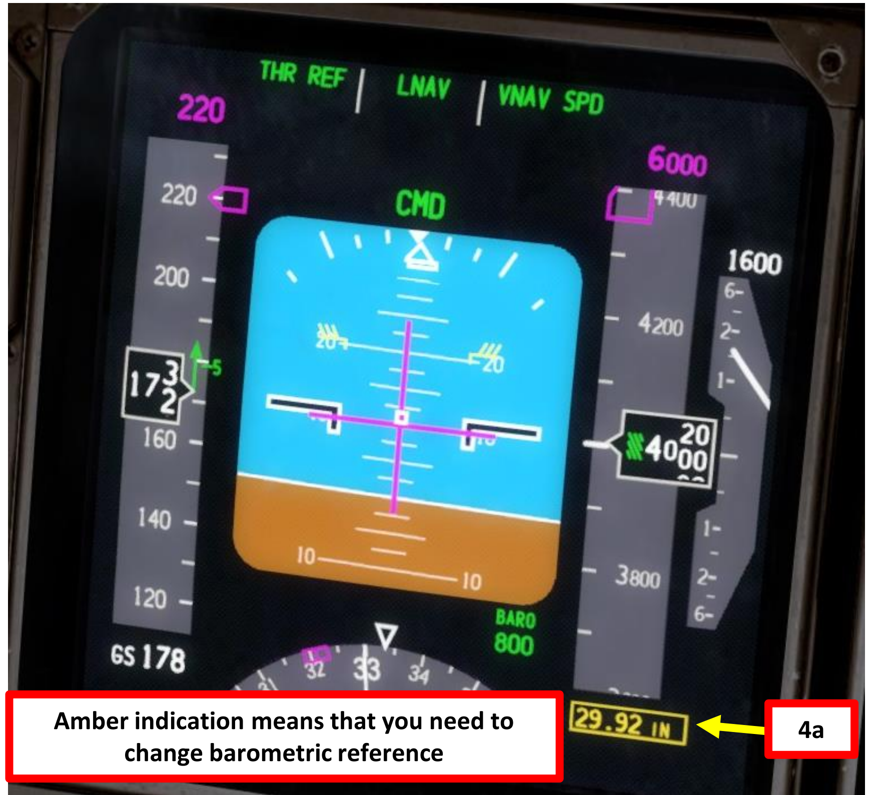
Autopilot HEADING aligned with actual flight path

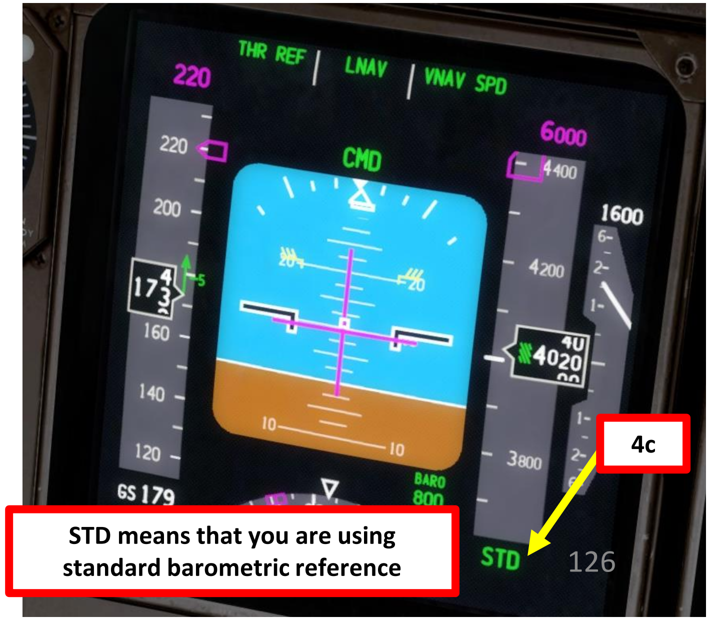
CLIMB

4. Once you pass transition altitude (3000 ft in Europe, 18000 ft in the US), click on the SET SPD knob to switch barometric pressure to STANDARD pressure in order to use flight levels as a reference. This means you will be using a standard barometric pressure of 29.92 in Hg, which is also used by other aircraft in the airspace instead of a local one given by an Air Traffic Controller. If pilots don't use a "standard" barometric pressure, different aircraft may collide in flight since they don't use the same pressure to define their current altitude. This is why higher altitudes are defined as "flight levels" (i.e. FL250 would be 25000 ft).

Transition Altitude (U.S. system)

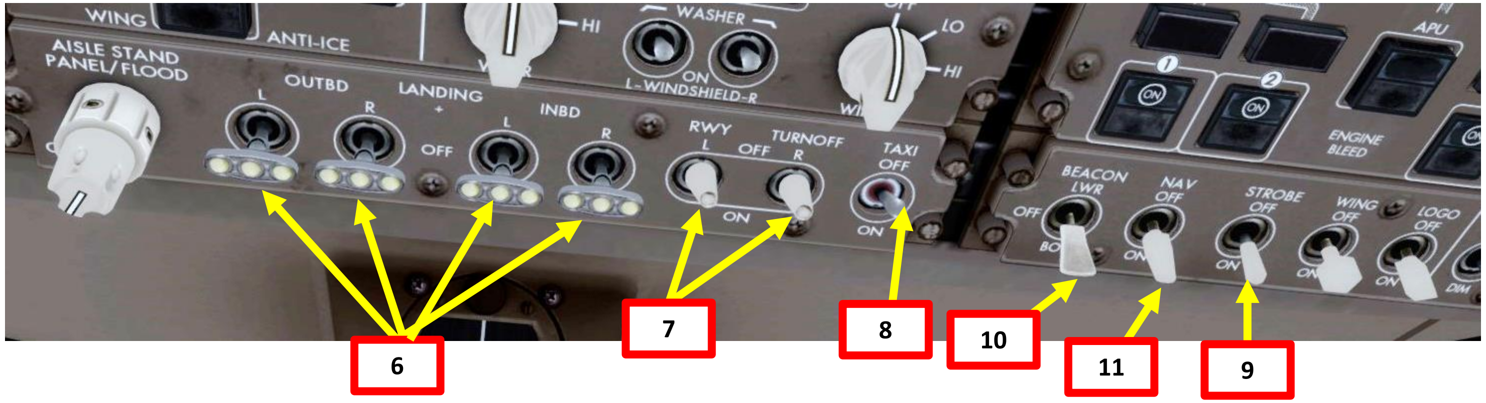


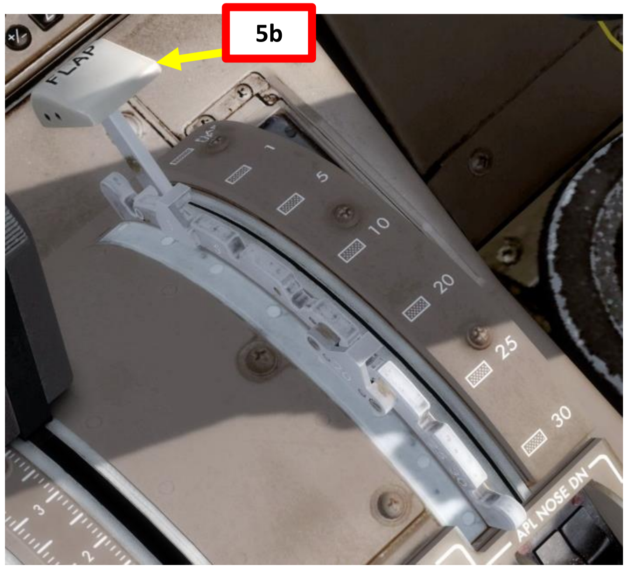




CLIMB

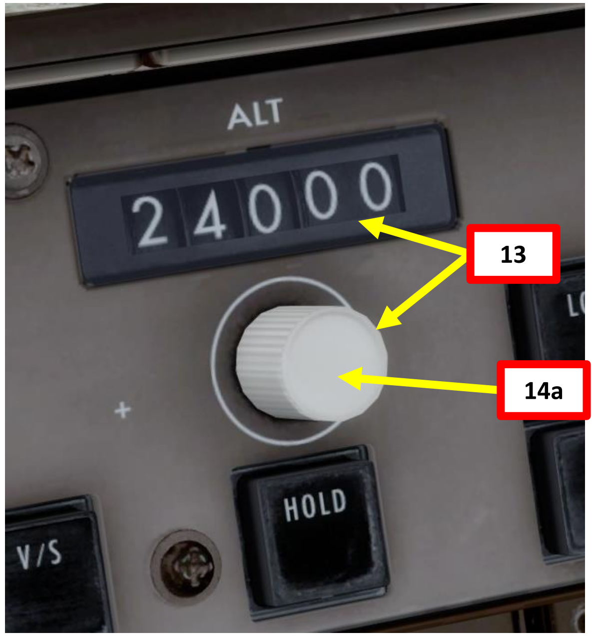
5. Once you have sufficient airspeed, set flaps to UP (right click)
6. Landing Lights switches – OFF
7. Runway Turnoff Lights switches – OFF
8. Taxi Light switch – OFF
9. Strobe Light switch – ON
10. Beacon Light switch – BOTH
11. Navigation (Position) Lights switch – ON





CLIMB

12. Once we have reached our first SID target altitude of 6000 ft, vertical autopilot mode will maintain 6000 ft (VNAV ALT mode) unless we set our cruising altitude and engage the VNAV SPD mode.
13. We will now begin our climb to our cruising altitude of 24000 ft. Set the ALTITUDE knob on the MCP (Mode Control Panel) to 24000.
14. Push (left click) the inner ALTITUDE button on the MCP to set new altitude target to the autopilot. Autopilot will now climb to selected altitude using the VNAV SPD mode.



