

NEMETH DESIGNS DEVELOPMENT GROUP

SIKORSKY S-76A *SPIRIT*

(FSX/FSXSE/P3D)

Flight Manual

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Overview

History

The development of S76 Spirit began in 1975, the first of four prototypes flew in 1977. The goal was to create a civil aircraft for offshore, ambulance and passenger transport service.

The first version in mass production was "A", later versions "B", "C" has improved engines and avionics. Having concentrated almost exclusively on military aircraft thus far, Sikorsky announced plan in January 1975 for a twin-turbine helicopter for the civil market. The company had carefully evaluated the needs of potential customers and, after having examined various solutions, had already acquired several options. Building of the four prototypes began in May 1976 (the designation S-76 was chosen to mark the American bicentennial). The project clearly showed the experience gained with the S-70 combat helicopter. The second prototype was the first to fly, on 13 March 1977, complete with IFR avionics.

From the outset, the aircraft was equipped for all-weather operation, as one of its main roles was intended to be the servicing of offshore oil rigs. The four-blade rotor of this aircraft is exactly like that of the S-70. The blades are built around a strong titanium spar; the leading edge is also titanium, while the trailing edge has a fiberglass and nylon honeycomb structure. The entire blade is pressurized for maximum structural integrity.

The rotor hub is made according to the latest techniques to minimize maintenance: the normal bearings have in fact been replaced by elastomeric ones needing no lubrication, and special dampers virtually eliminate vibration

The powerplant is installed above the fuselage behind the drive shaft and consists of two 650shp Allison 250-C30 turbine engines. There are two Allison Gas Turbine 250-C30 or 250-C30S mounted side-by-side aft of the main gearbox. Both engines have separate drive inputs to the main transmission, which reduce engine RPM and distribute torque upward to drive the main rotor, and aft through intermediate and tail gear boxes. The control of engines ensured by the

Engine Control Quadrant situated in the cockpit. It has engine levers for both engines with OFF, IDLE and FLIGHT marked positions.

Fuel system

The system has two independent suction fuel system with cross feed capability. Both has a fuel tank with check valve and tank drain, engine-driven fuel pump, fuel control valve and a prime solenoid/valve. The amount of fuel can be monitored by fuel quantity indicator and there's a low fuel caution light for both system on the annunciator panel. Each tank has 140.6-gallon fuel capacity.

The fuel system can be controlled by the Engine Control Quadrant positioning the fuel selector levers. Each fuel selector lever has OFF, DIRECT, PRIME and CROSSFEED position. In OFF position the engine has no connection with the tank, in DIRECT the engine is connected to the corresponding tank, in PRIME engine has connection with the corresponding and the other tank via prime/solenoid valve, in CROSSFEED the engine is connected to the other tank.

Rotor system

Four-blade articulated main rotor with one-piece aluminum hub and elastomeric bearings. Main rotor blades with titanium spars, fiberglass skins and honeycomb cores. Single bifilar vibration suppression system. Nose mounted vibration absorber, provision for main rotor tracker and tail rotor balancer. There's a four-blade flex-beam tail rotor installed. The blades are pressurized for maximum structural integrity.

Transmission system

The system consists of three gear boxes with associated shafting which transmit engine torque to the main gear box. Each engine connected to the main gear box. The main rotor drive shaft, to which the main rotor system is attached extends from the main gear box. A drive shaft extends from the main gear box to the intermediate gear box which is connected to the tail rotor gear box with shafting. An accessory drive section installed to the rear of the main gear box drives first and second stage hydraulic pumps, two main gear box oil pumps, the main gear box oil cooler and the AC generator.

Airframe

Nose mounted random, heated glass windshields with windshield wiper and washer. Pilot and Copilot seats with 5 points restraint harness. Two electric hinged cockpit doors left and right-side hinged cabin doors with electric door locks and single action door release. 204 cubic foot cabin with fittings for up twelve seats. Separate baggage compartment with dual lockable doors.

