



OPERATIONAL EVALUATION REPORT

CIRRUS DESIGN CORPORATION

SF50 (VISION JET)

GRUPO DE AVALIAÇÃO DE AERONAVES – GAA

BRAZILIAN AIRCRAFT EVALUATION GROUP

REVISION 1 – SEPTEMBER 13, 2019

GRUPO DE AVALIAÇÃO DE AERONAVES (GAA)

Aircraft Evaluation Group

SF50 (Vision Jet)



SF50 (Vision Jet) Team Composition

Original

Guilherme dos Santos Macedo	SF50 Chairman
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Revision 1

André Marques Caetano	SF 50 Chaiman, Evaluator Pilot
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OPERATIONAL EVALUATION REPORT

CIRRUS

SF50 (VISION JET)

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Department of Flight Standards

Revision Record

Revision Nº.	Content	Date
Original	Initial SF50 (Vision Jet) Operational Evaluation	03 MAY 2017
1	SF50 Vision Jet FL 310 configuration evaluation	13 SEP 2019

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Acronyms

AEG.....	Aircraft Evaluation Group (FAA)
AFM.....	Airplane Flight Manual
ANAC.....	<i>Agência Nacional de Aviação Civil</i>
AOM.....	Airplane Operations Manual
ATO.....	Approved Training Organization
CAPS.....	Cirrus Airframe Parachute System
CAS.....	Crew Alerting System
ECL.....	Electronic Checklist
EFIS.....	Electronic Flight Instrument System
FAA.....	Federal Aviation Administration
FSB.....	Flight Standardization Board (FAA)
FFS.....	Full Flight Simulator
FL.....	Flight Level
FMS.....	Flight Management System
FSTD.....	Flight Simulation Training Device
GAA.....	<i>Grupo de Avaliação de Aeronaves</i> (Brazilian Aircraft Evaluation Group)
GS.....	Ground School
IAC.....	<i>Instrução de Aviação Civil</i>
INSPAC.....	<i>Inspetor de Aviação Civil</i> (Flight Operations Inspector)
IS.....	<i>Instrução Suplementar</i>
LSP.....	Left Seat Pilot
MDR.....	Master Differences Requirements
MEL.....	Minimum Equipment List
MFD.....	Multi-Function Display
MMEL.....	Master Minimum Equipment List
ODR.....	Operator Differences Requirements
OTD.....	Other Training Device
PFD.....	Primary Flight Display
POI.....	Principal Operations Inspector
RBAC.....	<i>Regulamento Brasileiro de Aviação Civil</i>
RBHA.....	<i>Regulamento Brasileiro de Homologação Aeronáutica</i>
RVSM.....	Reduced Vertical Separation Minimum
SIT.....	Systems Integration Training
TASE.....	Training Areas of Special Emphasis
TCDS.....	Type Certification Data Sheet

1. INTRODUCTION

1.1. Background

The SF50 was evaluated in accordance with IAC 121-1009.

An operational evaluation campaign was conducted by the ANAC Aircraft Evaluation Group (GAA) in Duluth, MN, USA, from January 23rd until February 1st, 2017 where the proposed initial type rating training for the SF50 was evaluated.

In September 2019, the GAA conducted an operational evaluation of enhanced features that the manufacturer is incorporating into production aircraft. Many of these changes are minor improvements to the original certificated aircraft that do not significantly alter operations or procedures utilized in the original aircraft.

Changes that are more substantial include raising the maximum operating altitude from flight level (FL) 280 to FL 310. The aircraft is now equipped for operations in Reduced Vertical Separation Minimum (RVSM) airspace and the autopilot system incorporates an autothrottle function. The aircraft has also had enhancements made to the ailerons that allow for removal of the boundary layer energizers from the wing. For the purpose of this report, manufactured aircraft that incorporate the new features are referred to as the SF50 Vision Jet FL 310 configuration. Aircraft not so equipped are referred to as the SF50 Vision Jet FL 280 configuration. An SF50 reference in this report would indicate that the information associated would apply to either configuration.

Note: the evaluation of the enhanced features (September 2019) was performed by documentation analysis using the information provided by the manufacturer and the Flight Standardization Board (FSB) Report Revision 2, issued by the Federal Aviation Administration (FAA) on March 22, 2019. In case more detailed information is required, refer to the current FSB Report.

1.2. Objective

The objective of this report is to present the ANAC results from the operational evaluations of Cirrus model SF50 (Vision Jet).