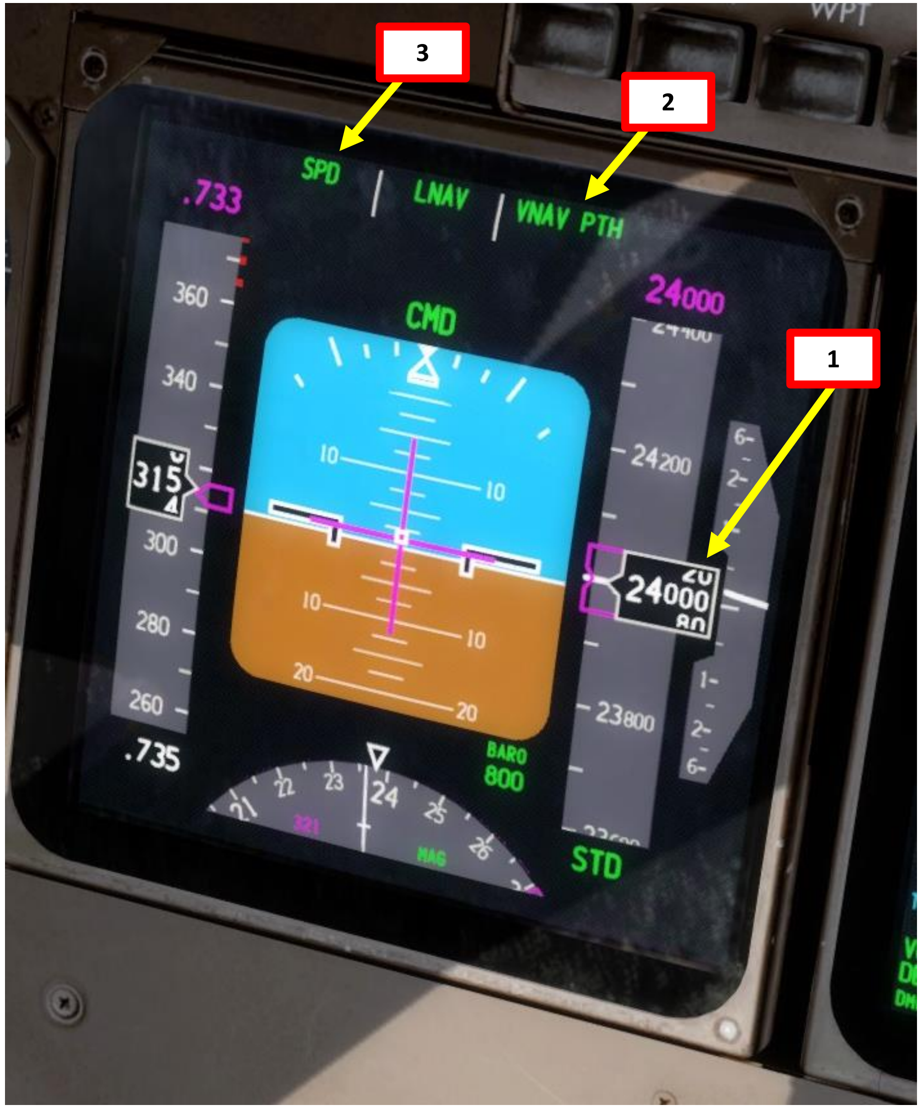
CLIMB

15. You will reach your “TOP OF CLIMB” point at “T/C” on your navigation display for your cruising altitude (24000 ft)

CLIMB

CRUISE

1. When reaching the top of climb, the autopilot will start levelling off.
2. Once levelled off to 24000 ft, the vertical autopilot mode will switch to VNAV PTH (Vertical Navigation Path).
3. The autothrottle system will automatically set the most efficient throttle setting during cruise.
4. You can monitor your progress on the FMC « PROG » (PROGRESS) page and on the « LEGS » page.



CRUISE

Introduction to Autopilot

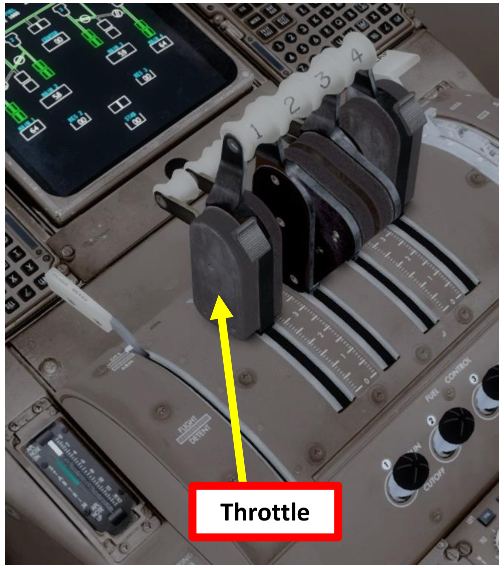
Many newcomers in the flight simulation world have this idea that the autopilot is the answer to EVERYTHING. And I mean: e-v-e-r-y-t-h-i-n-g. Spoiler alert: it's not. The autopilot is a tool to help you fly to reduce your workload, not a tool to replace the pilot. The autopilot should be seen as a system that can make your life easier.

Now, why am I saying this? Because *some* people's knowledge of the autopilot system is summed up in "hit LNAV and VNAV, then go watch an episode of Mayday while the aircraft does all the work". However, there are times where the autopilot can disconnect by itself (i.e. during major turbulence, or when the autopilot is trying to follow a flight profile (SID or STAR) that exceeds safety limitations like bank or pitch angles). The autopilot isn't smart: it will put you in dangerous situations if you ask him to. It will "blindly" follow whatever is set in the FMC. If there are conflicts or errors in the FMC's flight plan, the AP will gladly follow them even if they don't make sense. This is why you need to constantly be able to fly the aircraft manually if need be. The autopilot should be seen as a system that can make your life easier. This is why you need to be familiar with the capabilities of the AFDS (Autopilot Flight Director System) and be able to read what the FMA (flight mode annunciator) is telling you.

Autopilot and Auto-Throttle

The autopilot (AP) is separated in three main components: the flight director, the autopilot itself and the auto-thrust system. Aircraft pitch and attitude will help maintain the aircraft on a certain flight path. The throttle will help maintain the aircraft on a certain speed. Depending on the phase of flight (takeoff, climb, cruise, descent, final approach, etc.), the autopilot will react differently. During a climb, the AP will want to maintain the best, most fuel-efficient climb to save fuel. During a descent, the AP will want to slow down in order to approach the runway in a low-speed high-lift configuration. The Auto-Thrust system will take control over the engines throttles for you: when AT is engaged, you will see the throttle physically move by itself.

The AP has three channels: Left, Center and Right. The only time three autopilot channels will engage simultaneously is during automatic landing (AUTOLAND).



Autopilot Parameter Selectors

- IAS MACH Selector: Sets speed input to aircraft autopilot.
- SEL: Selects/toggles airspeed unit (IAS (indicated airspeed) vs Mach), usually used above FL260, or 26000 ft
- Heading Selector: Sets heading input to aircraft autopilot.
- Bank Angle Limit Selector: Sets autopilot bank angle limit
- Altitude Selector: Sets altitude input to aircraft autopilot.
- Vertical Speed (V/S) Selector: Sets vertical speed input to aircraft autopilot.

Autopilot, Flight Director & Autothrottle Selectors

- Auto-throttle (A/T) ARM Switch : Arms A/T for engagement. Auto-throttle engages automatically when FL CH, V/S, VNAV, ALT HOLD modes are used.
- Flight Director (F/D) Switch: Arms flight director
- CMD L/C/R: Engages selected autopilot channel in selected mode.
- DISENGAGE Bar: Disengages autopilot.

Autoflight – Thrust/Speed Modes

- THR: Engages auto-throttle in Thrust (THR) mode (selects climb thrust after takeoff or go-around). Mode inhibited under 400 ft altitude.
- SPD: Engages auto-throttle in SPEED mode (maintains IAS/MACH value in display). Speed Selector knob must be pushed to override the speed target of the FMC.

Autoflight – Vertical Modes

- VNAV: Vertical Navigation mode will follow the vertical components and restrictions of the flight plan entered in the FMC.
- FL CH (Flight Level Change): Aircraft climbs or descends to selected ALTITUDE at selected IAS/MACH
- V/S: Sets Vertical Speed to selected VERT SPEED.
- ALT: Aircraft climbs or descends to target altitude. Altitude Selector knob must be pushed to override the altitude target of the FMC.
- ALT HOLD: Aircraft levels off and holds its current altitude.

Autoflight – Lateral Modes

- LNAV: Lateral Navigation mode will follow the lateral components and restrictions of the flight plan entered in the FMC.
- HDG SEL: Heading and Bank Angle selector. Aircraft will roll towards the selected HEADING.
- HDG HOLD: Holds the current aircraft heading.
- LOC: Tracks VHF Ominidirectional Range (VOR) localizer. Aircraft will only be controlled laterally.

Autoflight – Vertical + Lateral Mode

- APP: Tracks localizer and glideslope during approach. Aircraft will be controlled laterally and vertically.

Autopilot Modes

Button	Description
VNAV	Vertical autopilot changes aircraft attitude to follow vertical navigation path determined by the FMS
FL CH	Vertical autopilot changes aircraft attitude to climb or descend to selected ALTITUDE at selected IAS/MACH
V/S	Vertical autopilot changes aircraft attitude to hold vertical speed
ALT HOLD	Vertical autopilot changes aircraft attitude to fly to target altitude
ALT	Vertical autopilot changes aircraft attitude to climb or descend to selected target ALTITUDE
LNAV	Lateral autopilot tracks navigation flight plan determined by the FMS
HDG SEL	Lateral autopilot tracks selected heading
HDG HOLD	Lateral autopilot maintains current heading
LOC	Lateral autopilot arms DFGS to capture and track a selected VOR or LOC course.
APP	Lateral and vertical autopilots track localizer and glide slope targets for approach
CMD (AP)	Engages Autopilot
DISENGAGE BAR	Disengages Autopilot
AUTOTHROTTLE (A/T ARM)	Engages/Disengages Autothrottle

Button	Description
SPD	Autothrottle system will adjust thrust to maintain desired indicated airspeed (kts).
THR	Autothrottle system will adjust thrust to select climb thrust after takeoff or go-around

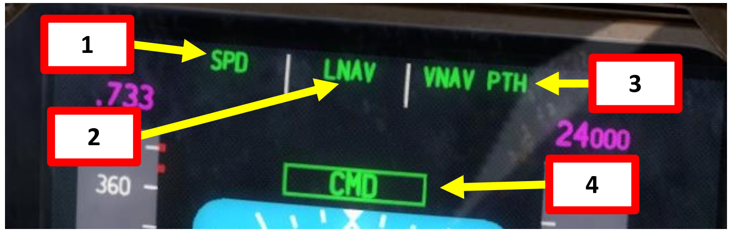
VERTICAL MODE
LATERAL MODE
VERTICAL & LATERAL MODE
AUTO-THROTTLE MODE

FMA (Flight Mode Annunciator)

The FMA displays the status of the auto-throttle, roll, pitch, and autopilot systems.