Electrical system

The DC power source provided by a 37 amp/hour 24 DC volt NiCad battery, two engine-mounted 28 DC volt generator and external power supply with overvoltage protection. Normally No.1 DC generator provides No.1 DC primary bus, essential bus and battery bus also charging the battery. No.2 DC generator feeds No.2 DC primary bus and inverter. If one DC generator fails, the operational will supply DC power to all system. Caution lights and an optional volt/amp gauge are used to monitor the DC power system operation. The AC power is provided by a 115 AC volt 3-phase 400Hz MGB driven generator and a 600 VA static inverter fed by 28 DC. The AC generator and inverter outputs are connected to the AC primary bus contactor feeding the AC No.1 primary, AC No.2 primary buses and two 115 AC volt/26 AC volt transformers. The two transformers provide 26 AC volt for No.1 and No.2 26 AC volt buses. Caution lights are used to monitor the AC power system operation. Both systems have circuit breakers to protect electrical devices against circuit overvoltage.

Hydraulic system

The system has four independent subsystems. The first and second-stage systems are to provide hydraulic actuation of the flight controls. The second stage also provides power to the utility system. Utility system includes landing gear extend/retraction system, pedal damper and nose vibration absorber. The first and second stage systems are electrically interconnected, so that one system malfunction occur the other cannot be shut off. The wheel brake system has independent hydraulic system to provide hydraulic pressure to wheel and parking brake. The fourth subsystem provides pressure for rotor brake.

Fire protection system

Fire protection includes a fire detection and indicating system, an electrically controlled fixed fire-extinguisher system for each engine, and a smoke detector for the baggage compartment. The engine fire detection system uses photocell flame detectors that sense infrared radiation of light, such as flame and cause the proper warning lights to illuminate. In addition, an audible warning signal notifies the crew of a fire. Smoke detection is provided by a smoke detector in the baggage compartment.

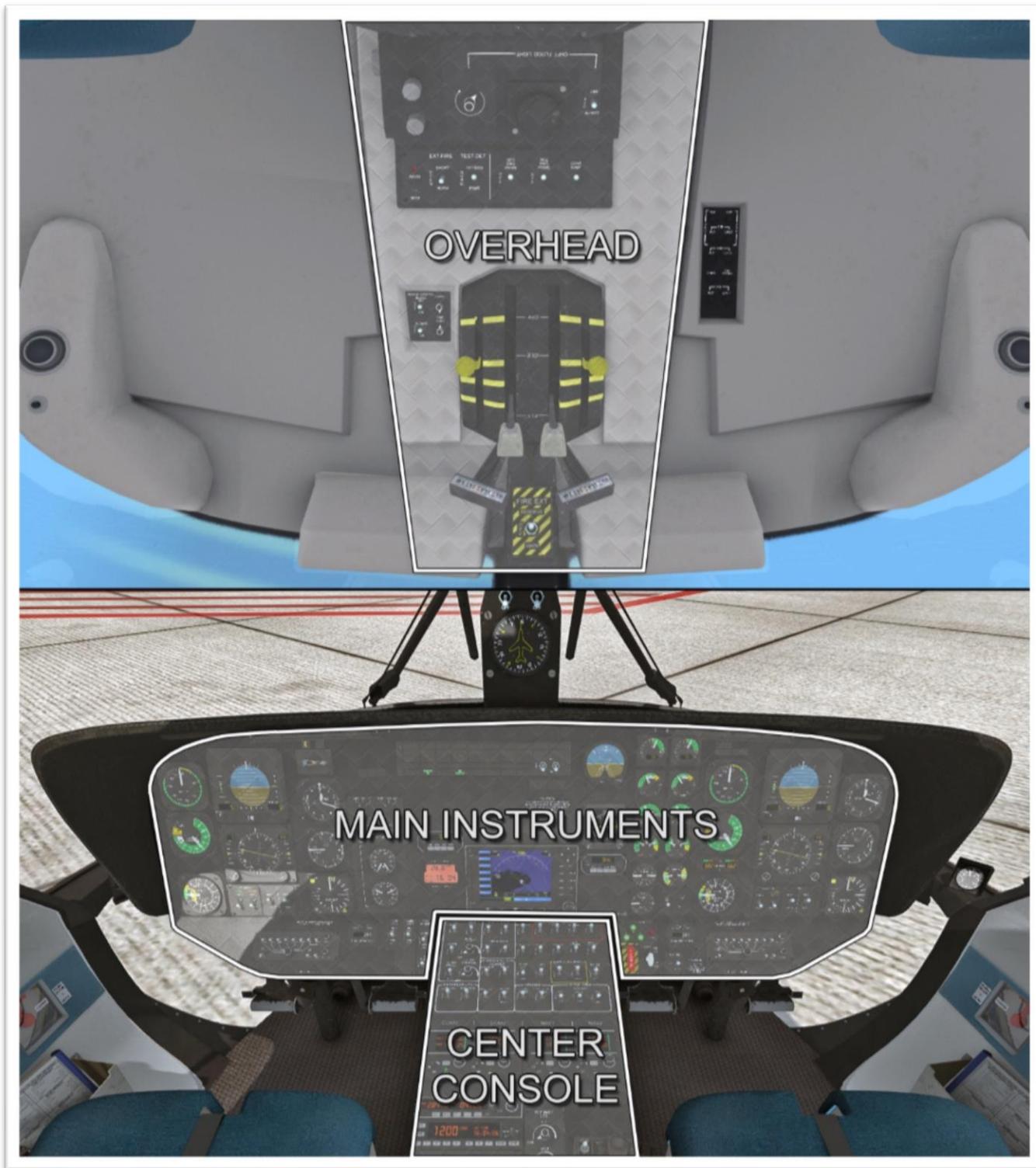
The detector is located on the forward aft bulkhead, just inside the left baggage compartment door. Engine fire-extinguishing capability is provided by two pressurized fire extinguisher bottles containing both a fire extinguishing agent and a propellant. A cross-feed system allows the use of both bottles for a fire in either engine compartment.



