Nemeth Designs

Aerospatiale AS350 Ecureuil
for Flight Simulator X

Operators Manual

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GENERAL

Ø 10.69 m (35.00 ft dia.)

Ø 1.86 m (6.10 ft dia.)

3.33 m (10.93 ft) high L/G

3.28 m (10.70 ft)

10.93 m (35.80 ft)

Overall length = 12.94 m (42.45 ft)

2.53 m (8.29 ft)

2.53 m (8.29 ft)

10.93 m (35.80 ft)

2.28 m (7.48 ft)

Ver.	Engine	Empty weight	Max takeoff weight	Max takeoff power	Max continous power	Main rotor speed
B1	ARRIEL 1B	1174 Kg	1950 Kg	478 kW	440kW	385 rpm
B3	ARRIEL 2B	1174 Kg	2250 Kg	632 Kw	543kW	390 rpm

BODY AND FUSELAGE

Structural subassemblies They are synthetic resins divided into 2 main classes, thermoplastics which soften when heated and harden when cooled. e.g. polyamides (NySon. Rilsan), polycarbonates, etc. and Thermosetting resins which, under the combined action of heat and a hardener, hot-cure irreversibly to form a new product, e.g. epoxy resins, silicone, etc. Laminates and laminated honeycomb are reinforced plastics with very good mechanical strength properties. Laminated materials are produced from thermosetting resins and reinforcing materials (glass. carbon, graphite. boron or other fibers).
The reinforcing fibers are formed in Jay-ups or woven, then impregnated with the basic resin. Several lay-ups or fabric layers are stacked up, Placed in a moid and cured. The direction of the reinforcing fibers depends on the loads applied. Laminated honeycombs have a honeycomb core (metar. glass fabric. Nomex, etc.), each face of which receives one or more preimpregnated layer of fabric. The whole assembly is oven-cured.

Body structure This is the strongest part of the airframe since it directly carries the flight loads and the landing loads. It also supports the main transmission components (MGB and rotor), landing gear, cabin floor and rear structure, and contains the fuel tank.

Rear structrure The rear structure consists of 3 frames ,joined by beams. The rear and forward frames support the engine. The tail boom bolts onto the 3rd junction frame and can be easily removed. The rear structure is arranged as a baggage compartment.

Canopy The canopy components - cabin roof, nose and uprights - are made of fiberglass-reinforced polycarbonate. They are hot-molded and assembled by thermowelding. The canopy structure bolts onto the cabin floor and onto the body structure bulkhead.

Bottom structure and cabin floor The bottom structure supporting the cabin is cantilevered out from the body structure. Two beams, laterally stiffened by cross members, are riveted to the body structure side beams and support the front pad of the landing gear.

Tail boom The tail boom is constructed of circular frames covered with skin. Overall bending rigidity is provided by plate stiffeners. The tail boom supports the tail gearbox (TGB), secured to 2 frames, the horizontal stabilizer mounted between 2 mainframes, the tail rotor driveshafts and the fins.

Tail unit The tail unit consists of a horizontal stabilizer , a upper fin and a lower fin.
In excessively nose-up landings, a tail guard protects the ventral fin. These vertical and horizontal surfaces act as stabilizers, i.e. when subject to a relative wind, they tend to counteract any changes to the helicopter's attitude and to bring the helicopter back to its original attitude after any deviations.
In cruise flight, the asymmetric NACA airfoil of the dorsal fin generates an aerodynamic force that opposes the main rotor's counter torque CR and thus reinforces the tail rotor thrust. This allows the tail rotor pitch to be reduced and power to be saved. In 83 version, a step on the RH side of the upper fin improves this phenomenon. The ventral fin has a symmetric NACA airfoil to stabilize the helicopter about its yaw axis. The vertical stabilizer has an asymmetric NACA airfoil, set at a negative angle to the horizontal datum; when subjected to a relative wind the airfoil generates an aerodynamic force tending to right the helicopter.

Doors The helicopter has the following doors: two cabin doors, one on either side, accessing the pilot seats, two subdoors, one on either side, accessing the rear of the cabin, a laminated LH baggage compartment door and a symmetric laminated RH baggage compartment door and a laminated rear compartment door. All the above doors have a key-operated safety lock.
The LH and RH baggage compartment doors are hinged along their top edges and can be held open by a rod which clips on the inside of the door for stowage.
Certain missions (hoisting and casualty evacuation) require better access to the rear of the cabin. This is achieved by replacing the LH standard door and LH hubdoor by a narrower pilot door and a wider sliding door running on rails. The sliding door may be opened, and locked open, in flight.

Skid type landing gear The landing gear supports the helicopter, protects the airframe on landing and damps out vibration when the helicopter is on the ground with the rotor spinning. The landing gear assembly comprises: a front cross tube and a rear cross tube, two skids and two hydraulic shock absorbers.

ROTOR SYSTEM

The main rotor drive system transmits engine power to the main rotor and to the tail rotor drive shaft, and provides the lift of the helicopter. It consists of the main rotor mast, the rotor hub and 3 rotor blades. The main rotor mast is secured to the MGB. It drives the main rotor hub and transmits the rotor lift to the airframe. The hub is attached to the rotor shaft and supports the blades. It is located at the center of the resultant lift of the blades and it absorbs the forces induced by the rotation (centrifugal forces, flapping and drag (lead/lag) loads. The blades convert the mechanical engine power into aerodynamic forces (lift).
Starflex semi-rigid, bearingless mainhub (laminated glass-resin star) without a drag damper is adopetd. No grease nipples. Modular, fail-safe design. Rotor blades are made of fiberglass molding, glass fabric skin and foam core a failsafe design. Main gearbox is a modular design. Attached by flexible bi-directional suspension. Two reduction gear stages (1 bevel gear drive, 1 epicytic gear train). Pressure lubrication with oil cooling system. Includes rotor brake and hydraulic pump drive. Main rotor mast built of removable subassemblies. Mast casing attached by 4 suspension bars which "support" the helicopter. It includes the servo actuators.