Green annunciation is when a mode is **ENGAGED**. **White** annunciation is when a mode is **ARMED**.

FMA (Flight Mode Annunciator)



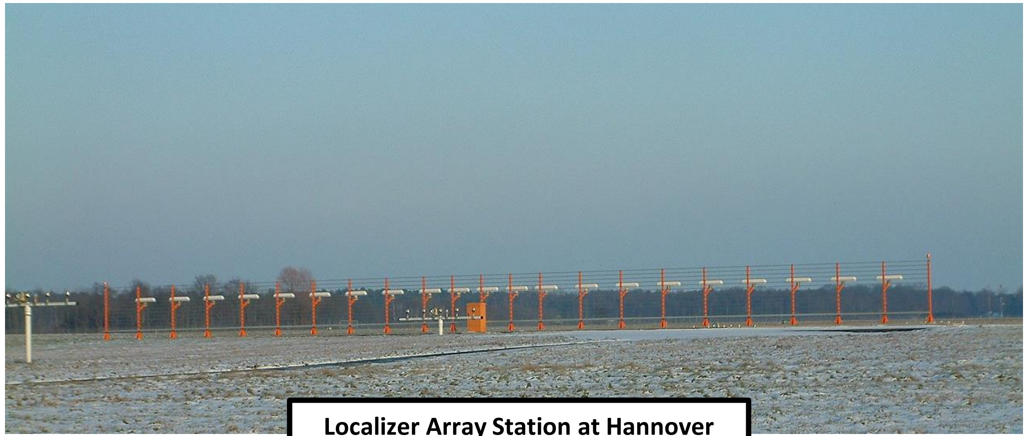
1: Autothrottle Mode	2: Roll Mode	3: Pitch Mode	4: Autopilot
THR: Autothrottle applies thrust to maintain the climb/descent rate required by the pitch mode	**HDG HOLD**: autopilot maintains current heading	**TO/GA**: annunciates by positioning either flight director switch ON when both flight directors are OFF or in flight when flaps are out of up or glideslope is captured.	**FD**: flight directors are ON and autopilots are not engaged
THR REF: thrust set to the reference thrust limit displayed on EICAS	**HDG SEL**: autopilot maintains heading set on the MCP with the HEADING SELECT knob	**ALT**: altitude hold mode activated or target altitude is captured	**CMD**: autopilot command is engaged
HOLD: thrust lever autothrottle servos are inhibited. Pilot can set the thrust levers manually	**LNAV**: activates Lateral Navigation autopilot roll mode, following FMC flight plan	**V/S**: autopilot maintains selected vertical speed	**LAND 3**: three autopilot channels engaged and operating normally for an automatic landing
IDLE: displays while autothrottle moves thrust lever to IDLE. IDLE mode is followed by HOLD mode.	**LOC**: Autopilot captures the localizer course	**VNAV PTH**: Vertical Navigation, AP maintains FMC altitude or descent path with pitch commands	**LAND 2 (Green with white triangles)**: autopilot redundancy reduced, only two autopilots available
SPD: autothrottle maintains commanded speed, which can be set using the IAS/MACH selected or by the FMC flight plan	**ROLLOUT**: After touchdown, AFDS uses rudder and nosewheel steering to steer the airplane on the localizer centerline	**VNAV SPD**: Vertical Navigation, AP maintains FMC speed with pitch commands	**NO AUTOLAND (amber)**: fault occurs after LAND 3 or LAND 2 annunciates, making AFDS unable to make an automatic landing
	TO/GA: annunciates by positioning either flight director switch ON when both flight directors are OFF or in flight when flaps are out of up or glideslope is captured.	**VNAV ALT**: Vertical Navigation, AP maintains MCP (Mode Control Panel) selected altitude in case of a conflict between the VNAV profile and the MCP altitude.	
	ATT: when autopilot is first engaged or the flight director is first turned on in flight, AFDS (Autopilot Flight Director System) holds a bank angle between 5 and 30 deg and will not roll to wings level.	**G/S**: AFDS (Autopilot Flight Director System) follows the ILS (Instrumented Landing System) glideslope.	
		FLARE: during Autoland, aircraft flare activates between 60 and 40 ft RA (radar altimeter)	
		FLCH SPD: Autopilot maintains airspeed by using aircraft pitch input	

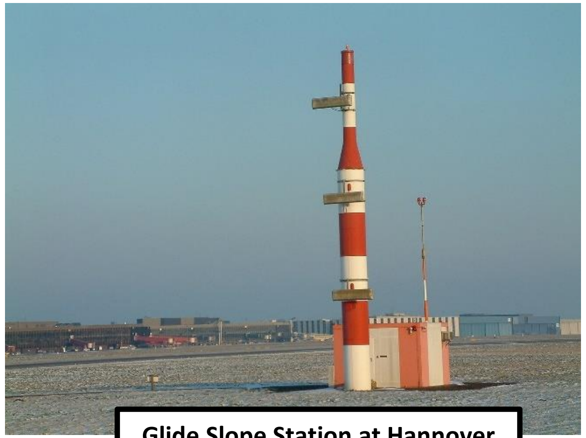
PLANNING DESCENT

So, you've finally made it all the way up to your cruising altitude? Congrats! Now, we have a bit of planning to do.

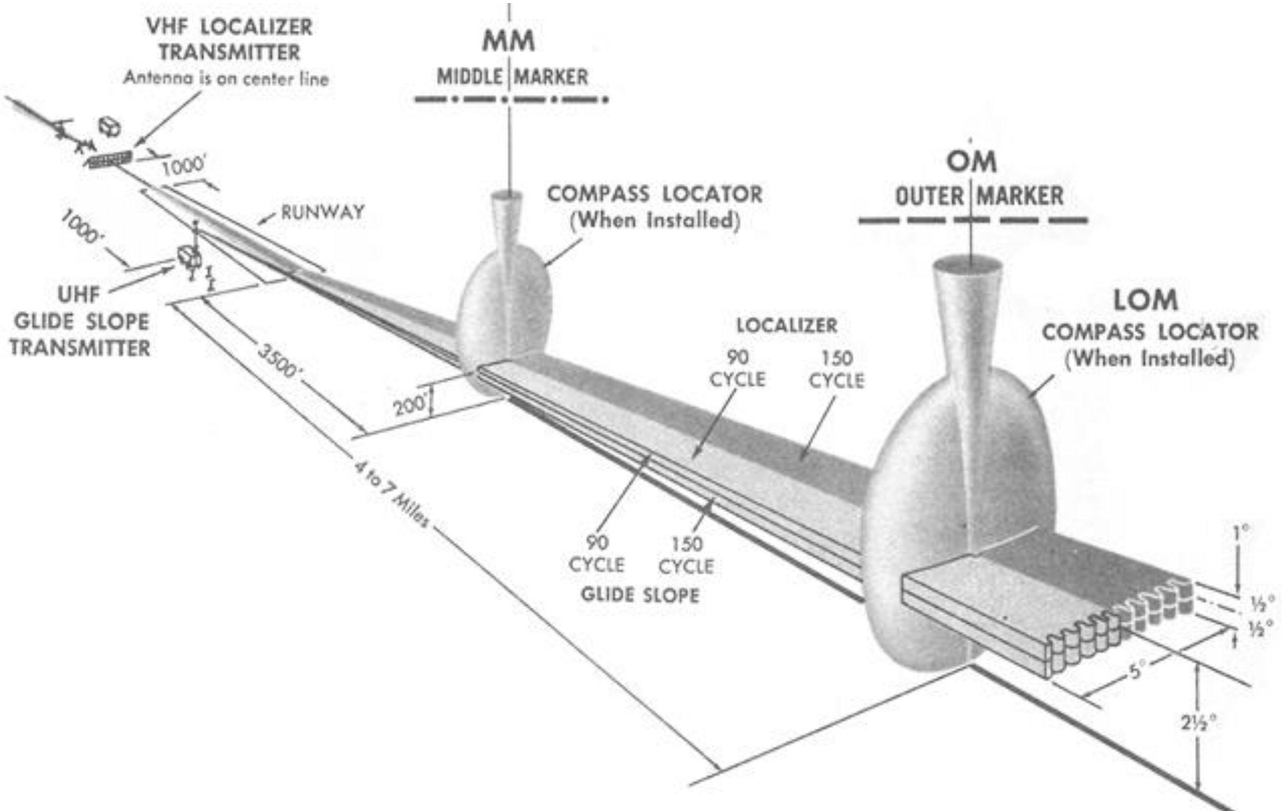
First, let's introduce you to the ILS (Instrument Landing System). This system exists to guide you during your approach.

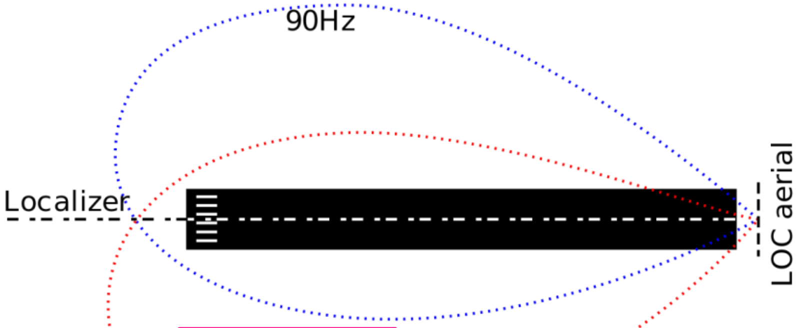
- The Localizer is generally an array of antennas that will give you a lateral reference to the center of the runway.
- The Glide Slope station will help you determine the descent speed you need in order to not smack the runway in a smoldering ball of fire.