Specifications

| | |
|----------------------------------|---------------------|
| Engine: | Allison 250 C30S |
| Takeoff power: | 650shp / 485kw |
| Max continuous: | 557shp / 415kw |
| Rotor Main rotor blade number: | 4 |
| Main rotor diameter: | 44.00ft / 13,41m |
| Tail rotor diameter: | |
| Tail rotor blade number: | 4 |
| Dimensions Fuselage length: | 43,37ft / 13,22m |
| T/R turning length: | 45,20ft / 13,78m |
| Fuselage width: | 7ft / 2,13m |
| Widest point width: | 10,00ft / 3,05m |
| Landing gear width: | 8,46ft / 2.58m |
| Height top, tail fin: | 11,75ft / 3.58 |
| Height top, TR arc: | 11,48ft / 4,42m |
| GR clearance, fuselage: | 1,00ft / 0,30m |
| GR clearance, T/R guard: | 6,50ft / 1,98m |
| Accommodations: | 2 + 12/13; 2 + 4 |
| Weights Max gross: | 10,500lb / 1763kg |
| Empty: | 5930lb / 2690kg |
| Useful load: | 4570lb / 2073kg |
| External load: | 3300lb / 1497kg |
| Gross with external load: | 10,500lb / 4763kg |
| Endurance Std fuel, no reserves: | 3,5 hrs. |
| Average fuel consumption: | 77-85gph,291-332lph |
| Range Max fuel: | 404nm / 749km |
| Max payload: | 404nm / 749km |
| Aux fuel, no reserves: | 462nm / 1042km |
| Performance Service ceiling: | 14,100 ft / 4310m |
| HIGE: | 2400ft / 732m |
| HOGE: | 1200ft / 366m |
| ROC, oblique: | 1350fpm / 411m/min |
| Econ cruise, S/L: | 135kts / 250km/h |
| VNE: | 155kts / 187km/h |