Rotor brake The rotor brake is designed to quickly stop the rotor spinning after engine shut-down, - without a brake, the rotor's kinetic energy would keep it spinning – and to prevent on ground turning of the rotor in the open air.

Tail rotor The tail rotor controls the helicopter about its yaw axis. The forces acting are the main rotors counter torque and the tail rotor thrust with a moment about the e.g. The tail rotor is a flexible seesaw type, mainly constructed of composites (carbon, Kevlar etc.) with only a few metal connecting parts. The conventional pitch and flapping hinges have been eilminated and with them, the maintenance intensive bearings. In fact, the tail rotor offers the same advantages as the main rotor, i.e. almost maintenance free, failsafe design, on conditional maintenance, etc.
Two-blade, hingeless, greaseless seesaw rotor with glass roving spar Pitch change by spar twisting a failsafe design. Tail rotor gearbox is an angle reduction gear with splash lubrication.

Vibration absorbtion The MGB bidirectional suspension is designed to filter out the vibrations but some always "gets through". To further improve the rotor hub vibration absorbers were installed.

ARRIEL 1 OR 2 ENGINE

Free-turbine engine (clutchless drive) with integral freewheeling modular design, cooling system and externally fitted oil tank. The ARRIEL 1 family of engines is designated by a letter denoting their applicability to a given version of the helicopter.

Main features
• A free turbine engine whose gas generator shaft and power turbine shaft are completely independent.
• A speed governor, which maintains the free turbine at constant rpm irrespective of the collective pitch (i.e. irrespective of the power required in flight) by acting on the gas generator rpm, therefore on the power developed.
Since the free turbine rpm is constant, the power transmitted to the rotors depends only on the engine torque, which is why a torquemeter can be used to measure the engine power output.
• Modular design, which means the main components can be inspected and replaced without the need to return the complete engine to the factory.

Lubrication The engine bearing and gears are lubricated and cooled by the circulation of pressurized oil. After lubricating the engine where it picks up off the ground the oil is extremely hot and prior to recycling, it must be cooled to preserve all its lubricating properties. This is the function of the oil cooling system.

Cooling In forward flight, the ram air flowing over the oil cooler is used for cooling. In hover, since there is no ram air, the cooling airflow is generated by the motor-driven fan, which cuts in automatically when the oil temperature in the oil tank reaches 77°C.

Control B1 The engine controls determine the quantity of fuel injected into the combustion chamber in the various operating configurations: STARTING - FLIGHT - ENGINE SHUTDOWN The engine has 2 mechanical controls: - A fuel flow control operated by the pilot (fuel flow control lever), and an automatic engine governor compensation control, coupled to the collective pitch control. This means the pilot has only one direct control to operate, the fuel flow control lever which, moreover, is only used for engine starting, shutdown and acceleration to the governed rpm (flight position).

The function of the free turbine governor is to maintain the free turbine speed (and hence the rotor speed as well) constant. The governor is a simple WATT type, consisting of a directly acting, flyweight centrifugal governor operating in an "open loop".

Thus when the fuel flow control lever is in "flight" position, the pilot has nothing to do (except to fly the helicopter) since the engine is controlled by its governing system, which automatically meters the fuel quantity to match the power demand (collective pitch function) and which, at the same time, keeps the free turbine rpm constant. The governing control acts on the free turbine governor; the control reacts automatically to collective pitch variations and it compensates for the STATIC DROOP of the centrifugal governor, by maintaining a constant rotor rpm (NR) irrespective of the fuel flow and hence irrespective of the power demand. It has a very fast response time to prevent surging during sudden accelerations and flameout during sudden decelerations. This is why this control is also called an anticipator since it acts prior to the normal reaction of the centrifugal governor.

In other words, the governor transmits a control order (it detects rpm variations and counteracts them) but it does not check or correct the results of its action. It cannot operate "intelligently" because it is not informed of the effects of its action. In cybernetics, such a governing system is termed "open loop", as opposed to "closed loop" systems where there is a feedback from the sensing element which compares the result with a reference value and modifies its magnitude. Consequently, with such a governor, the rotor rpm is not strictly constant: compared to the selected governor speed, the rpm drops slightly when the power demand increases and rises slightly when the power demand decreases. This small rpm difference is called "static droop".

Starting system B1 For starting the engine needs outside energy to initiate its operating cycle, in which it progressively becomes self-sustaining until it no longer needs outside energy and acts as a power generator. The starting system creates the conditions needed for the engine starting process. To initiate the starting sequence, the engine needs:
1 - Air. The required airflow is obtained by driving the generator (and therefore the compressors) with a starter.
2 - Fuel. We have already explained how the fuel is supplied during the starting sequence.
3 - High energy sparks to ignite the air/fuel mixture. The electric discharges are produced by an ignition system (ignition unit) which energizes 2 plugs called igniters. Functions are initiated when the pilot presses the STARTER push button on the fuel flow control lever. Function is initiated by moving the fuel flow control lever into the starting range. ONCE IGNITED, the air/fuel mixture begins to supply energy which, added to that of the starter, accelerates the gas generator Therefore the airflow increases (the compressors

rotate faster and faster), the fuel flow increases (the fuel pump rotates faster and faster) and the gas generator rpm and power increase.

This sequence continues until the engine reaches its self-sustained speed. The starting function can then be terminated (by releasing the push button to stop the starter and igniters) and the engine is accelerated by moving the fuel flow control lever to its forward "FLIGHT" detent until the governing system takes over control.

Control B3 The operating principle consists of varying the gas generator speed to maintain the free turbine speed virtually constant, irrespective of the engine power demand. The system is of the Full Authority Digital Engine Control (FADEC) type. It comprises an electrically-controlled hydromechanical unit and an electronic unit analysing the engine and flight control parameters.

The electronic analysis unit performs the following functions: - optimum automatic starting, - N2 (NF) control. - self-test monitoring of the sensors and the Digital Engine Control Unit (DECU).