Localizer Array Station at Hannover

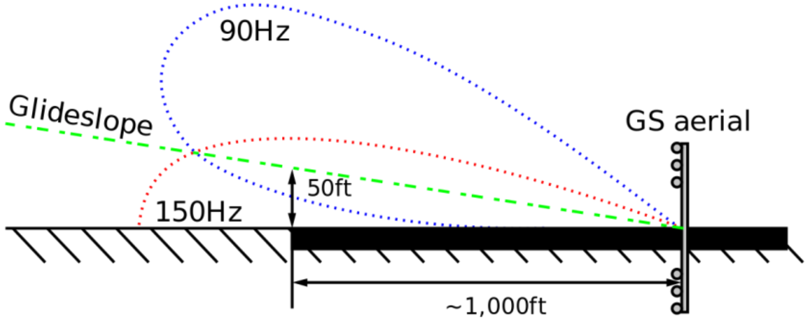

Glide Slope Station at Hannover

Great video explanation of ILS
https://www.youtube.com/watch?v=KVtEfDcNMO8





Lateral Axis

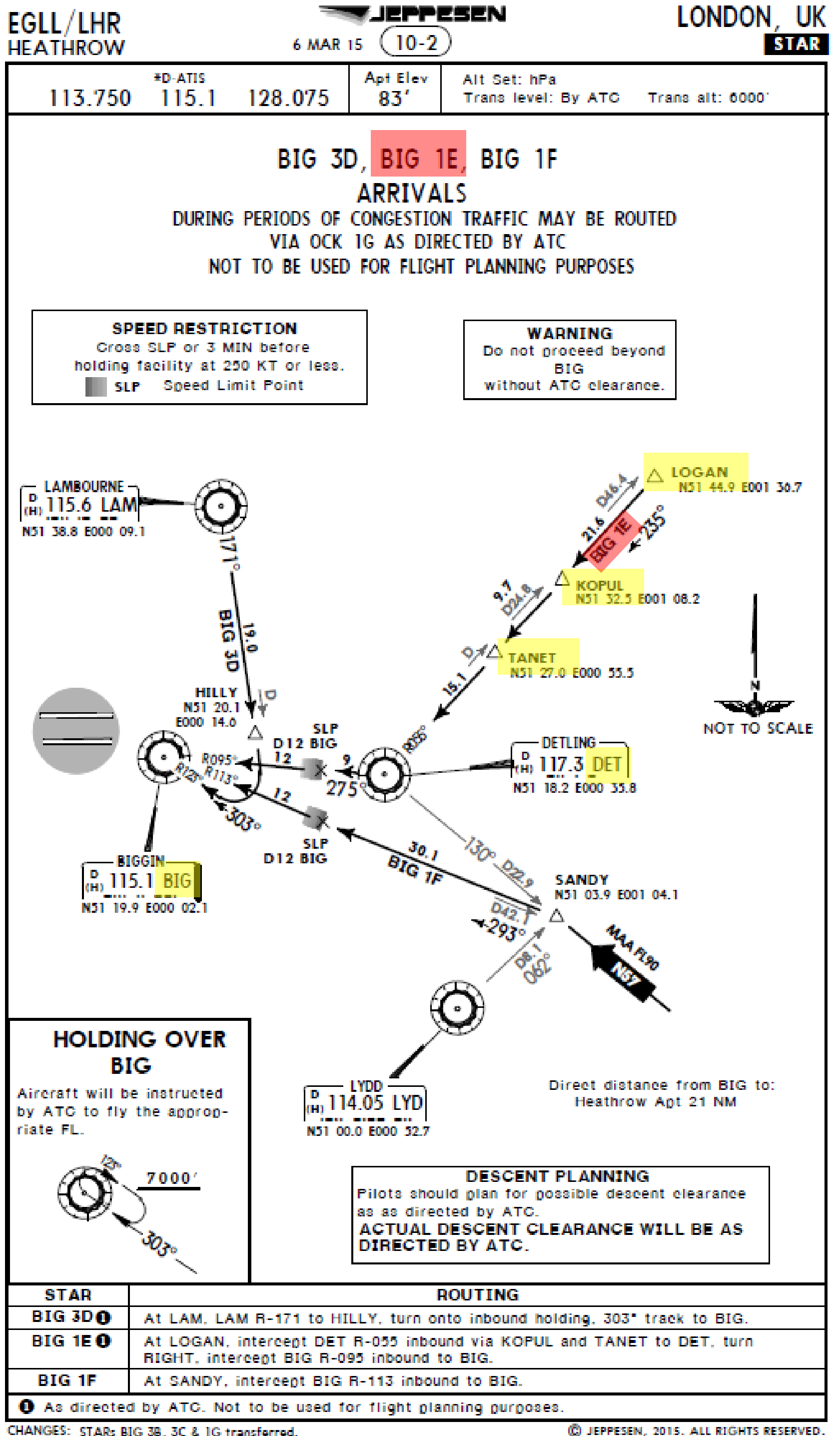


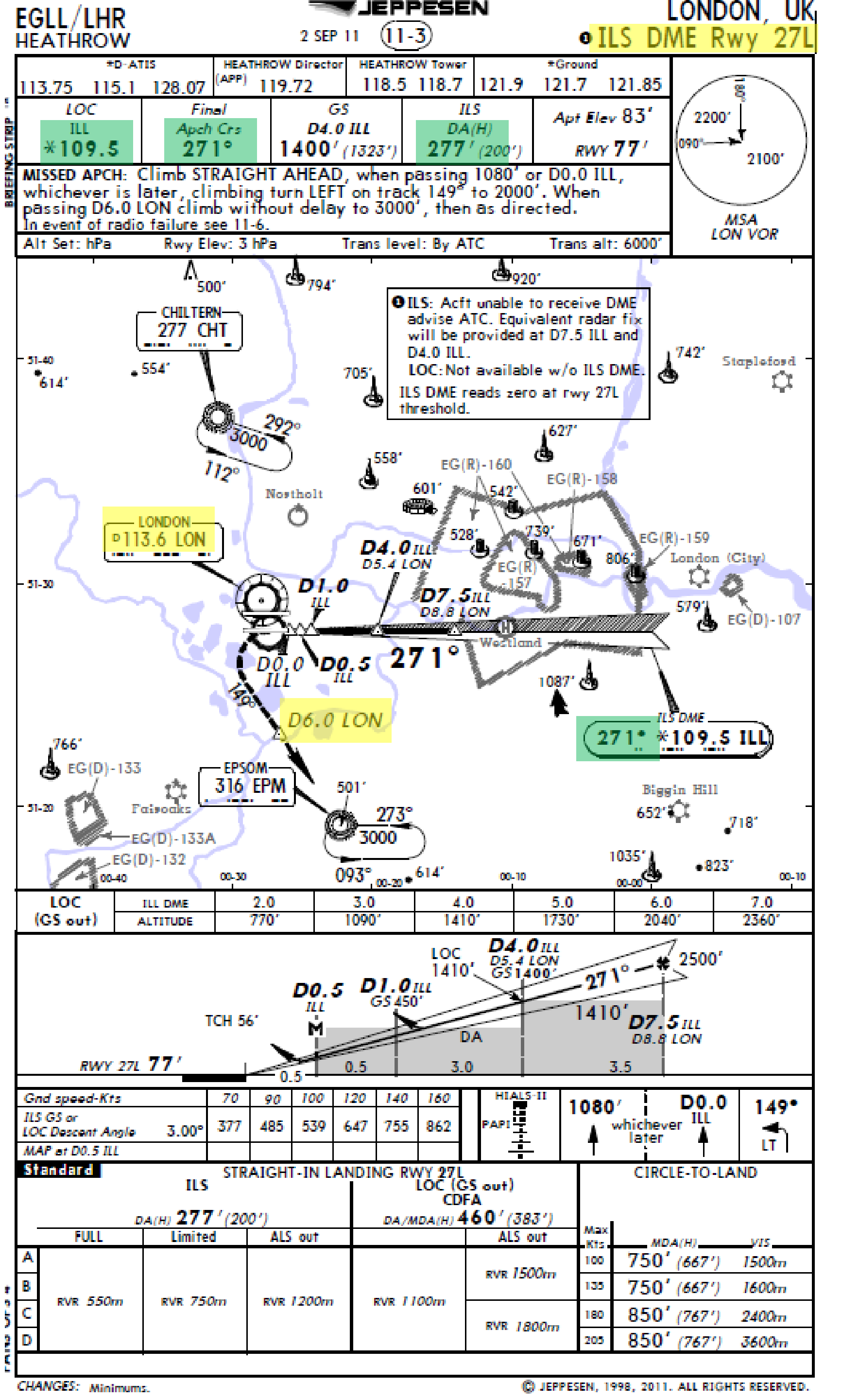
Vertical Axis

PLANNING DESCENT

These charts are for the STAR (Standard Terminal Arrival Route) from LOGAN to EGLL. We intend to:

1. Come from LOGAN waypoint
2. Fly from LOGAN towards the BIG1E arrival route.
3. Follow the STAR (BIG1E -> KOPUL -> TANET -> DET -> BIG)
4. Select an AIF (Approach Initial Fix) from the FMC database (in our case CI27L) and follow the approach towards the runway, guided by the EGLL airport's ILS (Instrument Landing System).
5. Land at Heathrow (EGLL) on **runway 27L** (orientation: 270 Left)





PLANNING DESCENT

Final Approach Course: 271
This is the heading you will take when approaching for final landing.