Cockpit Layout



Main Panel



- | | |
|--|--|
| 1. Backup attitude | 13. Airspeed (knots) |
| 2. Bearing indicator | 14. Torque indicator I and II |
| 3. Distance measuring equipment | 15. T5 temperature repeater |
| 4. N1 tachometer (RPM) | 16. Triple tachometer (% - rotor and engines) |
| 5. Lower temperature (T5) indicators | 17. Main attitude indicator |
| 6. Fuel flow meter (pound per hour) | 18. Horizontal situation indicator (HSI) |
| 7. Engine oil temperature (C°) and pressure (PSI) | 19. Bearing source selectors |
| 8. Hydraulic pressure (PSI) | 20. HSI source selectors (NAV1, NAV2, GPS) |
| 9. Transmission oil temperature (C°) and pressure (PSI) | 21. Barometric altimeter (feet) |
| 10. Main fuel tank (x100 pounds) | 22. Vertical speed indicator (feet per minute x1000) |
| 11. Fuel gauge test | 23. Radio altimeter |
| 12. Landing gear, fire warning and caution advisory lights | 24. Landing gear system |
| | 25. HSI fault test |
| | 26. Pilot's audio panel |

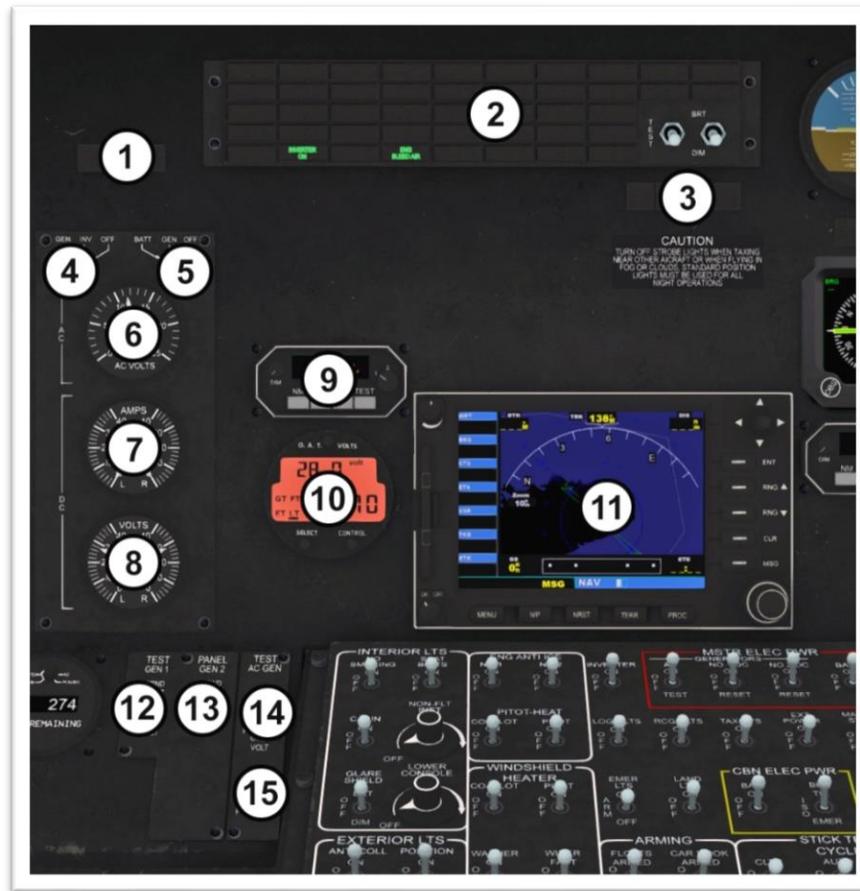
The bearing indicator (2.) consists of two needles. The source for these needles can be selected with the bearing source switches (19.) under the HSI indicator. Both needles can be set to either show the ADF bearing or individually the yellow for the NAV2 bearing and the green for the NAV1 bearing. The values of the selected bearings are also indicated on the top left and right corners of the display when signal is present.

By default, the distance measuring equipment (3.) shows the distance to the selected NAV source (NAV1 or NAV2) that is set with the small source selector knob. It can also be set to indicate the estimated time to the destination transmitter or waypoint; or the ground speed with the buttons below the screen.

The main attitude indicator (17.) has two small displays on the bottom right and left corners of the instrument. The left shows the value of the preset decision height (DH) that is set on the radar altimeter gauge (23.) The right shows the value of the measured distance to the surface below the aircraft. The small green arrows on the left indicate the tendency of descend or ascend. The scale on the bottom is the localizer deviation indicator and the scale on the right side is the glide slope deviation indicator.