A simplified explanation of the N1 control - and therefore of the rotor rpm N control - is as follows: When the load varies, the DECU uses the input parameters (Torque, T1, N1. P3, N2, T4.5) and the anticipator (collective pitch/power coupling) to compute an N1 set point value; it then compares this value with the current N1 and applies a proportional function to determine a new setting for the metering unit via the step motor in order to bring N2 back to the set point value.

The engine is controlled via 2 selectors on the instrument panel and a twist grip on the collective pitch lever.

Starting selector B3 • Starting selector - OFF: engine shut down. The guard is raised. - IDLE: engine running at "ground" idle. This setting is used when waiting on the ground, e.g. for the engine oil temperature to rise. - ON: the DECU runs the automatic starting sequence. This is the normal setting in flight. At this and the IDLE settings, a fold-down guard prevents inadvertent switchover to OFF in flight.

• Control mode selector - AUTO: the normal position, protected by a lock-down guard, when the DECU controls the engine automatically. - MANU: the pilot controls the engine using the twist grip. This setting is utilized only when there is a simulated DECU failure (Refer to the Flight Manual for the conditions). The red "GOV" warning light illuminates. The pilot must then control the fuel flow with the twist grip. During a simulated failure, reversion to automatic mode is possible at all times by moving the twist grip back to the normal flight detent,

- the control mode selector to "AUTO". The red "GOV" warning light then extinguishes. The 11Vi/T GRIP" light illuminates when the grip leaves the 'FLT" detent.
• "Forced idle" microswitch in autorotation training, the pilot twists the grip to move it out of the "FLT" detent to the "MIN" setting and to activate the microswitch. The DECU then adjusts the engine to the idle rpm. Moving the grip back to the "FLT" detent resets the DECU in "flight" mode.
• Description of warning lights - Red "GOV" light, indicating a major engine fuel control system failure with seizure of the metering unit or the manual engine control. - Amber "GOV" light, indicating a minor failure resulting in degraded engine fuel control. When flashing, the light indicates a failure not affect the engine fuel control system, such as loss of redundancy. - Amber "TVVT GRIP" light, indicating the twist grip is no longer in the "FLT" detent.

Twist grip B3 When the twist grip is turned, it rotates a ball-end rod which drives a module with a rack gear and a pinion gear. The module moves a connecting rod sliding inside the torque shaft running under the cabin floor between the collective pitch levers. The output motion is generated by a rack and pinion unit under the end of the copilot lever. A bail-slider control linked to the unit's rack gear transmits the twist grip orders to the governor. The copilot twist grip mechanism is similar to but simpler than the pilot's.
During normal flight, the grip is placed in a neutral detent and the DECU handles the engine fuel control. The DECU detects when the grip is moved out of this "flight" detent and illuminates the amber TWT GRIP" light on the failure warning panel. The fuel control is said to be "MIXED" and the pilot manually acts on the engine rpm but the DECU monitors the fuel flow limits. In manual mode (control mode selector set to "MANU"), the pilot is responsible for controlling the engine. In training (autorotation) mode with the selectors set to "AUTO" and 'ON", the pilot turns the twist grip towards the closed setting to initiate "forced idle". Reversion to the neutral detent resets the DECU to "FLT" mode.

Starting system B3 The starting sequence is fully automatic and the only control is an electric selector with 3 stable positions (OFF - IDLE - ON).
• Positions: "OFF" Initiates the DECU self-test when the helicopter is powered up by activating "OFF" input. Moving the selector from "ON" or "IDLE" to "OFF" shuts down the engine and closes the fuel supply solenoid valve.
"IDLE" Starts up the engine by activating the "IDLE input but stabilizes the engine rpm at ± 52% N1 . This setting is used when the outside air temperature is below -20°C in order to preheat the engine oil.
• Runs the engine starting sequence by activating the "FLT" input and accelerates the engine up to its nominal rpm. It is the normal setting in flight.

FIRE DETECTION SYSTEM

The fire detection system includes a "FIRE" light on the failure warning panel to alert the pilot if the temperature increases abnormally in the engine zone, for this, 6 detectors are installed around the outside of the engine at the critical points.
The detectors sensing element consists of 2 bimetallic strips. One strip (with a low coefficient of expansion) and a second strip (with a high coefficient of expansion) are soldered to-gether. An increase in temperature causes the 2 strips to expand by different amounts second more than the first. Since the two strips are integral, the bimetallic strip is forced to bend with first on the inside.
The detectros operate in two cases: when the temperature rises slowiy, the 2 bimetalic strips receive the same amount of heat and thus distort identically. Once the detection threshold is reached, the insulated bimetallic strip contacts stop whereas the non-insulated bimetallic strip continues to distort, the contacts therefore separate.
If the temperature rises rapidly, the non-insulated bimetallic strip receives more heat and hence distorts more quickly than its insulated countertpart, the contacts therefore separate once the detection threshold is reached.

ELECTRICAL SYSTEM

Direct current power sources

The helicopters electrical system can be energized by 3 DC power sources:

The 4.8 KW nominal power starter generator is driven by the engine and is the normal power source in flight. It powers the helicopter system and charges the battery. In the starting phase, when it drives the engine, the generator is powered by the battery or by an external power unit (EPU) and functions as an electric motor.

The Alkaline type, 24V battery provides power on the ground for self contained engine startups and for energizing the systems with the engine shut down. in flight is supplies backup power in case of engine failure (for a limited time depending on its charge)

The 28.5 V EXTERNAL POWER UNIT (EPU) can be used instead ol the battery on the ground for engine starting and for running the electrical tests.

AC system The AC system generates 115/26V, 400Hz single phase Power. It supplies the AC power consumers from the helicopter DC power system.
The AC power furnished by a static 28V DC to 115V and 16V AC inverter

Emergency cutoff: The "EMERG. CUTOFF" push button Is used in case of an emergency (e.g. crash) to simultaneously cut off the generator and the battery. When the "EMERG. CUTOFF" push button is depressed, generator excitation relay is no longer energized and the battery is isolated from electrical busbars, except essential equipment, safety systems. These are still powered directly by the battery.