The content of this report is applicable to operations under the framework of ANAC.

1.3. Purpose

The purpose of this report is to:

- Determine the Pilot Type Rating assigned for model SF50;
- Recommend the requirements for training, checking and currency applicable to flight crew for model SF50, and functionalities;
- Provide the Master Differences Requirements (MDR) for crews requiring differences qualification for mixed-fleet-flying;
- Provide an acceptable Operator Differences Requirements (ODR); and
- Present the compliance of model SF50 with the requirements of the RBHA 91 and RBAC 135.

1.4. Applicability

This report is applicable to:

- Brazilian operators of model SF50 under RBHA 91 and RBAC 135 requirements;
- Approved Training Organizations certified under RBAC 142 (Training Centers);
- Civil Aviation Inspectors (INSPAC) related to safety oversight of model SF50;
- ANAC Principal Operations Inspectors (POIs) of model SF50 operators.

1.5. Cancellation

Not applicable.

2. SUMMARY AIRCRAFT DESCRIPTION

The Cirrus model SF50, commercially known as Vision Jet, is a low wing, V-tail and pressurized airplane, powered by a single medium bypass ratio turbofan engine, mounted over the top of the fuselage. The fuselage structure is primarily manufactured from carbon fiber. The tricycle landing gear is fully retractable, demonstrated operated on paved runways only. The panel has the glass cockpit concept with the Cirrus Perspective Touch by Garmin avionics system consisting of two Display Units (PFD, in front of the LSP, and MFD, to the right of the PFD).

The SF50 flight controls system features a mechanical control system for pitch, roll, and yaw. The V-tail configuration uses common aerodynamic surfaces for pitch and yaw control (ruddervators). Pitch and yaw are mechanically mixed. Pitch, roll, and yaw axis are controlled from each crew seat in the airplane using a side stick and rudder pedals. All movements and forces are transmitted using control cables, pulleys, bellcranks, and push rods.

The SF50 is equipped with a Cirrus Airframe Parachute System (CAPS) designed to lower the airplane and its passengers to the ground in the event of a life-threatening emergency.

The airplane is certified for Day, Night, VFR and IFR flights to a maximum operating altitude of 31.000 feet (depending on the configuration) and is approved for flight into known icing conditions.

A summary of the aircraft specifications is presented in the table below. For more information, the TCDS issued by ANAC Product Certification Management (Gerência Geral de Certificação de Produto Aeronáutico – GGCP/SAR) may be consulted. In case of information disagreement between the table below and the TCDS, this last source shall prevail.

Table 1 – SF50 information

Specifications		SF50 Vision Jet
Certification Basis		RBAC 23
Engine		One (1) Williams International FJ33-5A turbofan engine
Minimum Crew		One pilot
Maximum Passengers		Up to 07 seats ⁽¹⁾
Weights	Maximum Ramp Weight (MRW)	2.740 Kg
	Maximum Takeoff Weight (MTOW)	2.722 Kg
	Maximum Landing Weight (MLW)	2.517 Kg
	Maximum Zero Fuel Weight (MZFW)	2.223 kg
Speeds	Maximum Operating Speed (VMO)	250 KIAS
	Maximum Operating Mach (MMO)	0.53 Mach
	Landing Gear Operation (VLO) – extended	210 KIAS
	Landing Gear Operation (VLO) – retract	150 KIAS
	Landing Gear Extended (VLE)	210 KIAS

Note:

(1) The two optional outboard seats are weight-limited to 90 lb.