The Horizontal Situation Indicator (18.) consists of the main compass with the course deviation indicator and heading marker, the distance to waypoint indicator on the top-left corner, the course indicator on the top-right corner, the glide slope indicators on both sides of the compass, and the heading marker and course selector knobs on the bottom of the instrument. The indicated NAV source can be selected with the NAV source selector switches (20.) below the HSI indicator.

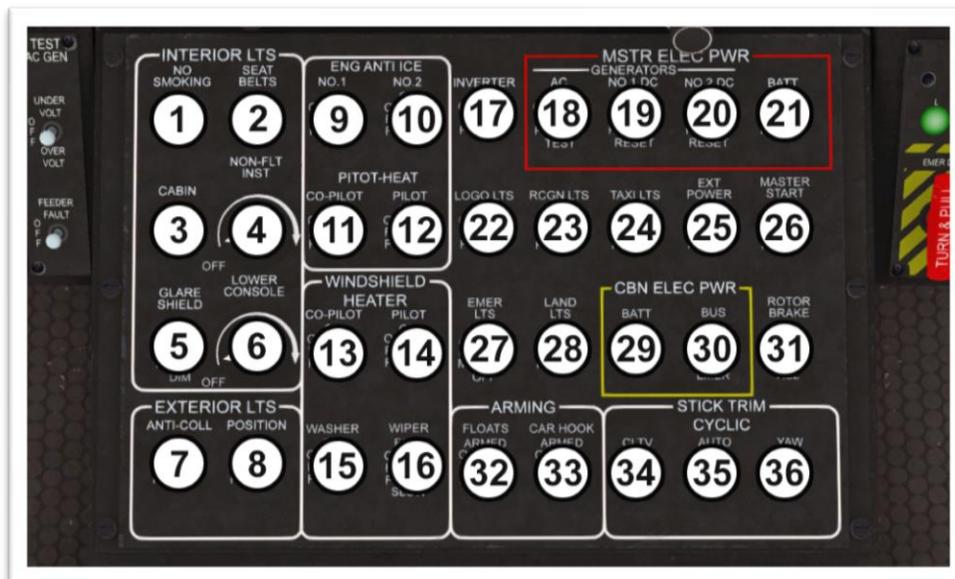
The landing gear control consists of the main landing gear lever, the landing gear position indicator lights, the emergency extension lever and the system movement (unlocked) indicator light. The emergency extension lever pulls the landing gears down with the force of gravity and locks them into the extended position after which the landing gears cannot be retracted. The unlocked indicator light indicated that the gears are between the retracted and extended positions.



- | | |
|---|-----------------------------|
| 1. Landing gear, fire warning and caution advisory lights | 8. DC voltmeter |
| 2. Caution and advisory lights | 9. DME |
| 3. ADF and HSI radio malfunction lights | 10. Chronometer |
| 4. AC system selector | 11. GPS |
| 5. DC system selector | 12. DC generator No.1 test |
| 6. AC voltmeter | 13. DC generator No.2 test |
| 7. DC ammeter | 14. AC generator test |
| | 15. AC generator input test |

The chronometer (10.) is a multi-purpose indicator. On the top row it shows either the outside air temperature or the DC bus voltage. The bottom row can be configured with the SELECT button to show the GMT, the local time, the estimated time to waypoint and the current flight time. The CONTROL button reset the flight time counter.