HYDRAULIC SYSTEM AND SERVO ACTUATORS

Servo actuators: The helicopter can be controlled without servo actuators, but this requires the pilot to apply non-negligible forces that are difficult to gauge. These control loads are absorbed by hydraulic servo actuators so that the pilot can fly the helicopter precisely and effortlessly. In case of loss of hydraulic pressure, accumulators in the main rotor servo actuators provide a small energy reserve, giving the pilot time to reconfigure in the safety configuration. The B1 and B2 versions are fitted with a yaw load compensator.
The tail rotor servo actuator is secured via a rod-end bearing to the airframe. The tail rotor control rod is attached to the output adapter casing. Attaching bolts (1) act as guides.

Hydraulic system The hydraulic system supplies hydraulic power to the servo actuators. The AS 350 has a constant power hydraulic system, including a gear pump driven at constant speed by the MGB and with a constant discharge flow of 6 I/min, a filter with a visual clogging indicator and a regulator valve to keep the pressure at its rated value.

FLIGHT CONTROLS

The flight controls modify the pitch angle of the main and tail rotors so that the pilot can control the helicopter's attitude, velocity and heading.
The collective pitch lever controls the main rotor lift by collectively varying the pitch. Lift direction and amplitude are controlled by the cyclic pitch stick. The cyclic stick tilts the rotor disk (cyclic pitch variation). The yaw control pedals modify the tail rotor thrust, thus the helicopter heading.

Moving the cyclic stick fore or aft drives a pitch linkage controlling the helicopter about its pitch axis. For instance, moving the stick forward cyclic pitch change tilts the rotor forwards.

Tail rotor control action is simpler, i.e. pushing the RH pedal forward increases the tail rotor pitch and hence the thrust pushing the LH pedal forward has the opposite effect.

Moving the cyclic stick laterally drives two roll link-ages controlling the helicopter about its roll axis. For instance, moving the stick to the right resulting cyclic pitch change tilts the rotor to the right.

FUEL SYSTEM

The helicopter's fuel system is designed to feed fuel from a tank below to the engine pressure pump above to ensure the fuel fed to the engine is absolutely clean. A pressure pump on the engine supplies fuel to the combustion chamber via a fuel governor.

The fuel system consist of fuel tank with 540lt max capacity, variable capacitance transmitter, electric boost pumps delivering fuel at low pressure to engine pump, fuel drain valve and water bleed valve, non-return valves, preventing fuel flowing through an inoperative pump, differential pressure switch, fuel pressure transmitter, bypass valve with visible "open" indicator, fuel shutoff valve.

LIGHT SYSTEMS

Interior lights The interior lighting consists of 3 independent systems: the cockpit (pilots) and cabin (passengers) dome lights, the instrument panel lighting and the console lighting

Exterior lights The exterior lighting consists of 3 position lights, an anti collision light and 2 searchlights for landing: one for approach and one for touchdown.

HEATING, DEMISTING AND VENTILATION SYSTEM

Hot air tapped at the engine centrifugal compressor outlet is mixed with ambient air drawn in by 2 convergent injectors under the cabin floor, and then is diffused into the cabin through 2 hot air outlets and 2 windshield demisting diffusers
.
The hot airflow from the compressor is adjusted by control valves beside the pilot's seat. The restrictor is a simple disk with an orifice to limit the P2 airflow.

The cabin is ventilated by outside air entering the cabin, at the front through a grid protected aerator. The air flow is adjusted by a butterfly valve operated by a pull knob under the pilot's side of the instrument panel. - overhead through a ram air scoop (1).
The ventilation air is ducted through 2 polycarbonate half-shells on the ceiling to the swiveling air outlets, whose flow can be adjusted or cut off.
The ram air scoop is equipped with water separators that trap most of the water and exhaust it out-side. The airflow may be adjusted to the summer or winter settings by rotating the water recovery bowl to open or close leakage ports.