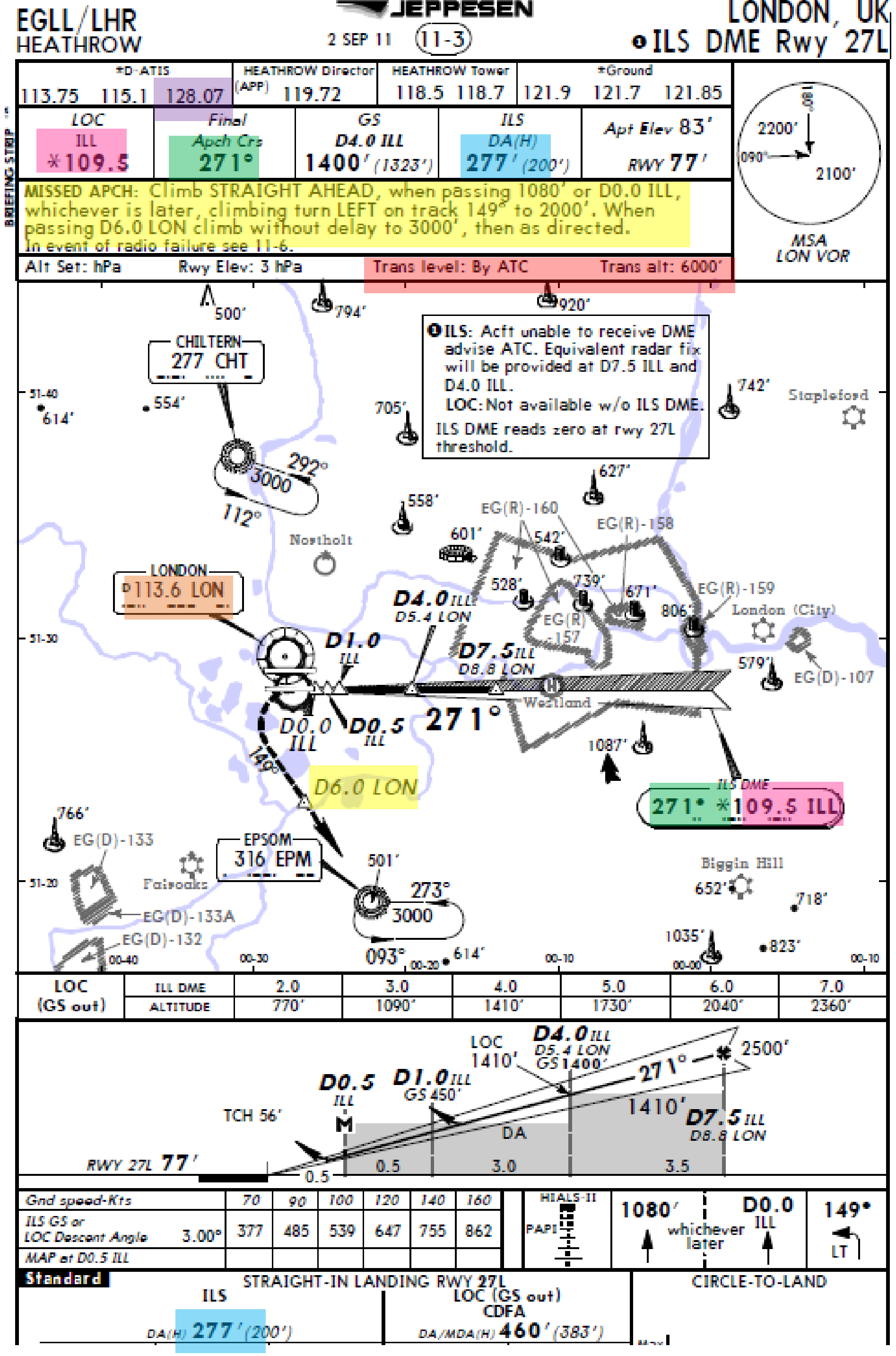
Minimums in BARO: 277
This is the minimum "decision altitude" (DA) during landing. If you go lower than 277 ft, you are committed to land no matter what happens. Above 277 ft, you can still miss your approach and go around.

ILS Frequency: 109.50 MHz
This is the ILS system frequency you will track to guide your aircraft for landing.

Missed Approach Standby Frequency: 113.60 MHz
VOR "LONDON" (LON) will be the beacon we will track in case we miss our approach and have to go around.

Missed Approach Procedure
In case we miss our approach, the procedure is to climb straight ahead. When passing 1080 ft, we climb LEFT on heading 149 to 2000 ft. When passing VOR beacon D6.0 LON, we must climb to 3000 ft and wait for instructions from the tower.

Transition Level & Transition Altitude
The transition altitude is the altitude at or below which the vertical position of an aircraft is controlled by reference to altitudes (6000 ft on chart). The transition level is the lowest flight level available for use above the transition altitude. Our transition level is defined "by ATC" (Air Traffic Controller). In that case, a rule of thumb is to add 1000 ft to the transition altitude which give us FL070, or 7000 ft.



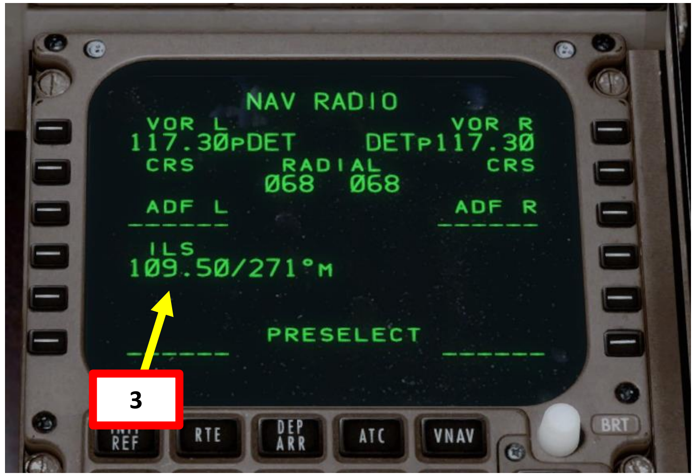
Here is a great link to know how to read these charts properly:

https://community.infinite-flight.com/t/how-to-read-an-approach-chart/8952

ATIS Frequency: 128.075
The ATIS (Automatic Terminal Information Service) will provide you valuable information including wind direction and speed, and the altimeter setting required for landing.

PLANNING DESCENT

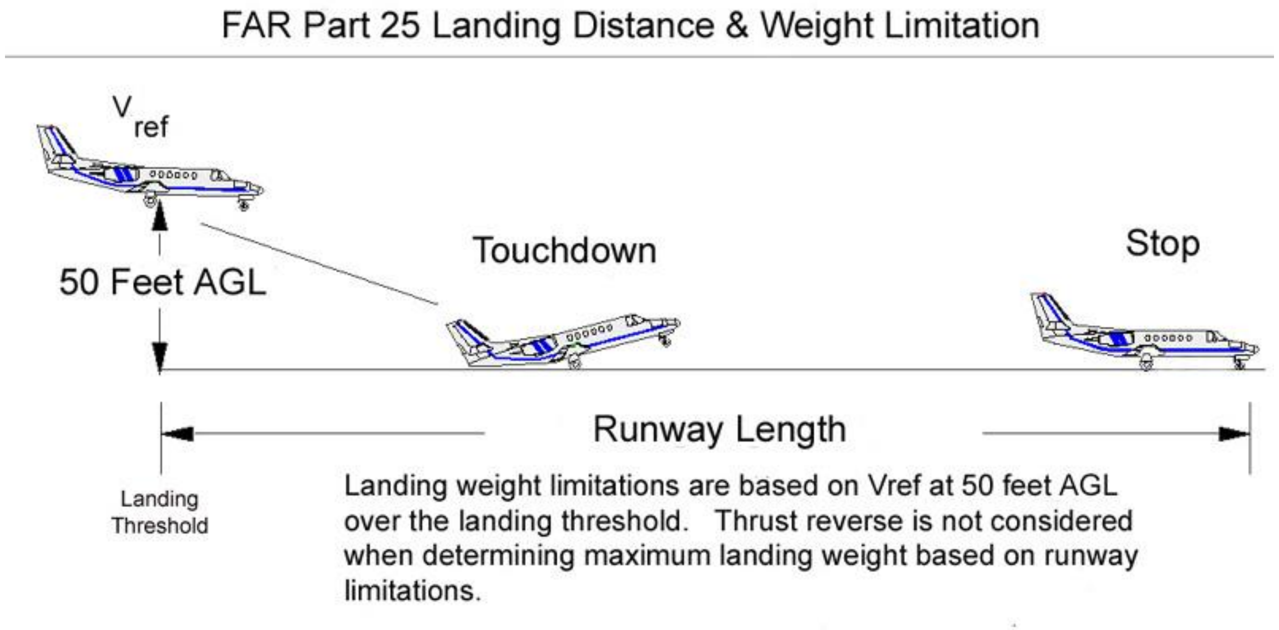
1. We have already selected in our FMC our Arrival runway as ILS27L and our arrival STAR "BIG1E" and our Initial Approach Fix "CI27L" at the beginning. Normally, we do this before we begin our approach. See the "FMC SETUP – WAYPOINTS" section.
2. In the FMC, go in the RAD NAV (Radio Navigation) page. The final approach course for runway 27L (271) will already be automatically displayed since we entered the destination airport. Press on the LSK next to ILS 109.50/271PARK to select this ILS frequency.
3. The ILS field will now display the VOR frequency, followed by the course (109.50/271).
4. Set MINIMUMS on BARO to 277
5. Set AUTOBRAKE to 3
6. Set Standby Attitude Indicator to APP (approach) mode



PLANNING DESCENT

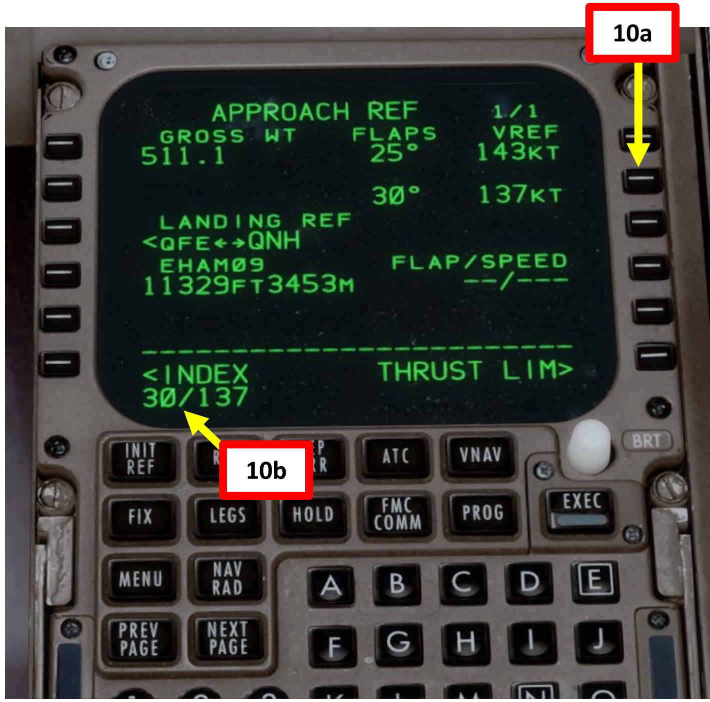
7. We must now define VREF for our desired flap setting (reference landing speed over the runway threshold). Luckily, the FMC (Flight Management Computer) can calculate this speed for us. The only input we need is the aircraft's Gross Weight (Sum of the weights of the aircraft, fuel, crew, passengers, and cargo) when reaching EGLL (Heathrow).
8. We will use the following formula to calculate Gross Weight @ Landing:

GW @ Landing = (Current GW) – (Current Fuel – Arrival Fuel) = <u>511,000 lbs</u>
Arrival Fuel @ EGLL = 18,200 lbs *(see FMC "PROGRESS" page at "EGLL - FUEL")*
Current Fuel = 24,300 lbs *(see TOTAL FUEL indication on EICAS ENG page)*
***Current Gross Weight* = 517,100 lbs** *(see FMC "INIT/APPROACH REF" page at "GROSS WT")*



PLANNING DESCENT

9. On the CDU keypad, enter the predicted gross weight at landing “511.0” (for 511,000 lbs) and select the LSK next to “GROSS WT” to update the VREF values. You should see them change to lower reference airspeed values.
10. Click on the LSK next to “30° – 137KT” to copy the VREF speed for a Flaps 30 degrees landing configuration.
11. Click on the LSK next to FLAP/SPEED to paste the calculated VREF value.

