EUROPEAN AVIATION SAFETY AGENCY

EXPERT DEPARTMENT / CERTIFICATION DIRECTORATE



Operational Evaluation Board Report

Final Report : 26 02 2015

Manufacturer: Sikorsky Aircraft Corporation

S76D

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S76D



Revision Record

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Executive Summary

Manufacturer Application

Sikorsky Aircraft Corporation applied July 2013 to EASA, Certification Directorate for an OEB evaluation of the Sikorsky S76D helicopter.

Scope of the evaluations

The OEB report addresses mainly :

- Aircraft Type Designation and Pilot License Endorsement;
- Full Type Rating course;
- Differences Training Course from S76C+ /C++ to S76D;

Team Composition and Regulatory Framework

Both, Captain Roel Huysmans (EASA) and Captain Patrick Domenech (DGAC / France) have made a Training Program evaluation - Test “T5” for the S76D. This test leads the full type rating course with no credit for prior experience (new aircraft and new type rating).
In addition T2 and T3 Tests have been performed to evaluate the differences training from the S76 C+ / C++ helicopter to the S76D.
Those evaluations have been done at Flight Safety International –West Palm Beach being the training provider for Sikorsky Aircraft Corporation for the theoretical and FSTD’s part, and the flight phase have been conducted in Sikorsky Facilities in West Palm Beach Florida.

EASA /OEB Section Rotorcraft Manager Jean-Marc Sacazes in close cooperation with David Carew the S76 Airworthiness Certification Manager and Rami P. Helou the Globalization & Sustainment Manager at Sikorsky Aerospace Services have participated actively to this Operational Evaluation Board (Refer also to the list of experts page 6).

EASA conducted this evaluation in accordance with EASA Air Operations and Air Crew requirements. This evaluation was based on CS-FCD.

Abbreviations / Acronyms

AC	Alternating Current
ACOC	Air-Cooled Oil Cooler
ADU	Air Data Unit
AEO	All Engines Operative
AFCS	Automatic Flight Control System
AGB	Accessory Gear Box
AHRS	Attitude and Heading Reference System
ALT	Altitude
ALTP	Altitude Pre-select
AMC	Acceptable Means of Compliance
AMLCD	Active Matrix Liquid Crystal Display
APCP	Auto Pilot Control Panel
ATH	Approach to Hover
ATT	Attitude
AVC	Active Vibration Control
ATR	Additional Type Rating
AWG	Audio Warning Generator
CAS	Crew Alerting System
CCD	Control Cursor Device
CDS	Cockpit Display System
CFR	Code of Federal Regulations
CLTV	Collective
CPD	Common Procedure Document
CVFDR	Cockpit Voice Flight Data Recorder
DAU	Data Acquisition Unit
DC	Direct Current (electrical)
DCEL	Deceleration
DTM	Data Transfer Module
DU	Display Unit
EASA	European Aviation Safety Agency
ECS	Environmental Control Unit
EDU	Electronic Display Unit
EGPWS	Enhanced Ground Proximity Warning System
ENG	Engine
EOP	Engine Oil Pressure
EOT	Engine Oil Temperature
EPAC	Engine Power Assurance Check
EU	Electronic Unit
FAA	Federal Aviation Administration
FADEC	Full Authority Digital Engine Control
FAR	Federal Airworthiness Regulation
FCLS	FADEC Control Load Shed
FD	Flight Director
FFS	Full Flight Simulator
FMA	Flight Mode Annunciator
FMS	Flight Management System

FMU	Fuel Metering Unit
FMV	Fuel Metering Valve
FNPT	Flight and Navigation Procedures Trainer
FTD	Flight Training Device
FOHE	Fuel-Oil Heat Exchanger
FSTD	Flight Simulation Training Device
FTO	Flight Training Organisation
GA	Go Around
GPM	Gallon Per Minute
HDG	Heading
HIP	Hover at Increased Power
HOV	Hover
HUMS	Health and Usage Monitoring System
IAD	Integrated Avionics Display
IBIT	Initiated Build In Test
IESI	Integrated Electronic Standby Instrument
IFR	Instrument Flight Rules
IEM	Interpretative and Explanatory Material
IGE	In Ground Effect
IGV	Inlet Guide Valve
IPS	Ice Protection System
IR	Instrument Rating
ITR	Initial Type Rating
JAA	Joint Aviation Authorities
JAR-FCL 2	Joint Aviation Requirements Flight Crew Licensing (Helicopter)
JAR-OPS 3	Joint Aviation Requirements Operations 3 (Commercial Air Transportation) (H)
JAR-FSTD	Joint Aviation Requirements -Flight Simulation Training Device
JOEB	Joint Operational Evaluation Board
LDP	Landing Decision Point
MCDU	Multifunction Control and Display Unit
MCL	Master Caution Light
MDR	Master Difference Requirements
MET-H	Multi Engine Turbine (Helicopter)
MFD	Multi-Function Display
MGB	Main Gear Box
MISC	Miscellaneous
MLG	Main Landing Gear
MTOM	Maximum Take Off Mass
MOP	Main Oil Pressure
MSA	Minimum Safe Altitude
MSG	Message
MWL	Master Warning Light
NAA	National Aviation Authority
N/A	Not Applicable
ND	Navigation Display
ODR	Operator Differences Requirements
OEI	One Engine Inoperative
OEB	Operational Evaluation Board
OFIB	Oil Filter Impeding Bypass
OPS	Flight Operations