Center Console - Switchboard



- | | |
|---------------------------------|-----------------------------|
| 1. No smoking sign | 18. AC generator |
| 2. Fasten seat belts sign | 19. DC generator I. |
| 3. Cabin lights | 20. DC generator II. |
| 4. Non-flight instrument lights | 21. Battery |
| 5. Panel lights | 22. Logo lights |
| 6. Panel lights | 23. Recognition lights |
| 7. Anti-collision lights | 24. Taxi lights |
| 8. Position lights | 25. External power |
| 9. Engine I. anti-ice | 26. Master starter switch |
| 10. Engine II. Anti-ice | 27. Emergency lights |
| 11. Copilot's pitot heater | 28. Landing lights |
| 12. Pilot's pitot heater | 29. Cabin battery |
| 13. Copilot's windshield heater | 30. Bus tie |
| 14. Pilot's windshield heater | 31. Rotor brake |
| 15. Windshield washer | 32. Float system ARM (INOP) |
| 16. Windshield wiper | 33. Cargo hook (INOP) |
| 17. Inverter | 34. (35-36) Trims (INOP) |

Center Console - Radios



- | | |
|-------------------------|---|
| 1. Com radio I. | 7. AFCS (Automatic Flight Control System) |
| 2. Com radio II. | 8. AFCS mode indicator |
| 3. Navigation radio I. | 9. Audio panel |
| 4. Navigation radio II. | 10. Instrument lights |
| 5. ADF radio | 11. Door status indicators |
| 6. Transponder | 12. Servos ON/OFF |

The NAVCOM radios (1.-4.) can be turned ON and switched OFF with the small ON/OFF knobs. The standby frequencies can be set with the frequency setting knobs on the bottom-right corners of the instruments. The large knobs set the whole MHz and the small set the fraction of a MHz. The active and standby frequencies can be swapped with the small white swapper buttons.

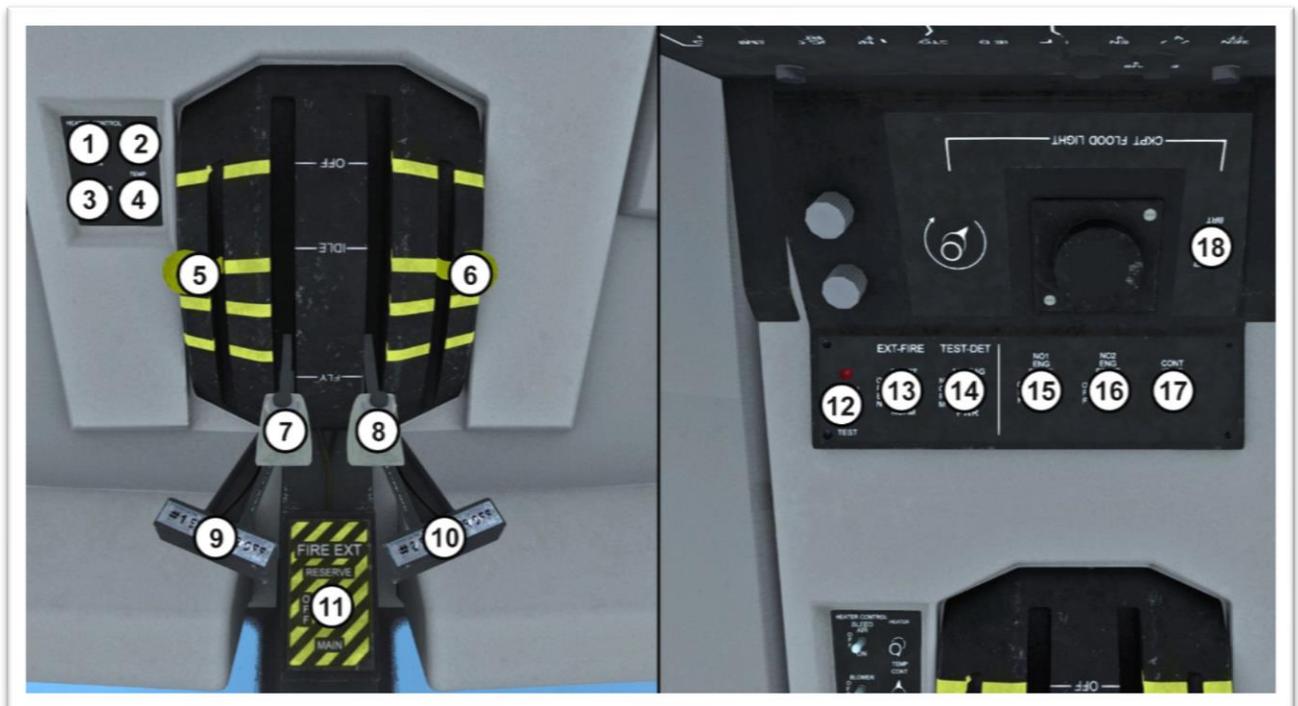
On the ADF radio (5.) the frequency of the Non-Direction Beacon (NDB) transmitter can be set with the frequency setting knobs on the right side of the instrument. This instrument also shows the estimated arrival time to the transmitter and the current flight time. These functions can be selected with the ET and FLT buttons. The SET button resets the flight time counter.