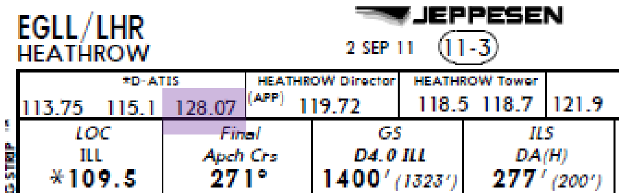


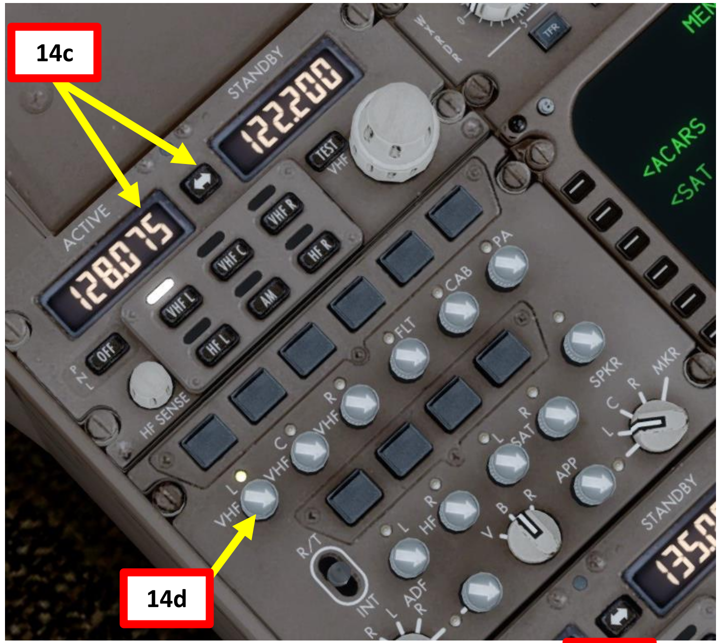
PLANNING DESCENT

12. On MCP (Mode Control Panel), set Final Descent Altitude to 2000 ft. The aircraft will not start descending yet because it hasn't reached the T/D (Top of Descent) point.
13. Go in the LEGS page of the FMC and make sure that you have enough distance to perform your approach at a 3 deg glide slope. You can use the following rule of thumb:
    <u>Required Descent Distance = (Altitude x 3)/1000 + (10 nm for deceleration)</u>
    = (24000 x 3)/1000 + 10 = 72 + 10 = 82 nm

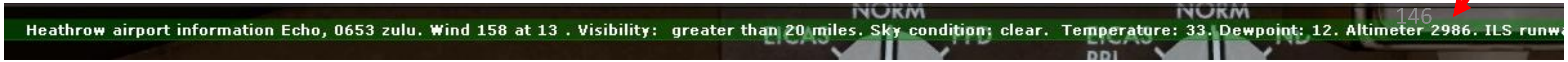
PLANNING DESCENT

14. You can consult the EGLL ATIS (Automatic Terminal Information Service) system with the radio to get the altimeter setting.
    a) Consult the EGLL chart and find the Heathrow ATIS Frequency (128.075).
    b) Set VHF-1 STANDBY radio frequency ATIS frequency (128.075)
    c) Click on the Transfer button to set the ATIS frequency to the ACTIVE frequency.
    d) Press the L VHF button on the Audio Select Panel to listen on the VHF-1 active frequency.
    e) You should receive the ATIS automated report on the radio for Schiphol Airport. The reported altimeter setting is 29.86 inches of Hg.
    f) Press the L VHF button on the Audio Select Panel to mute the VHF-1 active frequency once you have the information you need.
15. When reaching the transition level of 7000 ft, click on the "STD" BARO button to set barometric pressure instead of standard pressure. In our case, we will use the barometric pressure the tower told us (29.86 in Hg).





14e



PLANNING DESCENT

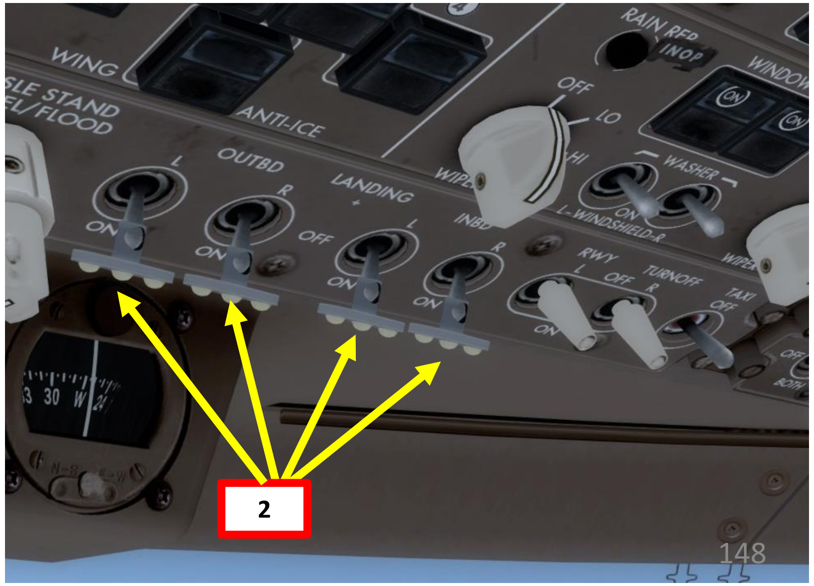
16. We must now set our transition level in the FMC
17. Click on the "VNAV" FMC page on the CDU and use the NEXT button to reach Page 3/3: ECON DES.
18. Select LSK next to the "FORECAST" menu.
19. Type "070" for FL070 (7000 ft) on the CDU keypad and click on the LSK next to "TRANS LVL".

DESCENT

1. You will automatically start descending when reaching the T/D point.

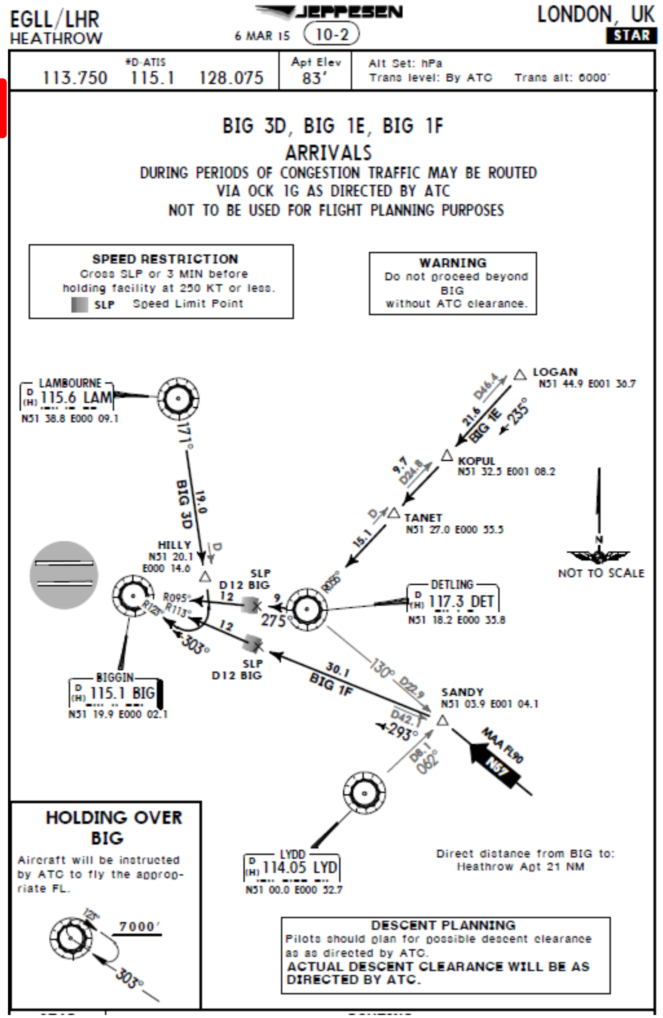
   NOTE: Alternatively, you can also start your descent a bit earlier in order to do a smoother descent that will be more comfortable for passengers by using the "DES NOW" mode. This DES NOW mode starts the plane down at a shallow 1000 FPM (feet per minute) until it intercepts the VNAV path. Going from 0 to 1000 FPM is far less noticeable to the passengers than quickly going from 0 to 3000 FPM is. DES NOW is also what you would press if ATC gave you a descent clearance prior to your T/D.

   ALTERNATIVE PROCEDURE: When you are about 5-10 nm from the Top of Descent point (T/D), click on the "VNAV" FMC page on the CDU, select Page 3/3 ECON DES, then select LSK next to "DES NOW" and click on the EXEC button on the CDU.
2. When reaching FL100, set Landing Lights to ON.