OTD	Other Training Device
PCP	PFD Control Device
PF	Pilot flying
PFD	Primary Flight Display
PIC	Pilot in Command
PL	Power Limiter
PLI	Power Limiter Indicator
PM	Pilot monitoring
PMA	Permanent Magnet Alternator
PV	Priority Valve
RCP	Reconfiguration Control Panel
RFM	Rotorcraft Flight Manual
RPM	Revolution Per Minute
RGB	Reduction Gear Box
RNAV	Radio Navigation
SAR	Search and Rescue
STBY	Standby
SVS	Synthetic Visual System
TAP	Terminal Approach Plate
TAWS	Terrain Avoidance Warning System
TCAS	Traffic Collision Avoidance System
TDP	Take Off Decision Point
THR	Throttle
TOC	Top of Climb
TOD	Top of Descent
TRI	Type Rating Instructor
TRTC	Type Rating Training Course
TRTO	Type Rating Training Organisation
TQ	Torque
TST	Test
TT	Triple Tachometer
VBROC	Best Rate Of Climb speed
VCP	Virtual Control Panel
VFR	Visual Flight Rules
VHLD	Velocity Hold
VMM	Vehicle Monitoring Module
VNAV	Vertical Navigation
VTOSS	Take Off Safety Speed
VTOL	Vertical Take Off & Landing
VNE	Velocity Never Exceed
WCA	Warning Caution Advisory

Part-ARA Annex VI to Commission Regulation (EU) No 290/2012 of 30 March 2012 amending Regulation (EU) No 1178/2011 laying down technical requirements and administrative procedures related to civil aviation aircrew pursuant to Regulation (EC) No 216/2008 of the European Parliament and of the Council (as amended)

Part-ARO .... Annex II to Commission Regulation (EU) No 965/2012 of 05 Oct 2012 laying down technical requirements and administrative procedures related to air operations pursuant to Regulation (EC) No 216/2008 of the European Parliament and of the Council (as amended)

Part-CAT ..... Annex IV to Commission Regulation (EU) No 965/2012 of 05 Oct 2012 laying down technical requirements and administrative procedures related to air operations pursuant to Regulation (EC) No 216/2008 of the European Parliament and of the Council (as amended)

Part-FCL..... Annex I to Commission Regulation (EU) No 1178/2011 of 3 November 2011 laying down technical requirements and administrative procedures related to civil aviation aircrew pursuant to Regulation (EC) No 216/2008 of the European Parliament and of the Council (as amended)

Part-ORA..... Annex VII to Commission Regulation (EU) No 290/2012 of 30 March 2012 amending Regulation (EU) No 1178/2011 laying down technical requirements and administrative procedures related to civil aviation aircrew pursuant to Regulation (EC) No 216/2008 of the European Parliament and of the Council (as amended)

Part-ORO ..... Annex III to Commission Regulation (EU) No 965/2012 of 05 Oct 2012 laying down technical requirements and administrative procedures related to air operations pursuant to Regulation (EC) No 216/2008 of the European Parliament and of the Council (as amended)

Part-SPA ..... Annex V to Commission Regulation (EU) No 965/2012 of 05 Oct 2012 laying down technical requirements and administrative procedures related to air operations pursuant to Regulation (EC) No 216/2008 of the European Parliament and of the Council (as amended)

I. Purpose and applicability

Data is being submitted by Sikorsky Aircraft Corporation in support of the OEB process.

This report is the result of an OEB evaluation on **Pilot Type Rating Training syllabus for the S76D** provided by Flight Safety International and Sikorsky.
In addition operator difference tables (ODR) provided by the manufacturer include a comparison between S76D and S76 C+ / C++ in order to evaluate differences training.

The OEB recommends for approval by NAAs:

- Aircraft Type Designation and Pilot License Endorsement;
- S76D - Full Type Rating course;
- Differences Training Course from S76C+ /C++ to S76D.

2. General Description of the S76D & S76C+/C++

General

Fleet Background:

The S76 is a twin-engine, single main rotor helicopter designed to carry up to 13 passengers and a pilot. Special equipment allows for extended overwater flight, transportation of external cargo, and hoist operations. Flight controls and instrumentation allow for a second pilot station as required

The four blades, midsized helicopter was designed for use in a variety of roles incorporating high performance and long range versatility. The helicopter is capable of carrying cargo and passengers in a variety of environments, including day and night VFR and day and night IFR.

The S76A is powered by two ALLISON C-30S engines, providing 650 SHP per engine at maximum continuous power; The S76A is certificated for a maximum gross weight of 10 500 pounds (4 763 kg)

The S76A+ utilizes the same basic airframe as the S-76A, but is powered by two TURBOMECA ARIEL 1S engines, rated at 701shp, de-rated to 650shp for dual-engine continuous operation. The S76A+ is certificated for a maximum gross weight of 10 800 pounds (4 898 kg)

The S76B is powered by two Pratt & Whitney of Canada PT6B-36 engines. The PT6B-36 engines provide an increase of 491 SHP(dual-engine), 320 horse power (minimum single engine), and a gross weight of 11 700 pounds (5 307 kg)

The S76C utilizes the same basic airframe as the S-76B, but is powered by two TURBOMECA 1S1 engines rated at 725 SHP for dual-engine continuous operation. The S76C is certificated for a maximum gross weight of 11 700 pounds (5 307 kg)

The S76C+ utilizes the same basic airframe as the S-76C, but is powered by two TURBOMECA 2S1 engines rated at 856 SHP horse power for dual-engine take-off operation. The S76C+ is certificated for a maximum gross weight of 11 700 pounds (5 307 kg)

The S76C++ utilizes the same basic airframe as the S-76C, but is powered by two TURBOMECA 2S2 engines rated at 922 SHP horse power for dual-engine take-off operation. The S76C++ is certificated for a maximum gross weight of 11 700 pounds (5 307 kg)

The S76D utilizes the same basic airframe as the S-76C++, but is powered by two P&W 210S engines rated at 1123 SHP horse power for OAI 30-sec power operations. The S76D is certificated for a maximum gross weight of 11 875 pounds (5 386 kg)

Structure

The helicopters structure consists of:

- Doors
- Fuselage
- Vertical stabilizer
- Tail cone
- Fairings
- Windows

Many materials are used in the construction of the S-76D fuselage and stabilizers. These includes:

- Kevlar sheet
- Kevlar honeycomb
- Sheet aluminium
- Aluminium honeycomb
- Fiberglass honeycomb
- Polyamide
- Fiberglass sheet
- Graphite/Kevlar

The S-76D has all composite main rotor blades.

The doors and major access panels are made of Kevlar honeycomb. The fuselage is made primarily of aluminium honeycomb. Most fairings are made of Kevlar sheet. The tail cone and leading edge of the vertical stabilizer are sheet aluminium over aluminium frames. The horizontal stabilizer is made of graphite, Kevlar, and honeycomb.