PANEL LAYOUT
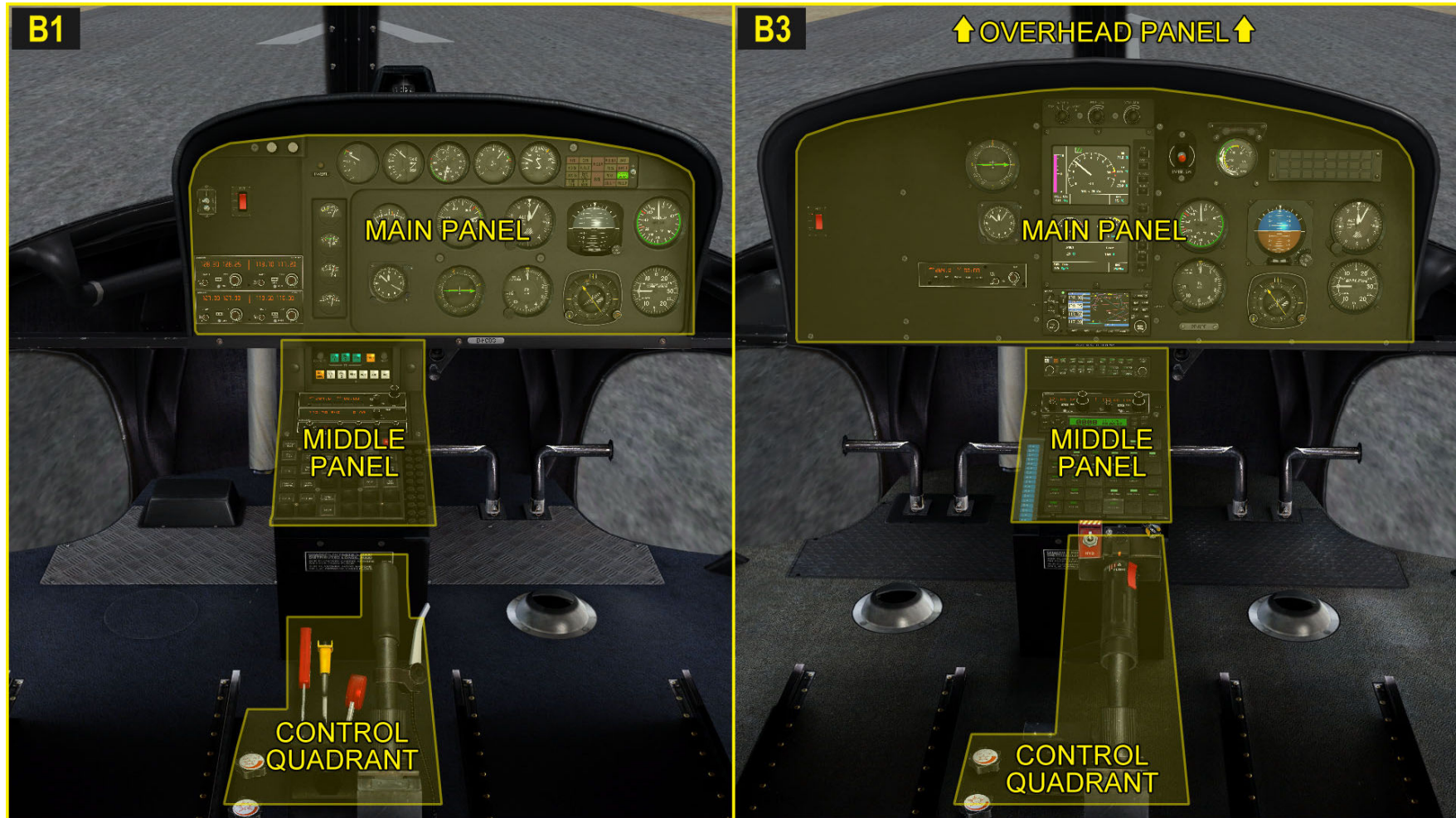
MAIN PANEL B1

1.) NAVCOM1 radio

    a) com1 off
    b) com1 freq. swap
    c) com1 freq. set

2.) NAVCOM2 radio

    a) com2 off
    b) com2 frew. swap
    c) com2 frew. set

3.) Inverter off warning light

4.) Voltmeter

5.) Fuel quantity

6.) Gas producer rpm

7.) T4 temperature indicator

8.) Torquemeter

9.) Fuel press

10.) Oil press

11.) Oil temp

12.) Ampmeter

13.) Hoist load

14.) Rotor rpm

15.) Altimeter
    a) barometric press. set

16.) Atittude indicator

    a) bars set

17.) Airspeed

18.) Clock

19.) ADF / VOR2 bearing

20.) Radio altimeter
    a) marker set

21.) HSI

    a) HDG set
    b) OBS set

22.) Vertical speed

23) Advisory panel

24) Cabin air flow control lever
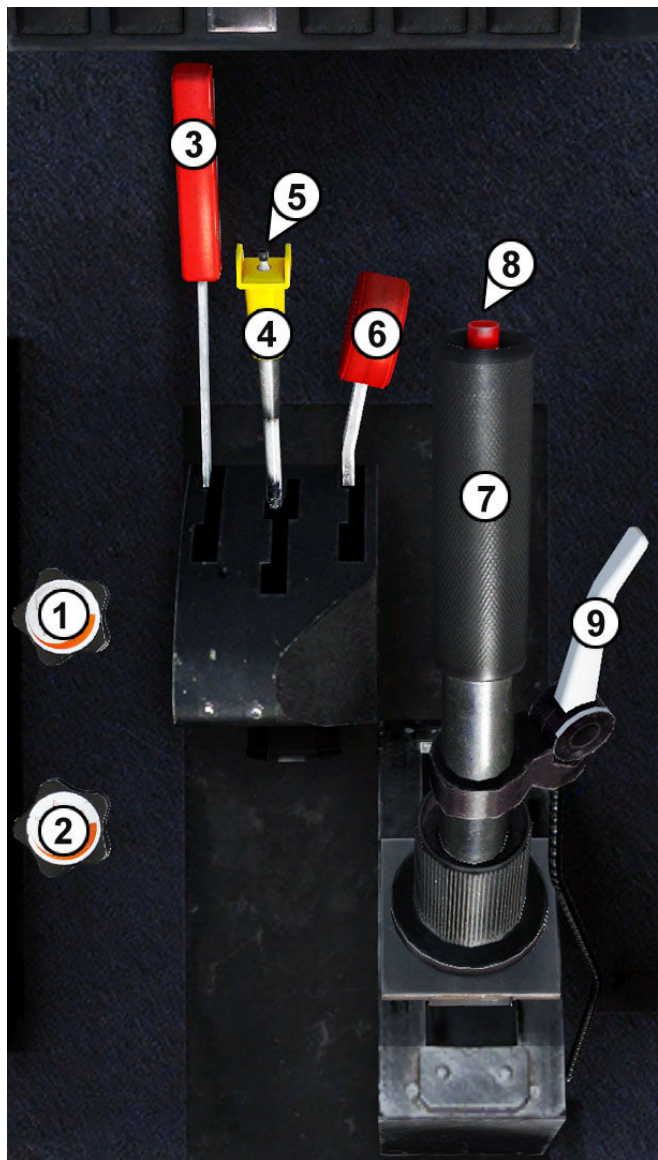
CONTROL QUADRANT B1

1. Demisting set knob

2. Heater set knob

3. Rotor brake lever

4. Fuel flow control level (F.F.C.)

5. Starter push-button

6. Fuel shut-off lever

7. Collective pitch control

8. Hydraulic off

9. Hoist release

MIDDLE PANEL B1

1.) Audio panel

    a) Com1
    b) Com2
    c) Marker ID
    d) VOR 1
    e) ADF
    f) DME

2.) ADF radio

    a) Freq. swap
    b) FLT / ET
    c) Reset FLT
    d) Off
    e) Freq. set

3.) DME

    a) Source select

4.) Transponder

    a) Freq. set

5.) External electric power /
    Battery

6.) Fuel boost pump no.1

7.) Generator

8.) Generator reset

9.) Eng. crank

10.) Electrical master cutoff

11.) Warning / caution light test

12.) Fuel boost pump no.2

13.) Anti collision light

14.) Position lights

15.) Hydraulic accumulator test

16.) Horn

17.) Pitot heat

18.) Instrument lights 1

19.) Instrument lights 2

20.) Taxi light

21.) Landing light

22.) Standby horizon

23.) Fuel flow meter

24.) Conf.