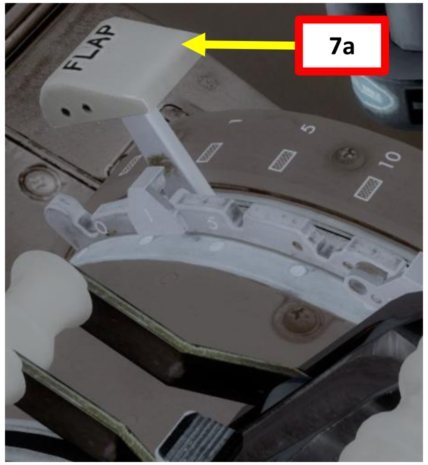
DESCENT

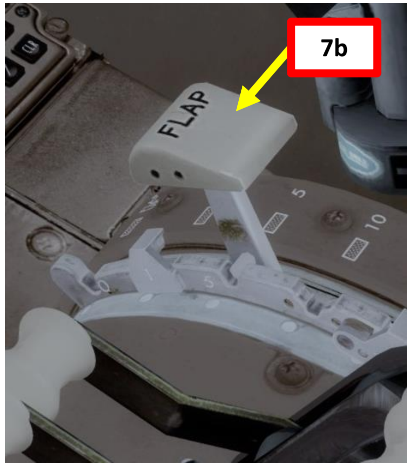
3. Before you reach the last waypoint of the STAR (BIG), the tower should be able to clear us for open descent to 2000 ft. Once you fly over the Deceleration Point (can be monitored on the Navigation Display), your aircraft will start losing speed and will begin your approach.
4. Open up the LEGS page on your FMC and look for the speed restriction at BIG. It says that we cannot fly faster than 240 kts.
5. Set autopilot speed to 240 and the altitude to 2000, then press the MCP Speed button (Speed Intervention) and the MCP Altitude button (Altitude Intervention).

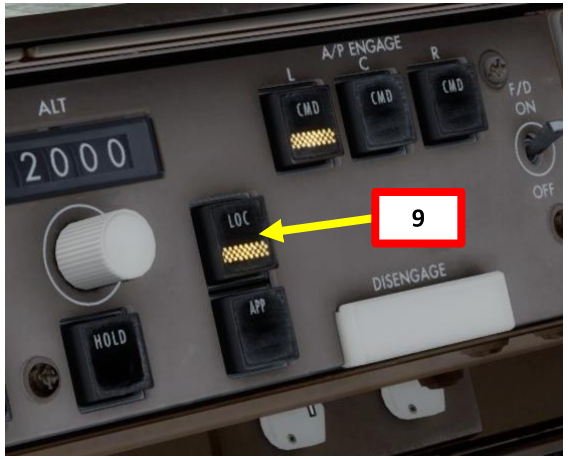


DESCENT

6. Once you are approaching the Approach Fix CI27L, slow down to FLAPS UP speed of 217 kts (indicated on speed tape) by setting the autopilot MCP SPEED to 217. If IAS window is blank, click on the MCP SPEED knob to activate the Speed Intervention functionality.
7. Set Flaps lever to 5 deg
8. Set MCP SPEED to the Flaps 5 Speed (177 kts), as shown on Speed Tape
9. Arm LOC (Localizer) switch

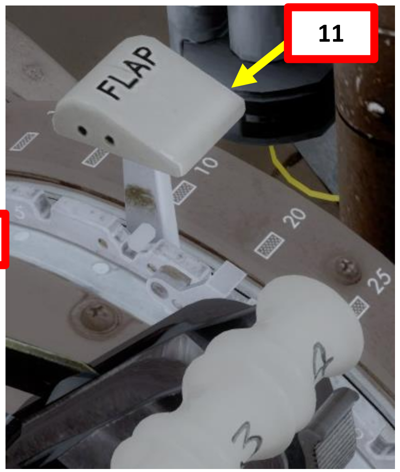






DESCENT

10. Once you are at least 25 nm from ILS approach (a bit before Approach Fix CI27L), press the “APP” autopilot mode to arm both LOC (Localizer) and G/S (Glide Slope) modes. All three autopilot channels (CMD L, CMD C and CMD R) should engage.
11. Set Flaps lever to 10 degrees
12. Once you are at 3000 ft, set MCP SPEED to the FLAPS 10 speed of 157 kts (indicated on speed tape)

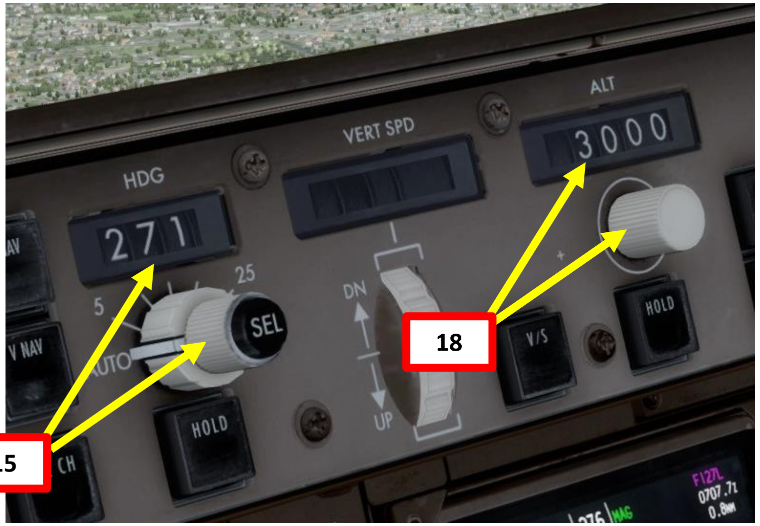


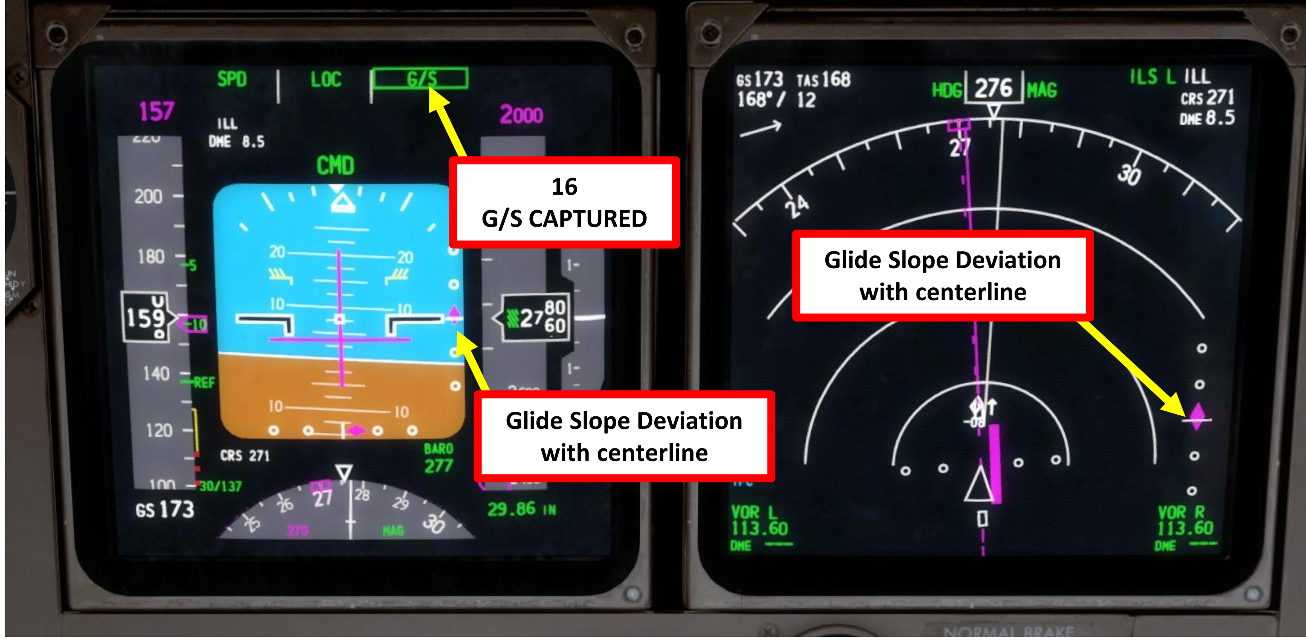
DESCENT

13. Set Navigation Display mode to APP (Approach) to check for ILS localizer and glide slope.
14. When LOC (Localizer) is captured, the PFD will indicate in green that the "LOC" autopilot mode is active.

DESCENT

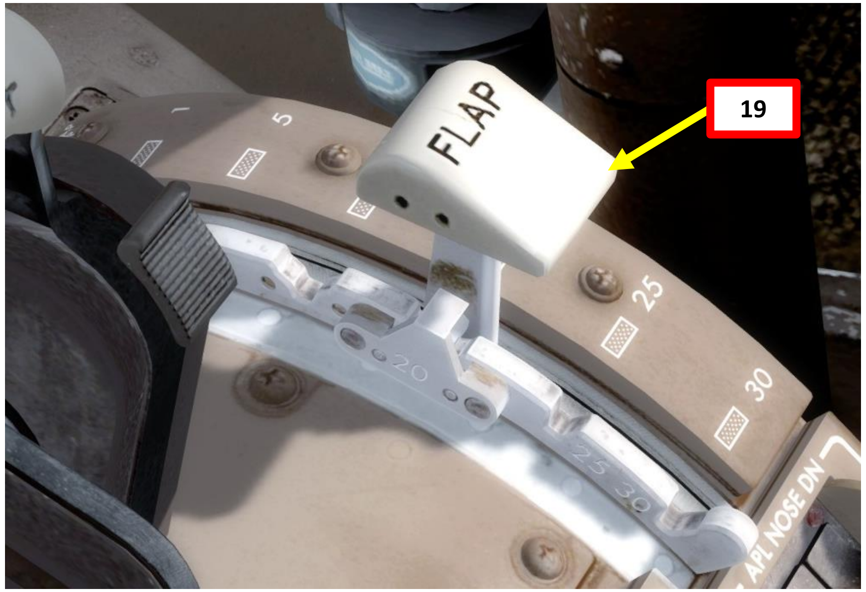
15. Set HEADING knob to 271, which is the runway QDM (magnetic heading)
16. When glide slope is captured, the PFD will indicate in green that the “G/S” autopilot mode is active.
17. Set Navigation Display mode back to MAP
18. Once localizer (lateral guidance) and glide slope (vertical guidance) are both captured, you can now set your autopilot altitude to the Go-Around Altitude of 3000 .





DESCENT

19. When lined up on approach, set flaps to 20 deg.
20. Set MCP SPEED to the FLAPS 20 speed of 147 kts (indicated on speed tape).