The squawk code can be set on the transponder (6.) with the numeric buttons after pressing the SET button on the instrument then pressing the SET again to confirm. The VFR button activates the 1200 VFR squawk code regardless of what was preset.

Unlike the real one, the AFCS system (7.-8.) in this add-on has a very limited functionality and works only in P3D. It can hold heading and vertical speed as well as altitude but cannot hold more difficult patterns governed

by flight directors. It can also auto-hover to a certain degree. Pressing the AP button midflight activates the autopilot which is indicated with a green light on the button. Upon activation the AFCS holds the current input values that are on the flight instruments. For instance, if the aircraft is in a descend with a particular vertical speed when the AP button was pressed then it tries to hold that value. The pitch can be adjusted manually in this mode and the AP tries to hold the pitch value that is adjusted with the cycle. The SAS/ATT button holds the current altitude. Pressing the AP button again disengages the AFCS system and resets the values to zero. The ADCS can be activated with the default P3D autopilot engage/disengage key and the SAS/ATT function can be activated with the default altitude P3D hold key.

Overhead Panel



- | | |
|---------------------------------------|--|
| 1. Cockpit heater bleed air | 11. Fire extinguisher system selector |
| 2. Cockpit heater temperature control | 12. Fire extinguisher system test and warning waring test lights |
| 3. Cockpit fan | 13. Fire extinguisher test mode selector |
| 4. Cockpit heater strength | 14. Fire detector test |
| 5. Engine No.1 fuel selector | 15. Engine No.1 fuel prime pump |
| 6. Engine No.2 fuel selector | 16. Engine No.2 fuel prime pump |
| 7. Engine No.1 control lever | 17. Continuous ignition |
| 8. Engine No.2 control lever | 18. Panel lights |
| 9. Engine No.1 emergency shutoff | |
| 10. Engine No.2 emergency shutoff | |

The engine levers on the engine control quadrant are connected to the fuel control by mechanical linkage. The quadrant has three marked positions: OFF; IDLE and FLY. Detents at each position indicate proper positioning of the levers. The engine levers schedule fuel flow and gas producer speed in the OFF to GRD IDLE range and establish the N1 speed limit for maximum engine power in the FLY position. In addition to the manual positioning, the levers also move into the OFF position when the fire extinguisher T-handles are pulled. A starter button is integrated onto the grip of both levers.

Procedures

ENGINE START

| | |
|---|--------------------|
| 1. Parking Brake | SET |
| 2. Flight Control Servo Switches | CENTERED |
| 3. Landing Gear Handle | DOWN |
| 4. Landing Gear Emergency T-Handle | IN |
| 5. Battery, Generators and Inverters, Bus-tie | ON |
| 6. Master Start Switch | ON |
| If External power available: | |
| a. External Power connector door | OPEN |
| b. External power connector | CONNECT |
| c. External power | ON |
| 8. Beacon light, exterior lights | ON, AS REQUIRED |
| 9. Arming Switches (float and cargo hook) | OFF |
| 10. Remaining Switches | AS DESIRED |
| 11. Rotor Brake | RELEASE |
| 12. AFSC Switches | OFF |
| 13. Caution / Advisory Panel | PRESS-TO-TEST |
| 14. Caution and Warning Lights | CHECK |
| 15. Landing Gear | CONFIRM LIGHTS ON |
| 16. Fuel | QUANTITY NOTED |
| 17. Circuit-Breaker Panels | CHECK |
| 18. Fire Detector and extinguisher System | TEST |
| a. Fire extinguisher test mode switch | OPEN |
| b. Engine No.1 and No.2 fire, emergency off and warn lights | CHECK, ILLUMINATE |
| c. Fire extinguisher select switch | MAIN, then RESERVE |
| d. Fire test light | CHECK, ILLUMINATE |
| e. Fire extinguisher select switch | OFF |
| f. Fire extinguisher test mode switch | NORM |
| g. Engine No.1 and No.2 fire, emergency off, test and warn lights | CHECK, GOES OUT |
| 19. Prime switches | OFF |
| 20. Engine control levers | OFF |
| 21. Fuel selector levers | XFEED |
| 22. Engine emergency shut off levers | FORWARD |
| 23. Engine No.1 | START |

