OPERATIONAL EVALUATION REPORT

SIKORSKY AIRCRAFT CORPORATION

S-76D

GRUPO DE AVALIAÇÃO DE AERONAVES – GAA

BRAZILIAN AIRCRAFT EVALUATION GROUP

AGÊNCIA NACIONAL DE AVIAÇÃO CIVIL

RIO DE JANEIRO, BRAZIL

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Revision Control

REVISION	DATE	HIGHLIGHTS OF CHANGE
Original	March 13, 2015	Original report
1	April 23, 2016	Pilot rating determination according to RBAC 61 EMD 06
2	June 30, 2016	Revision on pilot type rating determination

Approval

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1 General

1.1 Evaluation Team

1.1.1. Original

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1.1.2. Revision 1

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Acronyms

- AFM – Aircraft Flight Manual
- AOE – All Engines Operating
- APCP – Auto Pilot Control Panel
- ATR – Additional Type Rating
- ATT – Attitude Retention Mode
- EASA – European Aviation Safety Agency
- FAA – Federal Aviation Administration
- FADEC – Full Authority Digital Engine Control
- FD – Flight Director
- FFS – Full Flight Simulator
- FNPT – Flight and Navigation Procedures Training
- FSB – Flight Standardization Board
- FSTD – Flight Simulator Training Device
- FTD – Flight Training Device
- GA – Go Around
- GAA – *Grupo de Avaliação de Aeronaves*. Group responsible for aircraft operational evaluations within ANAC
- IAC – *Instrução de Aviação Civil* (Civil Aviation Instruction)
- IAS – Indicated Airspeed
- IESI – Integrated Electronic Standby Instrument
- IS – *Instrução Suplementar* (Suplementar Instruction)
- IFR – Instrument Flight Rules
- ITR – Initial Type Rating
- ILS – Instrument Landing System
- MDR – Master Difference Requirements
- MEL – Minimum Equipment List
- MMEL – Master Minimum Equipment List
- OEB – Operational Evaluation Board
- ODR – Operational Difference Requirements
- OEI – One Engine Inoperative
- OSD – Operational Suitability Data
- OTD – Other Training Device
- PF – Pilot Flying
- PFD – Primary Flight Display
- PLI – Power Limiter Indicator
- RBAC – Regulamento Brasileiro de Aviação Civil
- RBHA – Regulamento Brasileiro de Homologação Aeronáutica

- SAR – Search and Rescue
- SAS – Stability Augumentation System
- TBD – To Be Defined
- TCDS – Type Certificate Data Sheet
- V/S – Vertical Speed
- WCA – Warning Caution Advisory

2 Introduction

2.1 Background

This evaluation was conducted by documentation analysis using the information provided by the manufacturer and the determinations of the FSB Report, original version, issued by the FAA on November 13th, 2013 and the determinations of the OEB Report, final version, issued by the EASA on February 26th, 2015.

In case more detailed information is required, refer to the FSB Report and to the OEB Report mentioned above.

2.2 Objective

This report presents ANAC collection of results obtained from the operational evaluation of Sikorsky helicopter model S-76D.

2.3 Purpose

The purpose of this report is to:

a. Define the pilot type rating assigned for the S-76D helicopter;

b. Define the requirements for training, checking and currency applicable to flight crew for the S-76D, and functionalities;

c. Provide the Master Differences Requirements (MDR) for crews requiring differences qualification for mixed-fleet-flying;

d. Provide an acceptable Operator Differences Requirements (ODR);

e. Describe the required Flight Simulation Training Device (FSTD) for crew training, checking and currency.

2.4 Applicability

This report is applicable to:

a. Brazilian operators of the helicopter identified as S-76D in the ANAC TCDS ER-7906-10 who operate under RBHA 91 and RBAC 135 rules;

b. Approved Training Organizations certified under RBAC 142 (Type Rating Training Organizations - TRTO);

c. Civil Aviation Inspectors (INSPAC) related to safety oversight of S-76D helicopter;

d. ANAC Principal Operations Inspectors (POIs) of S-76D operators.

2.5 Cancelation

Not applicable.