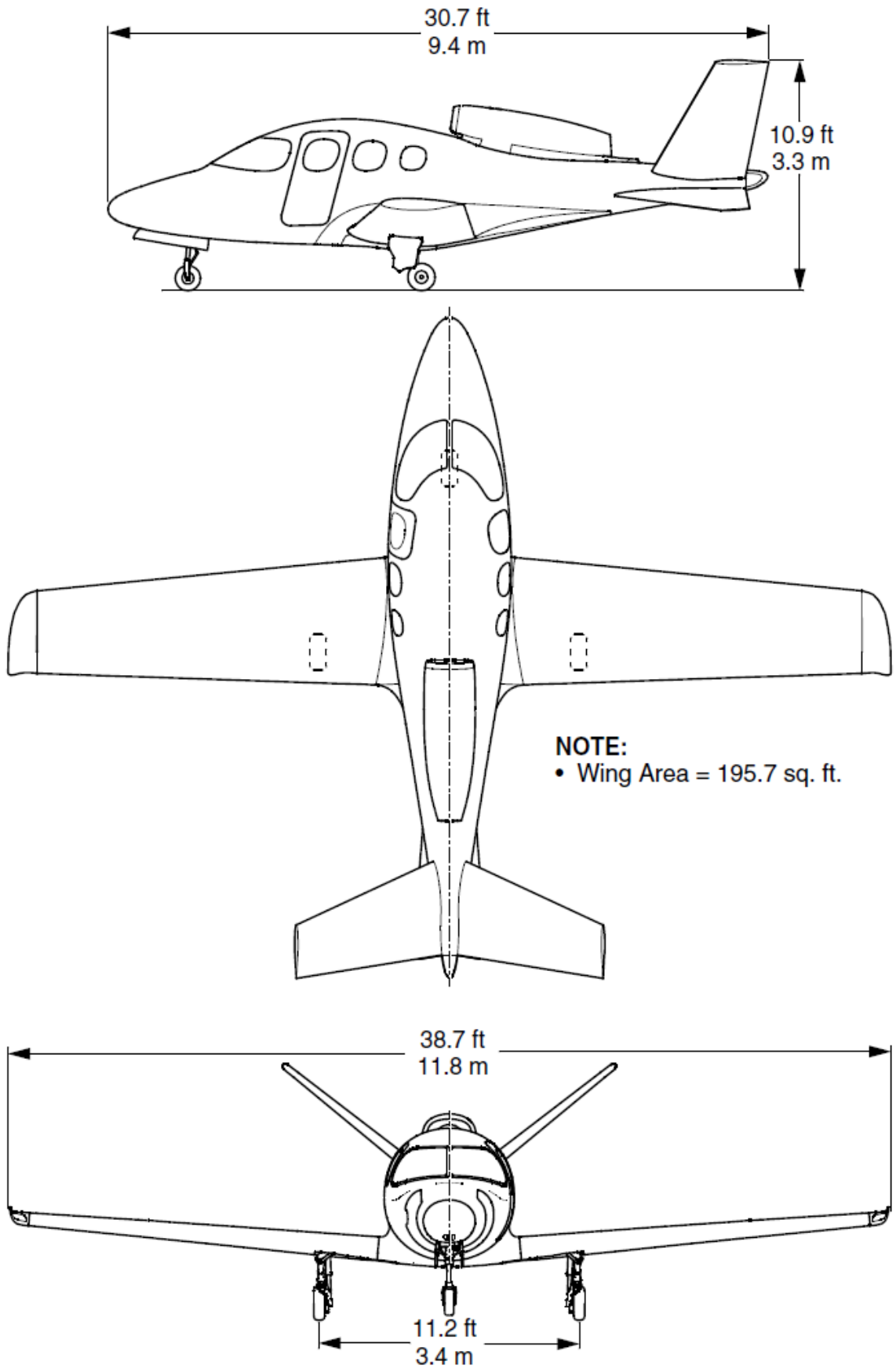


Figure 1 – SF50 three views

3. PILOT TYPE RATING

The Cirrus model SF50 Vision Jet type rating designation is “**SF50**”.

Table 2 – ANAC Type Rating list revision

Fabricante <i>(Manufacturer)</i>	Aeronave <i>(Aircraft)</i>		Observações <i>(Remarks)</i>	Designativo <i>(Designative)</i>
	Modelo <i>(Model)</i>	Nome <i>(Name)</i>		
CIRRUS DESIGN CORP.	SF50	Vision Jet	Relatório de Avaliação Operacional SF50 (Vision Jet) <i>ANAC Operational Evaluation Report SF50 (Vision Jet)</i>	SF50

4. MASTER DIFFERENCE REQUIREMENTS (MDR)

The Master Difference Requirements matrix for SF50 Vision Jet FL 280 and FL 310 configurations is shown in table 3. These provisions are applied when there are differences between aircraft 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 IS 00-007.

Table 3 – SF50 Vision Jet MDR matrix

		FROM AIRPLANE	
		SF50 Vision Jet FL 280 configuration	SF50 Vision Jet FL 310 configuration
TO AIRPLANE	SF50 Vision Jet FL 280 configuration	---	Not Evaluated
	SF50 Vision Jet FL 310 configuration	D/D/A	---

5. OPERATOR DIFFERENCES REQUIREMENTS (ODR)

Each operator of a mixed fleet of SF50 Vision Jet FL 280 and FL 310 configurations shall produce its own ODR, as required by IS 00-007.