25.) Windshield wiper

26.) Inverter

27.) Attitude

28.) Compass

29.) Hoist arm

MAIN PANEL B3

1.) ADF / VOR2 bearing

2.) Clock

3.) ADF radio
   a) Freq. swap
   b) FLT / ET
   c) Reset FLT
   d) Off
   e) Freq. set

4.) Vehicle Maintenance Display (VEMD)
   a) Lane 1 OFF
   b) Lane 2 OFF
   c) pages scroll
   d) pages reset – return to nominal display
   e) select data field
   f) increase numerical value / parameter of selected data field
   g) decrease numerical value / parameter of selected data field
   h) validate selected data

5.) GPS
   a) COM frequency swap
   b) NAV frequency swap
   c) COM / NAV select (left mouse), frequency adjust (mouse wheel)
   d) CDI indication on / off
   e) OBS indication

f) Message display
g) Flight plan page
h) Procedure page
i) map range set
j) Direct to page
k) menu
l) clear
m) enter / validate
n) Cursor (left mouse), Page/Group select (mouse wheel)

6. Electrical emergency cut-off (EMER switch)

7. Rotor / Free turbine rpm indicator

8. Caution / warning light panel (CWP)

9. Airspeed

10. Attitude indicator
   a) cage (left mouse), bars adjust (mouse wheel)
11. Altimeter
   a) barometric pressure adjust
12. Radar altimeter
   a) marker adjust
13. HSI
   a) Cousre select
   b) Heading select
14. Vertical speed
15) Cabin air flow control lever
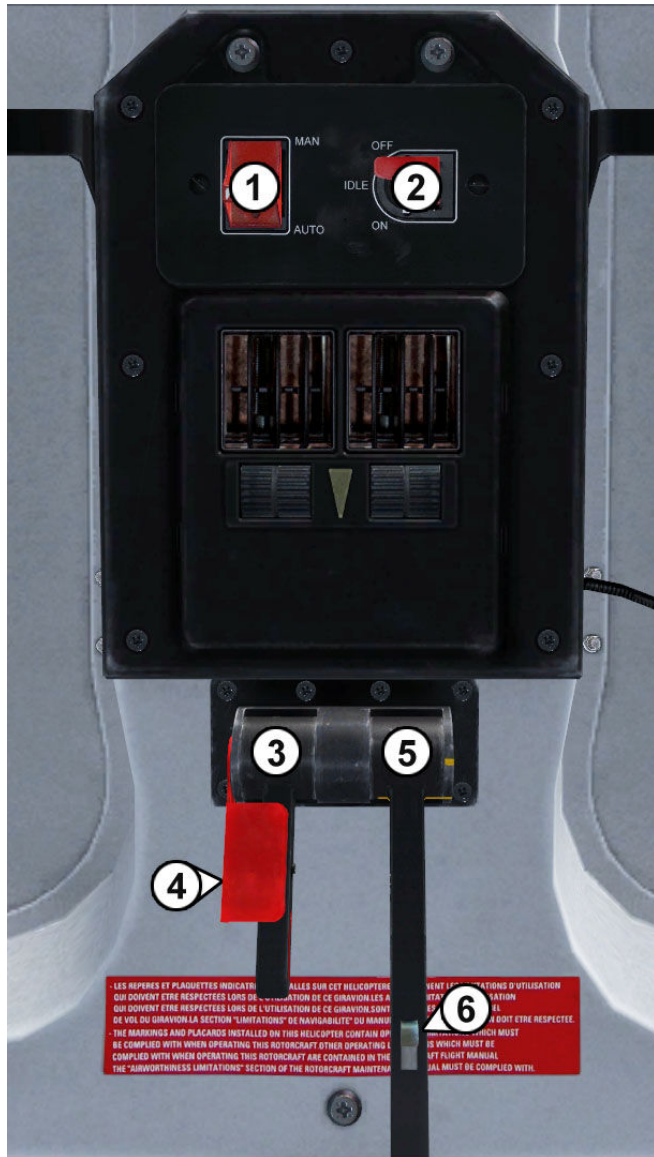
OVERHEAD PANEL B3