3 Pilot Type Rating

The specific pilot type rating assigned to the S-76D helicopter is designated "**SK76**".

Airmen who wish to pursue any specific type rating must comply with the requirements established on section 61.213 of RBAC 61.

The GAA recommends the update of ANAC type rating list (Instrução Suplementar – IS 61-004) with the following information:

Table 1 - Pilot Type Rating

XIV – Type Rating (Helicopter) – Multi Engine Operation (Turboshaft)				
Manufacturer	**Helicopter**		**RMK**	**Type Rating**
	Model	**Name**		**ANAC**
Sikorsky	S 76A	-	D	SK76
	S 76C	-		
	S 76D	-		

4 Master Difference Requirements (MDR)

The Master Difference Requirements matrix for S76 variants is shown in Table 2. These provisions are applied when there are differences between models which affect crew knowledge, skills, or abilities related to flight safety (e.g., Level A or greater differences) for training, checking and currency, respectively, according to IAC 121-1009.

Table 2 - Master Difference Requirements

		From Helicopter	
		S-76D	S-76 C+ / C++
To Helicopter	S-76D	**N/A**	**D/D/D**
	S-76 C+ / C++	**TBD**	**N/A**

Notes:

- S-76C+ is the marketing name of the S-76C helicopter equipped with 2 Turbomeca Arriel engines model 2S1.
- S-76C++ is the marketing name of the S-76C helicopter equipped with 2 Turbomeca Arriel engines model 2S2.

No evaluation of differences training from helicopter S-76D to helicopter S76C+/++ has been performed to date.

5 Operator Difference Requirements (ODR)

Each operator of a mixed fleet of S-76 shall produce its own ODR, as required by IAC 121-1009.

No ODR tables were provided by the manufacturer.

6 Specifications for Training, Checking and Currency

Specifications for training, checking and currency are detailed on the FAA FSB Report and on the EASA OEB Report mentioned above.

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.

A footprint of the pilot initial, additional and differences training is presented in Appendix 1.

6.1 Airmen Minimum Experience for Initial Flight Training

The initial and additional pilot type rating courses described on Appendix 1 are considered to be compliant with the requirements of RBAC 61. These courses are recommended to be used as a baseline for S-76D type rating training.

- 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
    - Have 70 Flight Hours as PIC
    - Hold a Multi Engine 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 (Multi Crew Coordination) 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.

- Candidates for an Additional S76D Type Rating must:
  - Hold a valid Pilot license,
  - Hold a Multi-Engine Turbine Pilot Type Rating

6.2 Airmen Minimum Experience for Differences Training

The candidate pilot for a differences training between the helicopters must hold a valid “SK76” type rating and be qualified on the base helicopter.

6.3 Training Area of Special Emphasis (TASE)

The following areas of emphasis should be addressed during ground and flight training in all referenced initial type rating training for the S76D. 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.

The training areas of special emphasis and findings listed in this 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 GAA 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 maneuvers.

Cyclic and collective

High proficiency in identification and selection of cyclic control (9 switches) and collective control (7 switches) 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.

6.4 Training Area of Special Emphasis (TASE) for differences between types:

Transition from S76 C+ / C++ to S76D: In addition of the TASE defined above, the following TASE has 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.

7 Compliance to RBHA 91 and RBAC 135

No Compliance Checklists were provided by the manufacturer.

8 Technical Publications

8.1 Master Minimum Equipment List - MMEL

The S-76D MMEL approved by the FAA shall be used by Brazilian operators as a basis for developing their MEL. These documents are available at the FAA website, through the link http://fsims.faa.gov/PICResults.aspx?mode=Publication&doctype=MMEL.

8.2 Rotorcraft Flight Manual - RFM

The S-76D RFM approved by GGCP/SAR shall be used by Brazilian operators as a basis for developing their Operator Rotorcraft Operations Manual.

APPENDIX 1

Initial and Additional Type Rating Training Footprint

Theoretical knowledge syllabus and test summary

- Initial and Additional Type Rating

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 GAA 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.

- 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

Flight training course summary

- 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 evaluation, the OEI TRAINING MODE system of the S76D is not certified. Tthe OEI Training will be on FFS until the S76D gets this capability.

- 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	