Cirrus Design Corp. provided a sample of ODR tables, which was considered acceptable by ANAC. These ODR tables are presented in Appendix 2 of this report and may serve as a basis for the operator to develop its own ODR tables to address the differences indicated in the MDR.

These ODR tables are Cirrus Design Corp. generic and therefore may not include items that are applicable to particular operators.

6. SPECIFICATIONS FOR PILOT TRAINING

6.1. SF50 Initial Type Rating training

The initial pilot type rating course described in this section was evaluated by ANAC and considered to be compliant with the requirements of RBAC 61. This course is recommended to be used as a baseline for SF50 type rating training. The initial type rating training footprint is provided in Appendix 1.

6.1.1. Prerequisites

The candidate pilot must, at least:

- hold a Private Pilot License - Airplane;
- hold an IFR rating;

Candidate pilots who do not have previous experience with Flight Management System (FMS), Electronic Flight Instrument System (EFIS) and/ or Global Navigation Satellite System (GNSS) may require additional training.

6.2. Seat Dependent Tasks training

Although there are no seat dependent tasks in the SF50, it is ANAC's recommendation that the Pilot Flying should occupy the left pilot seat.

6.3. Recurrent Training

No recurrent training was evaluated by the GAA.

Recurrent training must be compliant with the Brazilian regulations. Recommendation is for the recurrent training to include the Training Areas of Special Emphasis as identified in this report.

6.4. Differences Training

Pilots must receive differences training between the SF50 Vision Jet FL 280 configuration and SF50 Vision Jet FL 310 configuration. The level of training is specified in Appendix 3, Operator Differences Requirements (ODR) Tables.

6.5. Training Areas of Special Emphasis (TASE)

6.5.1. Ground Training:

Pilots must receive special emphasis on the following areas during Ground Training:

- Risk Management and SRM;
- Instrument Panels;
- Avionics – Displays, buttons and operation of the Cirrus Perspective Touch by Garmin;

- CAPS system operation and deployment strategy;
- Autopilot and Flight Director functionality;
- Oxygen System;
- Flight Controls;
- Automatic Flight Control System;
- Flight Controls and Envelope Stability and Protection systems (ESP) to include underspeed, overspeed, pitch nose high/low, and overbank with and without autopilot on;
- Yaw and Stability Augmentation System (SAS);
- Powerplant;
- Ice protection System;
- Weight and Balance;
- Performance and Flight Planning;
- CAS messages and checklists;
- Stick Shaker/Pusher activation;
- Autothrottle system and default configurations.

6.5.2. Flight Training:

Pilots must receive special emphasis on the following areas/maneuvers during Flight Training:

- Preflight airplane inspection;
- Cirrus Perspective Touch by Garmin operation;
- Electronic checklist handling and procedures;
- Steep turns;
- Stall prevention at first indication of stall and stall recovery with stick pusher activation (which should be considered full stall);
- Emergency descent;
- CAPS activation planning/simulation;
- Instrument Flight;
- Flight by reference to instruments in reversionary mode;
- Engine failure procedures, including Single Engine Flameout (SFO) approach;
- Engine fire procedures;
- Go around / rejected landing;
- Precision and non-precision approach;
- Ice protection system operation;
- Non-Flap approach and landing;
- Weather radar;

- Autopilot and Flight Director functionality;
- Autothrottle system and default configurations.

6.6. Special Considerations for Training in Actual Aircraft

6.6.1. No-flap landings.

The instructor must be attentive to airspeed control and available runway length and surface condition. The instructor must also observe brake limitations while conducting this training.

6.6.2. Stick pusher system.

The ANAC recommends that all pilots in SF50 training practice and demonstrate this system in flight or in a full flight simulator (FFS) and understand that an altitude loss in a stall can be significant if the stick pusher activates. During stall recovery training with stick pusher activation, altitude loss in excess of 500 to 1,000 feet should be expected. It is recommended that training maneuvers for stalls up to stick pusher be initiated at an altitude to allow complete recovery no lower than 3,000 feet above ground level (AGL), if conducted in flight.

6.6.3. Forward slips.

The ANAC recommends that all pilots in SF50 training avoid the use of forward slips or any other uncoordinated flight during operations below 200 feet AGL when the yaw damper is automatically disengaged.