1. Engine control mode

2. Engine starting selector

3. Fuel cutoff lever (release guard before use)

4. Fuel cutoff lever guard

5. Rotor brake lever (unlock before use)

6. Rotor brake lever locking switch
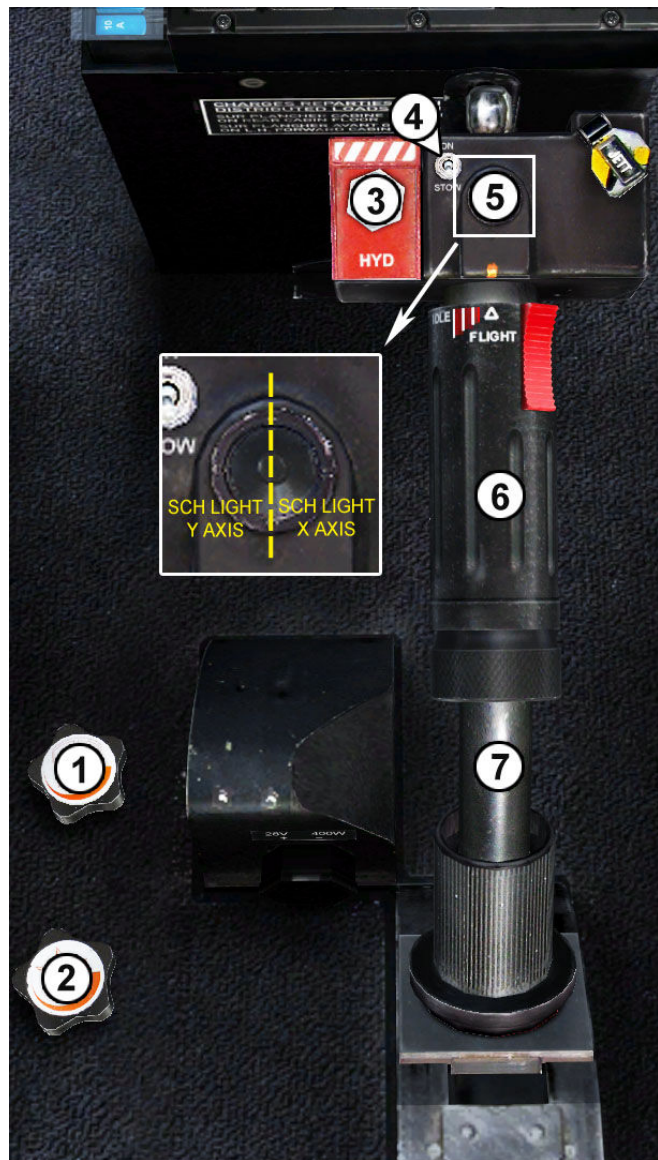
CONTROL QUADRANT B3

1. Demisting set knob

2. Heater set knob

3. Hydraulics cutoff switch

4. Search light ON/OFF

5. Search light control knob

6. Fuel flow / engine governing twist grip (manual mode)

7. Rotor pich control lever

MIDDLE PANEL B3

1. Audio panel

  a) Marker ID
  b) Com1
  c) Com 2
  d) Nav 1ID
  e) Nav 2 ID
  f) DME ID
  g) ADF ID

2. NAV / COM radio

  a) COM off
  b) COM frequency
swap
  c) COM frequency
adjust
  d) NAV off
  e) NAV frequency swap
  f) NAV frequency adjust

3. GTX 330 transponder

  a) VTR (preset 1200)
  b) ON
  c) OFF
  d) numeric buttons for
ID adjust

  e) time data field mode
select
  f) enter ID adjust mode
  g) stopwatch start/stop
  h) stopwatch reset

4. Battery / external power

5. Direct battery bus

6. Generator

7. Invertrer

8. Horn (only visual func.)

9. Avionic bus

10. Generator reset

11. Anti collision light

12. Position lights

13. Fuel boost pump

14-15. Instrument lights

16. Pitot heat

17. Attiude on

18. Gyroscopic devices on

19. Sand filter (not
equipped)

20. Hoist system (arm
extract)

21. Taxi light

22. Landing light

23. Crank

24. Wipers

25. Pitch trim

26. Roll trim

27. Trims release

28. Warning / caution
lights test

29. Fire detector test

30. Hydraulic backup
accumulator test

NORMAL PROCEDURES B1

Engine prestart check

1. Flying controls   Check Freedom of travels
2. Cyclic stick control   Neutral
3. Collective pitch control lever   Low pitch, latched
4. Yaw control pedals   Neutral
5. Rotor brake   Off, forward
6. Fuel shut-off lever   Forward
7. Fuel flow control lever   Closed, rearward
8. Battery   ON
    -   *Annunciator lights on with battery power:*
        HYD, GEN, MGB.P, PITOT, FUEL P
    -   *Annunciator light on with external power:*
        HYD, GEN, MGB.P, PITOT, FUEL P, BAT
9. Battery voltage   Checked
10. Test warning / caution lights   Test
11. Hydraulic   On
12. Heating, demisting, air conditioners   Off
13. Gyroscopic instruments (att., comp.)   On

Engine start

1. Fuel booster pumps   On
    -   *Annunciator light goes out:*
        FUEL P
2. Fuel quantity, fuel pressure   Check
3. Starter push-button   Press

4. F.F.C.   At ~Ng 10% move forward
5. Rotor   Check starts to turn
6. Engine oil pressure   Check
7. F.F.C.   Continue moving forward
   - *Annunciator lights go out:*
   MGB.P, HYD, HORN (at Nr 250)
8. Rotor rpm   Check, in the green zone
9. Generator   On
10. Inverter   On
11. External power   Disconnect if used
    - *Annunciator lights go out:*
      GEN, BAT
12. Pitot heat   On
    - *Annunciator light goes out:*
      PITOT
13. Check:
    - All annunciator lights out
    - Electrical system voltage and current within limits
    - Fuel pressure within limits
    - Engine oil pressure within limits
14. All necessary systems   On, engage
15. Hydraulic accumulator test   On
    - HYD annunciator light flashing
16. Move cyclic stich along both axes   Check press, assistance
17. Hydraulic system   Off
    - HYD annunciator light goes on, control press increases
18. Hydraulic system   On
    - HYD annunciator light goes out

Before take-off

1. Doors   Closed
2. Navigation, communication   On, active
3. Pressure and temperatures   All within limit
4. Annunciator / warning lights   Out
5. Heating, demister, air conditioning   Off

Engine and rotor shutdown

1. Switch off all consumers and the generator
2. Reduce engine power to ~50% using F.F.C. lever
3. After 1 minute shut down engine by moving the F.F.C. to full aft position.
4. Set the fuel booster pumps off, then all buttons to OFF.
5. Apply the rotor brake when Nr less than 140 rpm
6. Switch off battery

NORMAL PROCEDURES B3

Engine prestart

1. Rotor brake   Release, fully forward, lock
2. Fuel shut-off lever   Forward, guard
3. Hydraulic switch   On
4. EMER switch   Off
5. Starting selector   OFF
6. Battery / external power   On
7. Direct battery   On
8. Warning / Caution lights test   Perform