All windows are made of single-pane acrylic plastic with the exception of the glass heated windshield.

Landing Gear

The Fully retractable tricycle landing gear consists of a 360° swivelling nose wheel assembly and two main landing gear assemblies, which form a shock absorbing three-point support for landing and ground operations.

Hydraulic power from the second-stage hydraulic pump is used to extend and retract the landing gear. When retracted, doors close to cover the wheel wells, thus streamlining the aircraft. A pneumatic system is provided to lower the landing gear in case of a second-stage or utility system malfunction. All landing gear controls and position indicator lights are in the centre of the instrument panel.

Power Train

The power train is composed of the following components:

- Main Gear Box (MGB)
- Intermediate Gear Box (IGB)
- Tail Gear Box (TGB)
- Rotor Brake assembly
- Shafting, couplings and hangers

Main Gearbox

The MGB is housed within the main gear box pylon on the transmission deck. The MGB changes the angle of drive from the engines to the main rotor head. It also reduces engine rpm and provides the means to drive the tail rotor and main gear box accessories.
The MGB drives the following accessories:

- MGB oil cooler blower

- Two hydraulic pumps
- AC electrical generator
- Two gearbox lubrication pumps

Additional accessories mounted include a rotor brake and an accumulator/reservoir
Monitoring of the MGB is accomplished through temperature, pressure and chip indicating systems, and an Np/Nr display.

Intermediate Gear Box

The IGB at the base of the vertical stabilizer transmits torque and changes the drive angle of the tail drive shaft about 57°. It also reduces rpm from 3 491 to 3 370 rpm.
The IGB is equipped with a magnetic drain plug/chip detector/temperature sensor. The chip detector incorporates a fuzz burn-off feature that eliminates small particles that could give false indication.

Tail Gear Box

The TGB mounted at the upper end of the vertical stabilizer transmits torque and changes the angle of drive from the IGB to the tail rotor. The TGB reduces rpm approximately 50% from the input side to the tail rotor. It also provides a mount for the tail rotor servo and the pitch control mechanism for the tail rotor.
The TGB is equipped with a fuzz burn-off feature that eliminates small particles that could give false indications.

Rotor Brake System

The rotor brake system is available to keep the rotors from turning when the helicopter is parked and while starting the engines. It also assists in stopping the rotors after engine shutdown.

The rotor brake is hydraulically activated and the brake and disc assembly are bolted to the tail rotor drive shaft pick-off flange.

The manual rotor brake system consists of the following:

- Accumulator/reservoir and relief valve
- Master cylinder
- Rotor brake assembly
- Pressure switch
- WCA caution message

Main Rotor

The main rotor is composed of four rotor blades and rotor head hub assembly that incorporates blade dampers, spindles, elastomeric bearings, droop stops, and flap restraints. A swash plate on a spherical bearing is attached to the main rotor head to allow for control inputs from the hydraulic servos to reach the main rotor.

The bifilar vibration absorber on top of the main rotor absorbs 3-per rev vibrations prior to their transfer to the airframe.

The main rotor system consists of a fully articulated main rotor head. Components include the following:

- Four rotor blades
- Main rotor head assembly
- Swash plate
- Bifilar
- Active Vibration Control system (AVC)
- Main rotor controls

The blades are made of composite. The Kevlar tip cap is an integral part of the blade with a 29.75° sweep. This increases blade performance and reduces blade tip noise in forward flight. The blades are also equipped with a blade tracking wiring (RTB) system that determines the vibration levels of the aircraft.

Tail Rotor

The Tail rotor is composed with four blades, is mounted onto and driven by the tail rotor gearbox. The blades are constructed of Nomex and aluminium honeycomb cores that are covered with a graphite, fibreglass composite skin.

Flight controls

The conventional helicopter flight controls consist of a collective pitch lever and a cyclic control stick to control the main rotor and tail rotor pedals to control the tail rotor.

The cyclic and collective control systems position the swash plate of the main rotor head to control the main rotor blade pitch individually (cyclic) and collectively. The heading (direction) system controls pitch of the tail rotor blades.

The movement of the controls in the cockpit is transmitted mechanically through control rod and bell cranks to the mixer (upper deck controls). From the upper deck controls, the movement is transmitted by cables to the tail rotor servo.

The two-stage hydraulic servo system actuates the rotor system and eliminates feedback through the flight controls

Collective and cyclic trim and a force gradient system permit trimming of the controls and provide a reference point for the Automatic Flight Control System (AFCS).

The AFCS provides a fully coupled four-axis flight control system.

Servo Control System

Servo actuators are dual stage hydraulically powered cylinders that transfer control movements to the main rotor stationery swash plate and the tail rotor pitch change beam shaft.

Power Plant

The power plant system is composed of two Pratt &Whitney 210S, installed side by side aft of the main gear box.
The P&W 210S is a free-turbine turbo shaft engine. A dual channel Full Authority Digital Engine Control (FADEC) maintains engine output at desired power levels Output power is transmitted forward by a power shaft to a freewheeling unit in the main gear box. Each engine has a control lever (ECL) on the cockpit overhead engine control quadrant. The Control levers are connected electrically to the FADECs.

Fire Protection

The fire protection system includes a fire detection and indicating system, an electrically controlled fire extinguishing system for each engine, and a smoke detector for the luggage compartment. Flame detector cause the engine FIRE light to illuminate on the "FIRE CONTROL PANEL" and an aural alert in the headsets.

The S-76D utilizes a thermopile design flame detector that detects a hydrocarbon fire that flickers at a rate of 3 Hz. An audible aural alert warning system is also incorporated into the system to provide additional warning to the crew.

A smoke detector in the baggage compartment provides smoke detection. The detector on the forward bulkhead is just inside the left baggage compartment door.

Two pressurized fire extinguisher bottles provide engine fire extinguishing capability. The bottles contain a fire-extinguishing agent and a propellant. A cross feed system allows the use of both fire bottles for a fire in either engine compartment.

Portable fire extinguishers are provided for cabin fire.