7. SPECIFICATIONS FOR CHECKING

7.1. Initial and Recurrent Checking.

Initial and recurrent proficiency checks shall be performed in accordance with RBAC 61 and IS 00-002. Evaluators are encouraged to draw from the special emphasis areas in paragraph 6.5 to develop their plans of action for checking in this aircraft.

7.2. Differences Checking.

Pilots must receive differences checking between the SF50 Vision Jet FL 280 configuration and SF50 Vision Jet FL 310 configuration. The level of checking is specified in Appendix 2.

7.3. Other Checking Items:

7.3.1. Forward slip to a landing.

The FSB evaluated this maneuver and does not recommend the forward slip or significant sustained uncoordinated flight in the SF50. The AEG recommends that this maneuver be omitted on the SF50 type rating practical test. If the SF50 type rating practical test is conducted concurrently with any other practical test (i.e., combined SF50 type rating with the initial issuance of a commercial pilot license), this maneuver must be trained and checked in a separate airplane capable of the maneuver.

NOTE: During the FSB evaluation, the pilot had to manually deactivate the automatic yaw damper system during this event. The slip caused erroneous AOA indications and initiated stall warning and stick shaker events.

7.3.2. Power off 180-degree accuracy approach and spot landing.

The FSB evaluated this maneuver and does not recommend the maneuver be performed in the SF50. The AEG recommends that this maneuver be omitted on the SF50 type rating practical test. If the SF50 type rating practical test is conducted concurrently with any other practical test (i.e., combined SF50 type rating with the initial issuance of a commercial pilot license), this maneuver must be trained and checked in a separate airplane capable of the maneuver.

NOTE: During the FSB evaluation, the maneuver was flown in accordance with the ATP and aircraft type rating standards for airplane. Several risks were identified as a result. It requires this maneuver to be performed from an altitude of 1,000 feet AGL or less. Because the recommended traffic pattern altitude by Cirrus for the SF50 is 1,500 feet AGL, flying the maneuver starting at 1,000 feet AGL required the pilot to place the aircraft on downwind closer to the runway than desired. Due to the closeness of the downwind leg, the turns to base and final were greater than 30 degrees of bank. In addition, it was noted that, if the pilot needed to arrest the descent and abort the maneuver, timely application of thrust would be critical. It is also noted that, between 1,000 and 2,000 feet AGL, Cirrus recommends utilization of the CAPS system if the engine fails. Below 1,000 feet AGL, the CAPS system must not be deployed, and Cirrus recommends limited maneuvering and does not recommend a 180-degree turn at those altitudes.

8. SPECIFICATIONS FOR RECENT EXPERIENCE AND CURRENCY

No specific requirements for recent experience or currency are established for models SF50 other than those already specified in RBAC 61 and RBAC 135. If a pilot has not flown the SF50 within 180 days, the ANAC recommends the pilot regain proficiency by flying with an appropriately rated instructor either in the aircraft or FSTD with emphasis on operation of the Cirrus Perspective Touch by Garmin integrated avionics system.

Differences level for currency between the SF50 Vision Jet FL 280 configuration and SF50 Vision Jet FL 310 configuration is not applicable.

9. FLIGHT SIMULATION TRAINING DEVICES (FSTD) AND OTHER TRAINING DEVICES (OTD)

The initial type rating training evaluated by ANAC was performed in the airplane. For initial type rating training using a flight simulator, it should be qualified as FFS Level C or D. If a lower level FFS is desired for flight training, a specific evaluation should be performed by ANAC in order to certify the suitability of the device.

The SIT device used for the ANAC operational evaluation was the Cirrus Perspective Touch by Garmin station. If another device should be used for the SIT lessons, it must:

- Consist of actual Avionics System panels, instruments, switches and controls in the correct positions;
- Represent the same interface with the operator (touchscreen / knobs / switches);
- Simulate ground and flight operations including all phases of flight (takeoff and landing can be automatic);
- allow the pilot to operate it through its multiple pages, icons and menus exactly like the real airplane;
- Simulate airplane systems fully integrated to ensure correct interaction, especially among the FMS, AFCS, ECL and flight instrument displays;
- Simulate avionics failures.

The FSTD must be qualified by the ANAC. The FSTD and OTD must be approved for training by the ANAC.