| | |
|---|------------------------|
| 24. Oil Temp & Pressure | NOTE |
| 25. DC Gen No.1 caution light | CHECK, GOES OUT |
| If External power was used: | |
| a. External Power | OFF |
| b. External power connector | DISCONNECT |
| c. External power connector door | CLOSE |
| 26. Rotor Brake | OFF |
| 27. Transmission Oil & Hydraulic Systems | NOTE |
| 28. Engine No.1 control lever | IDLE |
| 29. Flight Control and Servo System | CHECK |
| 30. Engine No.1 control | FLY |
| 31. Engine No.2 | START |
| 32. Oil Temp & Pressure | NOTE |
| 33. DC Gen No.2 caution light | CHECK, GOES OUT |
| 34. Engine No.2 control lever | IDLE |
| 35. No.2 Engine Lever | FLY |
| 36. Fuel selector Levers | DIRECT |
| 37. AC Gen Caution Light | CHECK, GOES OUT |
| 38. Engine Anti-Ice | AS REQUIRED |
| 39. Baggage Compartment Smoke Detector | TEST |
| 40. Climate Control | SET |
| <u>TAXI</u> | |
| 1. COM / NAV / Transponder | SET |
| 2. Altimeter | SET |
| 3. Heading Bugs / Course Selectors | SET |
| 4. Doors | SECURE, LOCKED |
| 5. Parking Brake | OFF |
| 6. Flight Instruments | CHECKED |
| <u>TAKEOFF</u> | |
| 1. Power Assurance | AS REQUIRED |
| 2. Fuel Selector, engine control, emergency shut off levers | DIRECT / FLY / FORWARD |
| 3. Engine anti ice | AS DESIRED |
| 4. Cautions & Advisories | CLEAR OR NOTED |
| 5. Temp's and press' | NOTED |
| 6. Fuel Quantity | NOTE |

CLIMB

- | | |
|--------------------------|----------------|
| 1. Landing Gear | CONFIRM UP |
| 2. Remaining Switches | AS DESIRED |
| 3. Cautions & Advisories | CLEAR OR NOTED |
| 4. Temp's and Press' | NOTED |
| 5. AFCS | AS DESIRED |

LANDING

- | | |
|---|------------------------|
| 1. Fuel Selector, engine control, emergency shut off levers | DIRECT / FLY / FORWARD |
| 2. Engine anti ice | AS DESIRED |
| 3. Remaining Switches | AS DESIRED |
| 4. Cautions and Advisories | CLEAR OR NOTED |
| 5. Temp's and Press' | NOTED |
| 6. Landing Gear | DOWN |
| 7. Parking Brake | AS DESIRED |

PRE-SHUTDOWN

- | | |
|---|------------------|
| 1. Flight Controls | Neutral, Down |
| 2. Parking Brake | SET |
| 3. AFCS | OFF |
| 4. Radios | OFF |
| 5. Engine control levers | IDLE |
| 6. Cool Down Complete, Engine control levers | OFF |
| 7. Rotor Brake | AS DESIRED |
| 8. Remaining control lever (If Applicable) | OFF |
| 9. Exterior lights, navigation light | OFF |
| 10. Master Start Switch | OFF |
| 11. DC Gen No.1, No.2, AC Gen, Inverter and Bus Tie | OFF |
| 12. Fuel selector levers | OFF |
| 13. Overhead Switches | SET, OFF, NORMAL |



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