Fuel system

The S76D has an engine suction fuel feed system that consists of the following;

- Two integral tanks
- Fuel vents
- Filler caps
- Drain lines
- Fuel selector valves
- Fuel supply lines
- Fuel quantity indicating system and fuel low-level warning system

Each engine has a complete fuel system a normally closed cross-feed system that permits engine operation from either fuel tank. The left tanks stores and normally supplies fuel to the N°1 engine, the right tanks stores and normally supplies fuel to the n°2 engine. The S-76D has approximately 142 gallons (537 litres) of usable fuel in each tank. The two integral fuel tanks are side by side below the baggage compartment.

Cockpit Layout

S76D

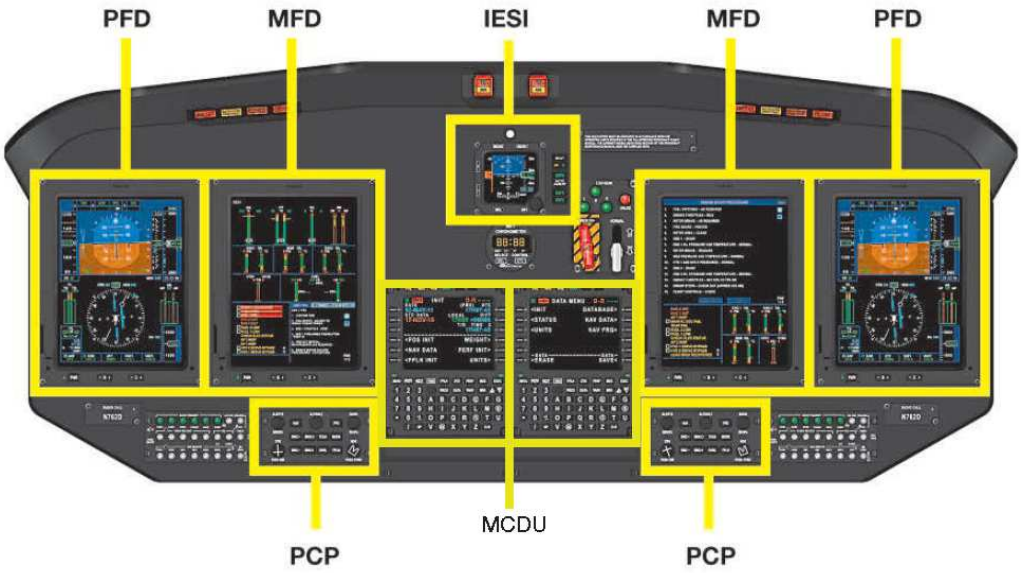


Core Avionic System

The Sikorsky S-76D is equipped with the Avionics System (AVS) and the Automatic Flight Control System (AFCS) that comprise the THALES Top Deck system. The avionics suite is a fully integrated system of display, control, navigation, communication, surveillance, and alerting system.

The Top deck system performs the following

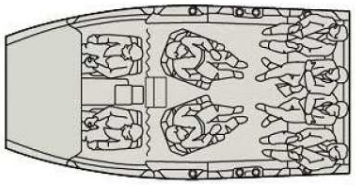
- Display of Primary Flight Data (PFD)
- Full autopilot functions
- Flight planning and navigation
- Radio management
- Enhanced situational awareness
- Surveillance of flight environment
- Monitor/Control of various aircraft systems
- Crew alerting
- Customer configurable normal procedures checklists
- Maintenance/trouble shooting data recording and post flight display
- avionics interface and data output to HUMS equipment



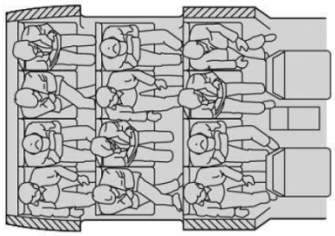
Cabin / Seating

The cabin has several seating possibilities. These include the executive and offshore configurations.

1. Executive seating is a standard 6-seat configuration



2. Offshore seating has a 12 seats



Hydraulic system

The helicopter has four independent hydraulic systems. The first and second stage systems provide the necessary to actuate the main rotor and tail rotor systems. Both the wheel brake and rotor brake hydraulic systems are self-contained and utilize hydraulic power for system activation.
The first and second stage systems, while hydraulically independent, work in parallel with each other and are electrically interlocked. They develop, distribute, and control hydraulic power to operate the flight controls via servo actuator. The Warning Caution Advisory (WCA) panel and the engine page display provide the pilot monitoring capability. The second stage also provides hydraulic power to the utility system, which includes the landing gear and a pedal damper/yaw trim actuator.

Electrical Power

The electrical system consists of both AC and DC power systems.

DC power

The DC power system provides electrical power from the battery, the generators, or an external power unit. A 24 volt battery provides engine starting and backup power.
Two engine mounted 28 VDC starter-generator furnish generator power. Either generator is capable of supplying DC power to all essential and primary buses.
An external power unit supplies external power for starting and system operation through a receptacle on the right aft fuselage.
DC power is distributed through seven DC buses. The master switch panel and circuit-breaker panel in the cockpit control and provide circuit protection for the DC electrical power. Caution lights on the WCA monitor the DC system operation.

AC power

The main AC generator is a 10 KVA generator driven by the main rotor at 107%. The AC generator supplies AC power for the windshield heating system, electronic unit of the Active Vibration System (AVC) weather radar. The main AC generator is on right side on back of the main gearbox.
AC power is distributed through a single AC Bus. The master switch panel in the cockpit provide control protection of the AC electrical power system. Caution lights on the WCA monitor the AC system operation.

Environmental Control System

The Air -Con heating and ventilation system consists of

- Engine bleed-air valves,
- A blower,
- Sound suppressor,
- Cabin and cockpit ducting
- Temperature sensors
- Cockpit heating and ventilation controls

The optional Freon air conditioning system by Keith Products, provides conditioned air for the cabin and cockpit. The air conditioning system intake and exhaust ducting is share with the heating and ventilation system.