9. Fire detector test   Depress
10. CWP light **FIRE**   Goes on
11. Fire detector test   Release
12. CWP light **FIRE**   Goes out
11. CWP light illiminate   Check
    -on battery:
    GENE, PITOT, ENG P, FUEL P, HORN, MGB P, HYDR
    -on EPU:
    same lights + **BATT**
12. Battery voltage   >22V
13. Heating, demisting, air cond.   Off
14. Fuel boost pump   On
15. Anti coll. light   On
16. Starting selector   IDLE
17. Engine parameters   Check
    -Ng increases
    -T4 below limits
    -NR increases
    -Eng. oil press. increases
18. Starting selector   ON
19. CWP lights go out at Ng~67%
    ENG P, MGB P, HYDR
20. Pitot heat   On
21. CWP light goes out
    PITOT
22. Fuel boost pump   Off
23. CWP light **FUEL P** out   Check
24. Starting selector guard   Set
25. Generator   On

27. Inverter	On
28. All necessary system (Avionics, nav. etc.)	On, tested
29. EPU	Disconnect

Before takeoff

1. ACCU. test	Depress
2. CWP light **HYDR**	Flashes
3. ACCU. test	Release
4. CWP light HYDR	Goes out
5. Hydraulic cutoff	Off
6. CWP light **HYDR**	Goes on
7. Hydraulic cutoff	On
8. CWP light HYDR after 2-4 sec.	Goes out
9. Horn	On if NR>340 rpm
10. CWP light **HORN**	Out if NR>360 rpm, check
11. NR	In green range, check
12. Fire detector test	Perform
13. Parameters check	
No CWP illuminate	
Electrical system voltage within limits	
Eng oil press within limits	
All temperature and pressure within limits	
14. Doors	Closed, check

Shutdown

1. Avionics, non-required systems	Off
2. Starting selector	IDLE

3. Engine oil cooling	Wait min. 10 sec.
4. Pitot, horn	Off
5. Starting selector	Off
6. Generator	Off
7. Rotor brake	Apply when NR<170 rpm
8. ACCU test	Depress for 2 sec.
9. Anti collision light	Off
10. Direct battery	Off
11. Battery	Off

VEMD operation

The VEMD is switched on when the electrical power is engaged. The equipment performs an initialization test which checks correct operation of each of the two lines. During the test, the test page is displayed.
Any line can be cut by pressing the associated pushbutton (OFF1 or OFF2). This validates the initialization tests and switches the remaining line to operating mode. If the test is correct, the VEMD automatically goes to operating mode.

 The flight mode is displayed by default. when no other mode is selected. The [SCROLL] pushbutton is used to scroll the pages as shown on the following diagrams.
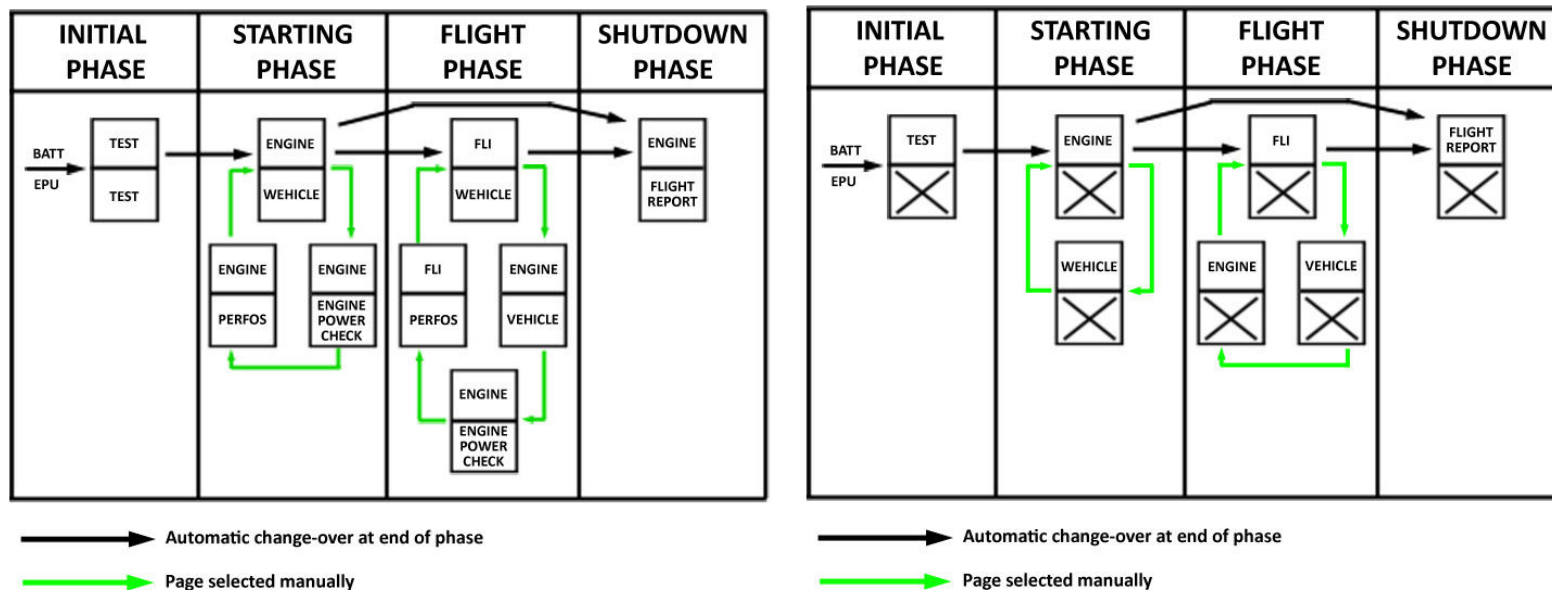
For mission planning purposes data fields on the PERFORMANCE page can be modified by using SELECT and „+ / -„ buttons.

Config mode is displayed by pressing SELECT when both pages are switched off.

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