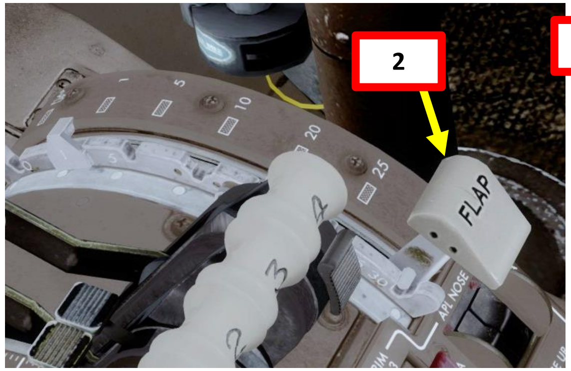


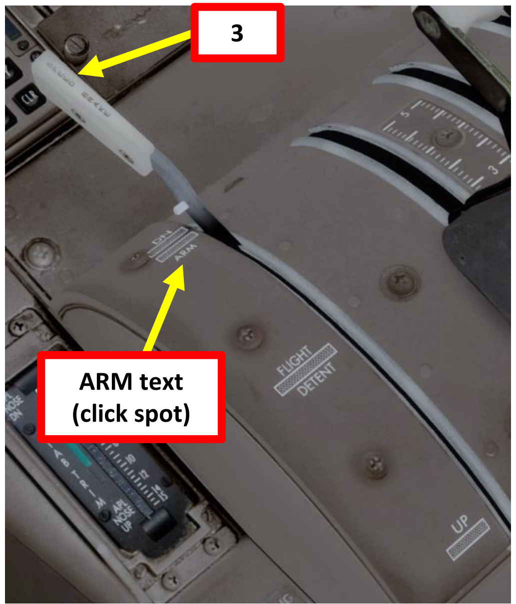
DESCENT

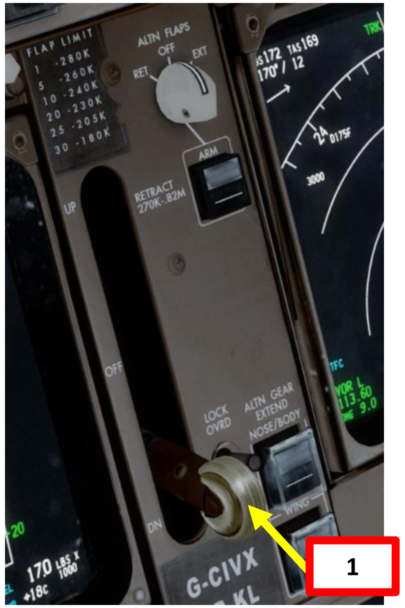
FINAL APPROACH

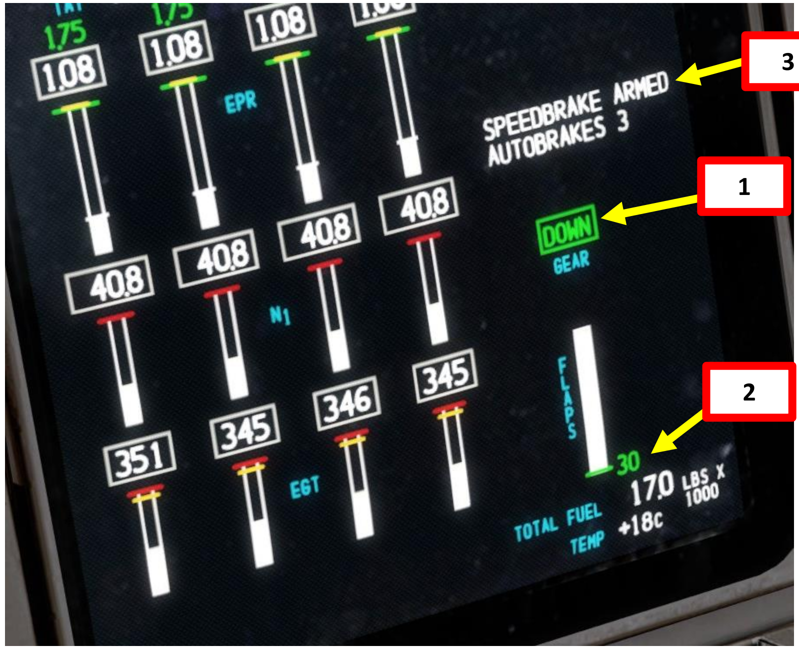
1. Once you are at 1500 ft on final approach, set landing gear down.
2. Set Flaps Lever to 30 degrees
3. Arm Speed Brake (you can click on the ARM text next to the lever)
4. Set MCP SPEED to the VREF+5 speed of (137 + 5) kts (indicated on speed tape). In other words, set the autopilot MCP SPEED to 142.
5. This landing will be done with the Autoland (LAND3).
    - When flying at 400 ft, the autopilot will switch to LAND mode in order to set the aircraft in a proper altitude and attitude to flare properly.
    - When flying at 50 ft, the autopilot will switch to FLARE mode in order to flare the aircraft to have a smooth touchdown.
    - On touchdown, the autopilot will switch to ROLLOUT mode. This mode will keep the aircraft on the runway centerline.

NOTE: If for some reason you decide to do a manual landing instead, a good procedure is to disconnect the Autopilot switch and the Autothrottle switches and follow the flight director to the runway by flying manually. You will then land the aircraft visually. Don’t follow the flight directors to touchdown: they’re not designed to provide accurate design past this DH (decision height).









FINAL APPROACH

LANDING

1. When you hear an audio cue “MINIMUMS”, this means you have reached your minimal decision altitude. You are now committed to land.
2. At 20 ft, pull up slightly to reduce rate of descent
3. At 10 ft, throttle back to IDLE
4. On touchdown, push the nose into the ground to improve adherence with the runway and maximize braking (the Autobrake system will already brake for you)

LANDING

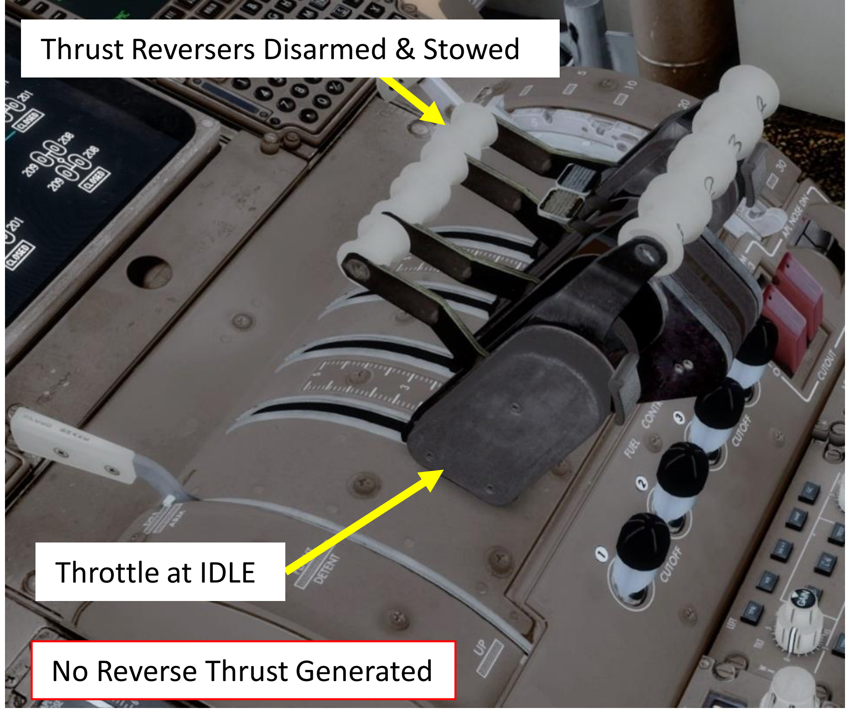
LANDING

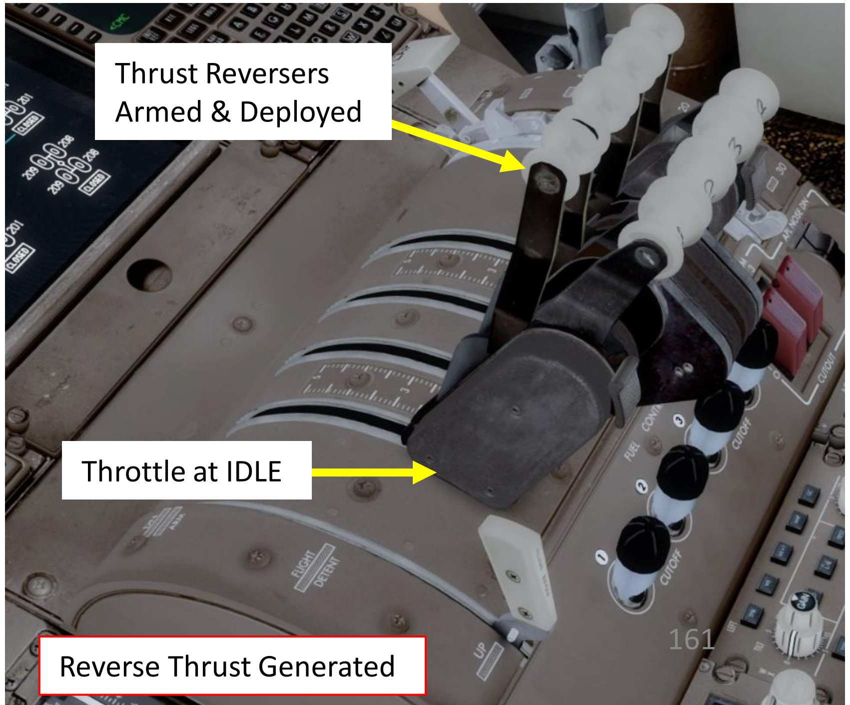
LANDING

5. Press and hold “F2” (“Throttle decrease quickly” binding) to deploy thrust reversers until you slow down enough to vacate the runway safely.

The Thrust Reverser lever can be moved by pressing and holding the “Throttle (decrease quickly)” control mapped to your joystick. Make sure that the “Repeat” slider is set fully to the right. The default key binding is “F2”.

Take note that the Reverse Thrust lever can only be engaged if your throttle is at IDLE. The reason for that is a mechanical stopper that prevents you from engaging thrust reversers at high throttle settings.





LANDING

LANDING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