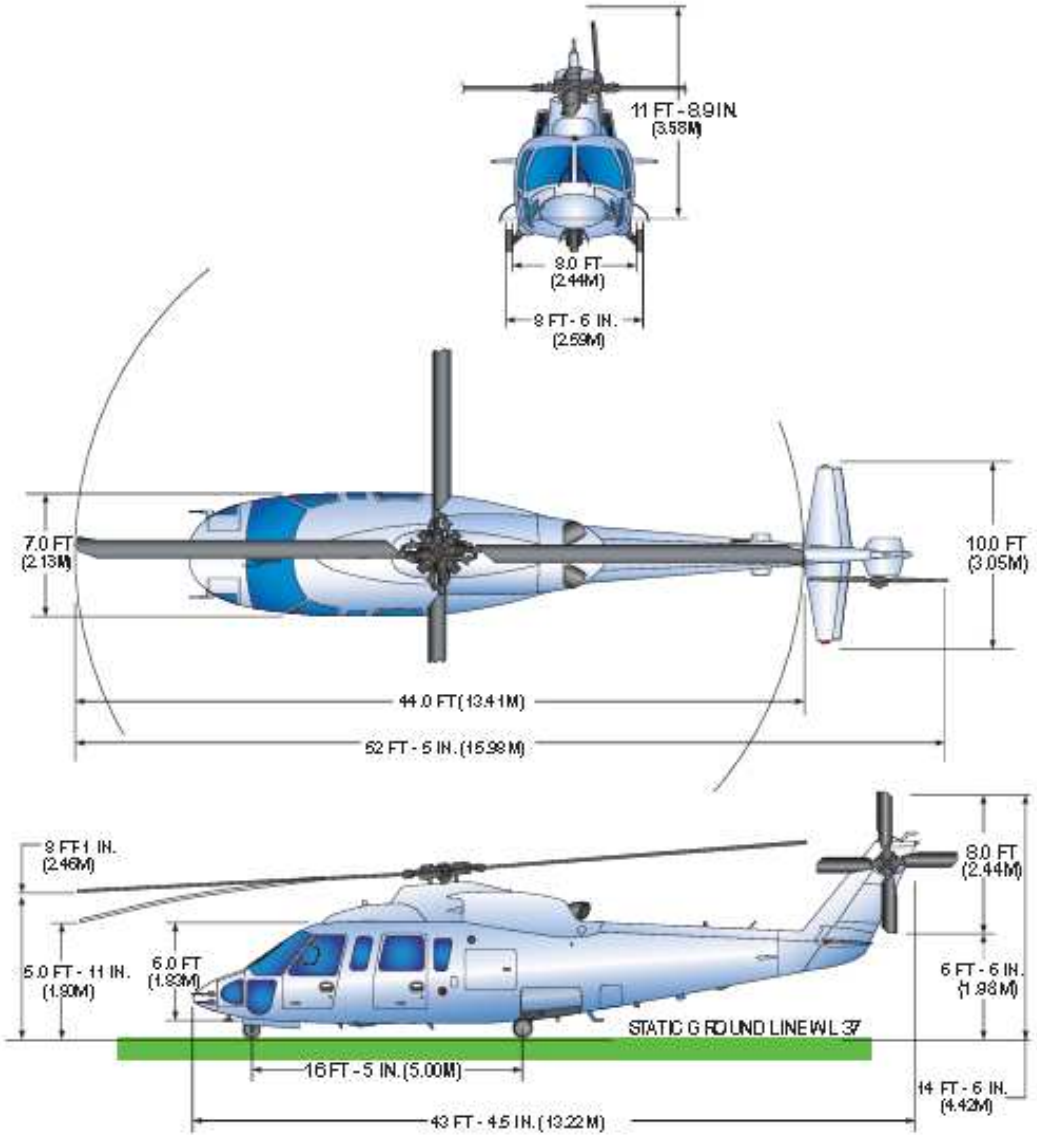
3. Aircraft main characteristics:

3.1 Sum up of main characteristics of the S76D and S76 C+ / C++

Reading mode; Column by column, from left to right side ⟶			**S76D**	**S76 C+ / C++**
Dimensions	Fuselage	Length (maximum)	15,98 m (52 ft)	identical
		Width	2,59 m (8ft)	identical
		Height	4,42 m (14ft)	identical
	Main rotor	Diameter	13,41 m (44ft)	identical
	Tail rotor		2,44 m (8ft)	identical
Number of Main Rotor Blades			4	identical
Minimum Flight Crew	VFR		1	identical
	IFR		2	1
Seating Capacity	Including Pilot Seats		14	identical
Engines			2	identical
Fuel tanks	*Usable fuel*		1128 lit	1084 lit
Air Speed	Power ON	Absolute VNE	155 KIAS	identical
	Power OFF		136 KIAS	identical
Rotor Speed	Power ON	AOE	106 to 108 %	identical
	Power OFF		91 to 115 %	identical
Maximum Operating	*En route altitude (Density altitude)*		10 000ft	15 000ft
MTOM with Internal load			5386 Kg	5307 Kg
MTOM with External load			11875 lbs	11 700 lbs
Category A see RFM Supplement	Density Alt	Clear Heliport	TBD	3000 ft
		VTOL operations	TBD	5000 ft

3.2 Exterior Dimension

S76D & S76C+ / C++



3.3 Differences between the S-76C++ and the S-76C+

Engine
S-76C++ engine upgraded to Turbomeca 2S2 from the Turbomeca 2S1 with greater horsepower.
Different N1, T5, fuel flow and oil limits.
Engine control was changed from a single channel DECU (S-76C+) to a dual channel FADEC (a Fully Authority DECU) (S-76C++).
S-76C++ can do power assurance check (PAC) in flight.
S-76C++ has single track control quadrant for the engine control levers (ECLs). Manual control of the engine is accomplished electrically with an overhead control switch in the cockpit. The S-76C+ engine is manually controlled by manipulating the ECL in a secondary track in the engine control quadrant.
One Engine Inoperative (OEI) 30-second usage is cumulatively counted on the Turbomeca 2S2 engine (the engine did not need to be replaced until the entire 30 seconds was used) whereas the 2S1 engine required replacement any time the 30-second limit used.

A barrier filter prevents FOD from entering the engine and allows the aircraft to be flown in fallowing and blowing snow. The S-76C+ does not have engine barrier filters.

Electrical
Lighter weight inverters for the S-76C++.
S-76C++ inverters power the 26VAC buses.

Fuel System
Turbomeca 2S1 fuel system uses a manual back up control; the Turbomeca 2S2 fuel system uses an electrical back up control system.

Note:
Difference of version S76C+ and S76C++ may be adequately addressed through self-instruction and FLM reading for those two variants, it is a familiarization training.

4. Operator Difference Requirement (ODR) Tables

Operator difference requirements are those operator specific requirements necessary to address differences between a base aircraft and one or more variants, when operating in mixed fleet flying, or when seeking credit in transition programs. ODRs include both a description of differences and a corresponding list of training, checking, and currency compliance methods which address pertinent OEB and regulatory requirements

Operator Difference Requirement tables have been produced by Sikorsky Aircraft Corporation to evaluate the training differences between the **S76D** and the **S76C+ / C++.**

5. Optional specific equipment

No optional specific equipment is provided nor taken into account requiring specific training at the time of the report

6. Master Difference Requirement (MDR) Tables

6.1 Difference Level Summary.

The Common Procedures Document (CPD) describes one acceptable method and guidelines for conducting an Operational Evaluation of an aircraft type or a variant certificated. As such the document offers an acceptable method for compliance with the intent of the applicable regulatory requirements.

The methods and guidelines presented in this document are not the only acceptable methods for ensuring compliance with the appropriate regulatory sections. Operators may use other methods if those methods are shown to provide the necessary level of safety and are acceptable to the regulatory authority.

Difference levels are summarised in the following table for training, checking, and currency. This table is an extract only and complete descriptions of difference levels for training, checking and Recent Experience/currency are given in OPS/FCL as Common Procedures for conducting Operational Evaluation Boards.

6.2 Training, Checking, and Recurrent Training difference requirements table

		From Helicopter	
		S76D	**S76 C+ / C++**
To Helicopter	**S76D**	**N/A**	**(D/D/D)**
	S76 C+ / C++	**(TBD)**	**N/A**

T2 and T3 Tests have been performed to evaluate the differences training between the S76D and the S76 C+ / C++ helicopter. OEB has concluded that the Master Differences Requirements are at levels D/D/D**.**

7. Type Rating List and Licence Endorsement List

The proposal of this OEB is to update the Type Rating List as following:

7.1 Type Rating List

- Type Rating List (Helicopters)

1 Manufacturer	2 Helicopter	3	4 Licence endorsement
Sikorsky			
-ME Turbine-	S76D	(D)	S76
	S76C+ S76C++		

8. Specification for Training

8.1.1 General

The Type Rating Training courses proposed by Sikorsky and Flight Safety International for the S76D and the differences training courses from the S76C+/C++ to the S76D fulfilled the minimum requirements of EASA Air Crew- Part-FCL.
The assessment was based on the S76D, Pilot Initial and Additional, Type Rating Training syllabi, and the differences training courses from the S76C+/C++ to the S76D proposed by Sikorsky and Flight Safety International.

The OEB recommends pilot type rating training courses are divided into the following phases for approval in Approved Training Organizations (ATO) and also for operator specific training, provided the operator specific documentation is used throughout the course.

- Prerequisites for entry onto the specific course,
- Theoretical knowledge instruction syllabus and test summary including training devices (OTD),
- FSTD training courses (including either FFS or FTD),
- Helicopter flight training courses,
- Skill test.

8.1.2 Other Training Devise

Not available at the time of the draft report.

8.2 Course pre-entry requirements

All candidates must fulfil the requirements of Part-FCL.725 for the issue of class and type rating and those of PART-FCL.720.H (c), specific for the issue of an initial multi-engine, single or multi-pilot helicopter.

The OEB recommends the training organisations to distribute a list of the acronyms of systems of the S76 and pre learning files timely before the start of the course to enable candidates for this type-rating to become familiar with those acronyms and the location of systems in the cockpit.

Due to the complexity of the helicopter systems, the OEB recommends during the theoretical training phase, additional sessions in OTD, or similar devices to get a practical knowledge so as to better assimilate the complexity of systems more easily in particular FMS, EFIS environment, TCAS and TAWS.

8.3 Initial and Additional Type Rating

S76D Type Rating Courses are divided into two different training patterns:

- **ITR** courses are aimed to applicants for whom the S76D is the first Type Rating on a Multi-Engine Turbine (MET) helicopter.

- **ATR** courses are aimed to candidates who already have a Type Rating on a Multi-Engine Turbine helicopter or in multi-pilot operations and require the issuance of an additional Type Rating .

8.3.1 Initial Type Rating (ITR)

➢ Candidates for the Initial single-pilot S76D Type Rating must:

- Hold a valid Helicopter Pilot license,
- Hold a Single-Engine Piston or Turbine Pilot Type Rating
- Comply with the requirements set out in Part –FCL Subpart H – Section 1 & 3
- Have 70 Flight Hours as PIC
- Hold a Multi Engines Turbine pre-entry course.

➢ Candidates for the initial multi pilot S76D Type Rating shall, before starting flight training:

- have at least 70 hours as PIC on helicopters;
- except when the type rating course is combined with an MCC course:
  - hold a certificate of satisfactory completion of an MCC course in helicopters; or
  - have at least 500 hours as a pilot on multi-pilot aero planes; or

- have at least 500 hours as a pilot in multi-pilot operations on multi-engine helicopters;

- have passed the ATPL(H) theoretical knowledge examinations.

8.3.2 Additional Type Rating (ATR)

➢ Candidates for an Additional S76D Type Rating must:

- Hold a valid Pilot license,
- Hold a Multi-Engine Turbine Pilot Type Rating
- Comply with the requirements set out in Part FCL Subpart H – Section 1 & 3.

8.4 Initial and Additional Type Rating training minimum syllabus summary

8.4.1 Single Pilot Type Rating training minimum syllabus

- Single Pilot “IFR”

At the moment of the OEB report, the S76D is not certified for single pilot IFR operation.

- Single Pilot “VFR”

The official provider of training for SIKORSKY, doesn't provide a Single Pilot “VFR” course. The OEB team due to the complexity of the systems integration on the S76D, recommends to follow the same amount of theoretical training syllabus (see 8.5 paragraph) and flight training hours (see 8.6.1) paragraph, the IFR flight sessions will be replace by VFR sessions.

8.4.2 Multi Pilot Type Rating training minimum syllabus

The 8.5 paragraph and 8.6.1 paragraph summarise the minimum training hours required for an Initial and Additional Type Rating courses in Multi Pilot (MP) crew.

8.5 Theoretical knowledge syllabus and test summary

8.5.1 Initial and Additional Type Rating

Theoretical instruction should be provided in accordance with Part – FCL Subpart H – Section 1 – FCL.710, FCL 725 and AMC1 FCL.725(a) II
The following sections present a summary of the material for an Initial and additional Type Rating training program should consider. Whilst based on the programs. Training providers should ensure their type specific courses cover the pertinent material.

Note : If an initial type rating for a turbine powered aircraft is required, the candidate must first undergo a turbine engine course).

Initial and Additional Type Rating theoretical knowledge syllabus	S76D
Helicopter system	40 h 30
General Operational Subjects (Includes Load and Balance, Performance, Flight Planning, RFM/AOM/FCOM and CRM)(*)	4 h 30
Systems Integration (completed as part of Ground School)	9h00
Total Theoretical Knowledge Syllabus	54 h 00
Theoretical examination session	2h00
TOTAL	56 h 00

(*)Theoretical instruction elements can be covered during the ground training course and/or during flight training briefing phase.

On completion of the theoretical phase, the trainee is accessed via a multiple-choice questionnaire and *a* minimum of 100 questions is recommended covering the entire program either for Single or Multi pilot Training Course. To obtain the type rating, the threshold for passing is 75% of correct answers in the written examination on a range of multiple-choice or computerized questions.

The OEB recommends due to the complexity of the systems of the S76D, especially displays and systems integration, to better understand their function, to integrate a training device into the theoretical course. An OTD has to be used and if not available, upper level devises like FTD, FNPT, FFS or an equivalent way of cockpit training proposed by the training organizations such as the rotorcraft itself can be used. No credit towards flight training is given hereby.

Optional equipment or specific types of operation are not included in the minimum theoretical training syllabus and have to be added.

8.5.2 Difference Training between from S76 C+ / C++ to S76D for MULTI PILOT / IFR

Difference Type Rating theoretical knowledge syllabus	From S76 C+ / C++ to S76D
Helicopter systems	36 h 30
General Operational Subjects (Includes Load and Balance, Performance, Flight Planning, RFM/AOM and CRM)	4 h 00
Systems Integration (completed as part of Ground School,	7 h 30
Theoretical examination session	Recommended
Total Theoretical Knowledge Syllabus	48 h 00

8.6 Flight training course summary

8.6.1 Initial & Additional Type Rating - MULTIPILOT / IFR

Training Course	Initial Type Rating			Additional Type Rating		
Flight Simulation Training Device & Helicopter	**FFS & Hel. PF + PM**		**Hel only**	**FFS & Hel PF + PM**		**Hel. only**
SIM01 - Preparation and checks / Flight Manoeuvres / Post flight procedures	2H00	2H00	N/A	2H00	2H00	N/A
SIM02 - CATB procedures / Normal & Abnormal system operations / Abnormal & Emergency procedures	2H00	2H00	N/A	2H00	2H00	N/A
SIM03 - Flight Manoeuvres / Normal & Abnormal systems operations / IFR procedures	2H00	2H00	N/A	2H00	2H00	N/A
SIM04 - Normal & Abnormal systems operations / Abnormal & Emergency procedures / IFR procedures	2H00	2H00	N/A	2H00	2H00	N/A
SIM05 - Flight Manoeuvres / Abnormal & Emergency procedures / IFR procedures / optional equipment	2H00	2H00	N/A	2H00	2H00	N/A
SIM06 Normal & Abnormal systems operations / Abnormal & Emergency procedures / IFR procedures	2H00	2H00	N/A	2H00	2H00	N/A
SIM07 Normal & Abnormal systems operations / Abnormal & Emergency procedures / IFR procedures	2H00	2H00	N/A	2H00	2H00	N/A
SIM08 Normal & Abnormal systems operations / Abnormal & Emergency procedures / IFR procedures	2H00	2H00	N/A	2H00	2H00	N/A
Skill Test on FFS *In accordance with Part FCL Appendix 9*	2H00	**02h00**	N/A	**02h00**	**02h00**	N/A
Total Flight Simulation Training Device	**18h00**	**18h00**	N/A	**18h00**	**18h00**	N/A
Helicopter flight training	**2h00**		N/A	**2h00**		N/A
Total Flight Training	**20h00**	**18h00**	N/A	**20h00**	**18h00**	N/A

At the moment of the OEB, the OEI TRAINING MODE system, of the S76D, is not certified, the OEI Training will be on FFS, until the S76D, gets this capability.

8.6.2 Difference Training from S76C+ / C++ to S76D for MULTI PILOT / IFR

From S76 C+ / C++	To S76D	
Flight Simulation Training Device & Helicopter	**FFS & Hel PF + PM**	
Simulator session 1 Preparation and checks / Flight Manoeuvres / Post flight procedures	1H30	1H30
Simulator session 2 CATB procedures / Normal & Abnormal system operations / Abnormal & Emergency procedures	1H30	1H30
Simulator session 3 Normal & Abnormal systems operations / Abnormal & Emergency procedures / IFR procedures	1H30	1H30
Simulator session 4 Normal & Abnormal systems operations / Abnormal & Emergency procedures / IFR procedures	1H30	1H30
Simulator session 5 Normal & Abnormal systems operations / Abnormal & Emergency procedures / IFR procedures	1H30	1H30
Total Flight Simulation Training Device	7H30	7H30
Helicopter flight training	1H00	-
Total Flight Training	16H00	
Skill Test *In accordance with Part FCL Appendix 9*	Not Required	

8.6.3 CAT A Training procedures

At the moment of the OEB report , the FFS data regarding CAT A profiles were not available nor the OEI Training mode of the aircraft.

8.6.4 Instrument Rating Extension

The proposed initial and additional type-rating program includes the IR rating

8.7 Training Area of Special Emphasis (TASE)

The following procedures for training should receive special attention. Since, although they relate to separate issues, they are inter-connected.

In addition, the S76D should be emphasized throughout the training programs with regards to the high level of automation in this helicopter. Also due to the fact, that this aircraft can be operated either in Single pilot or in Multi pilot operations, Crew coordination and proper flight management (CRM) should be reinforced to cover both operational issues.

Training areas of special emphasis TASE

The training areas of special emphasis and findings listed in this OEB report are based on a basic configuration of the S76D model at the time of the report. The installation and use of future optional equipment and modifications may require additional evaluations and consequently introduce new findings and training areas of special emphasis. Cat A procedures and SAR modes are part of the future optional equipment and/or procedures. Items listed under this chapter are not listed as per order of importance.

Crew coordination

Highlighting all aspects of CRM and CFIT prior or at least before the end of a training course is recommended by the OEB due to the highly integrated cockpit components. Selection and/or use of various systems such as TCAS, WX Radar, FMS, maps, Jeppesen Charts, reconfiguration options, future SAR modes might need extra attention inside the cockpit and the reduced attention in flying the aircraft has to be coordinated. An inside/outside procedure should be established.

Thales Top Deck system

Thorough and deep knowledge of the Thales Top Deck system is highly recommended. Well trained crews can interact fast and easily with this integrated system for the selection of radio and navigation frequencies ,performance management, GPS functions, waypoint databases and flight planning. Contrarily, insufficient knowledge and/or improper use of its hard- and software might lead to confusion, preoccupation, loss of situational awareness and CFIT

IESI

The IESI or the integrated electronic standby instrument needs special attention during training. Not that this system is so complex, but the use of it might be necessary in extreme emergency situations with limited time of system power remaining, where insufficient knowledge on how to select radio frequencies, navigation or ILS options could lead to preoccupation and unnecessary time delays. The use of the system and the possibilities should be reviewed by crews on a regular base as the specific function selection might be forgotten over time.

Coupler side of command

Selection of the side of command or the transfer of command should be positively identified before take-off or when changes are made to the side of command for normal and non-normal situations.

Coupler

Inadvertent decoupling of the coupler on the APCP does not remove the selected upper modes on the PFD although the modes are no longer coupled to the AP.

WCA Filter

Not all cautions are displayed when the WCA filter is active to prevent an overload on information during non-normal situations in flight.

Transfer of command

Transfer of command on the APCP leads to the decoupling of the NAV modes in most of the cases. Basic modes remain normally engaged.

Rotor blades

Part of operational procedures, crews operating the S76D and ground crews have to be aware that the rotor blades of the S76D can fly very low in front of the helicopter and are a safety hazard.

WCA

All the caution and warnings should be read and identified during normal and non-normal situations. Proper use of CRM / MCC techniques are highly important regarding the acknowledgement of the WCA messages.

Throttles

The S76D engine throttle levers do not contain a red fire light to indicate the relevant side or engine which encounters an engine fire. Adequate MCC and/or CRM techniques leading to the correct engine identification have to be used to prevent a wrong throttle selection during execution of the emergency procedures for a possible engine fire situation. Improper identification could lead to the loss of both engines.

Engine page

At the time of the report the MFD engine page is a mandatory page on the PF side during flight.

Cyclic trim

Any forces applied to the cyclic disable the trim motors of the pitch and roll trim.

Inadvertent power off flight

A combination of low IAS airspeed (60-75 KIAS) and a high negative V/S can lead to power off flight during automated flight and has to be avoided to prevent rotor over speed.

Forward view

Pilot seat height has to be adapted in accordance with the AFM as forward vision might be limited during flare manoeuvres.

Cyclic and collective

High proficiency in identification and selection of cyclic control (9 switches) and collective control (7switches) during all phases of flight is essential.

GA

Crew have to be well aware to select to proper NAV source and the ALTPRE selection, after an ILS approach if automated flight is desired during the missed approach procedure.

8.8 Training Area of Special Emphasis (TASE) for differences between types,

Transition between S76 C+ / C++ to S76D

In addition of the TASE defined in 8.7 the following TASE have to be considered:

FADEC

The differences in the FADEC logic and control regarding Major Faults, Degraded/Manual Control, Power Limiting logic and the PLI indication system for both AEO and OEI operations, versus the Turbomeca DECU logic and Power Limiting.

THALES versus UNS or GARMIN

The differences in the Thales FMS “logic” compared to the UNS or Garmin GPS when loading the approach and sequencing arrivals.

Cyclic and collective grips

The different location and additional switches located on the cyclic and the collective.

AP

The differences in the Thales Autopilot and FD functions compared to the Honeywell/Sperry 7600 in the ALTPRE, GA and SAS vs. ATT selection.

9. Specification for Testing, Checking, Currency & Recent experience

9.1 Skill test

As required by Part-FCL.725 (c).

9.2 Proficiency Checks

As required by Part-FCL.725 (c).

9. 3 Specification for Currency / recent experience

TBD

10. Specification for Flight Simulation Training Devices

When this report has been finalized S76D a Full Flight Simulator(FFS) was available and qualified as FFS interim Level C in accordance with CS-FSTD (H) compliant with EASA requirements.

11. Application of OEB report

This OEB report applies to commercial operations. However, the OEB also recommends private or corporate operations to follow the findings of this report.

12. Appendices

Appendix 1 : EASA TCDS. (Not Certificated at the time of the report)
Appendix 2 : Operator Difference Requirement (ODR)Tables (Between S76C++ and S76D)
Appendix 3 : S76D Pilot Training Syllabi
Appendix 4 : S76 C+ / C++ to S76D Differences Training Course;

Notes:
Appendices are available for NAA's by request to EASA Expert Department / Certification Directorate or to Sikorsky Aircraft Corporation Manufacturer.