10. COMPLIANCE WITH RBHA 91 AND RBAC 135

Since the SF50 does not comply with RBAC 135.163 (a) for a dual pilot IFR operation, this airplane can only be operated under RBAC 135 IFR rules by complying with RBAC 135.105.

No Compliance Checklists were provided by the manufacturer.

11. TECHNICAL PUBLICATIONS

11.1. Master Minimum Equipment List - MMEL

Brazilian operators shall use the FAA approved MMEL as a basis for developing their MEL (according to IAC 3507).

11.2. Airplane Flight Manual - AFM

Brazilian operators shall use the Airplane Flight Manuals – AFMs approved by GGCP/SAR for model SF50 for developing their Airplane Operation Manuals – AOMs, when applicable.

12. MISCELLANEOUS

12.1. Forward Observer Seat

The SF50 is a single pilot aircraft and the primary forward observer seat would be the right flight deck seat. In the event that right flight deck seat would be occupied during a check the SF50 has a middle row designated by the Cirrus AFM and PIM as seats 3, 4 and 5. Seats 3, 4 and 5 would be alternate observer seats.

12.2. Aircraft Approach Category

Model SF50 is classified as “Category A” for normal straight-in landing approaches and normal circling approaches.

12.3. Electronic Checklist (ECL)

The ECL was evaluated and determined to be operationally suitable.

APPENDIX 1

SF50 TYPE RATING TRAINING FOOTPRINT

Day 1	Day 2	Day 3	Day 4	Day 5
GS 1 (3.5 hrs.)	GS 2 (3.5 hrs.)	GS 3 (3.3 hrs.)	GS 4 (3.4 hrs.)	Flight 1 (2.0 hrs.)
SIT 1 (2.0 hrs.)	SIT 2 (2.0 hrs.)	SIT 3 (2.0 hrs.)	SIT 4 (2.0 hrs.)	
Day 6	Day 7	Day 8	Day 9	Day 10
Flight 2 (2.0 hrs.)	Flight 3 (2.0 hrs.)	Flight 4 (2.0 hrs.)	Flight 5 (2.0 hrs.)	Practical Test
<p>Legend:</p> <p>GS – Ground School (instructor-led class)</p> <p>SIT – Systems Integration Training (using a Cirrus Perspective Touch by Garmin station)</p>				
<p>Notes:</p> <p>1- SIT and Flight sessions DO NOT INCLUDE time for briefing and debriefing.</p> <p>2- Flight Lessons must be performed either in an airplane or in a FFS.</p>				

The training outlined above reflects the training evaluated by ANAC and is considered acceptable for SF50 type rating training aiming an ANAC license endorsement. An operator or an ATO may develop a variation of this training provided it is proven that it maintains an equivalent level of safety. Depending on the level of the modification, ANAC may judge necessary an operational evaluation of the proposed training.

APPENDIX 2

OPERATOR DIFFERENCES REQUIREMENTS (ODR) TABLES

The ODR tables presented in this appendix were proposed by Cirrus Design Corp. and validated by the ANAC. These tables list the minimum differences levels training, checking and currency for flight crew members.

DESIGN OPERATOR DIFFERENCE REQUIREMENTS TABLE						
FROM BASE AIRCRAFT: SF50 Vision Jet FL 280 Configuration TO RELATED AIRCRAFT: SF50 Vision Jet FL 310 Configuration				COMPLIANCE METHOD		
DESIGN FEATURE	REMARKS	FLT CHAR	PROC CHNG	TRAINING	CHECKING	CURRENCY
Autothrottle	Added autothrottle system to autopilot function. Autothrottle control panel added to power quadrant. Autothrottle PFD status indications added. Autothrottle CAS messages added.	No	Yes	D	D	A
Aircraft Limitations and Performance	Max operating altitude raised to FL 310. Performance differences related to higher true airspeed and lower fuel consumption. Increase in payload by 150 pounds.	No	Yes	B	B	A
Engine Limitations	ITT limits adjusted to FJ33-5A engine due to operations at FL 310.	No	No	B	A	A
New aileron design	Removal of static aerodynamic devices.	Yes	No	B	A	A
Cabin design changes and new optional features	Cabin seats altered and optional seating available with executive console. Door seal redesign.	No	No	B	B	A

Flight instruments	Added IFR Low and High charts and sectional charts to map menus. Font and graphics changes to EFIS screens. ADF added as an option.	No	No	B	A	A
Electrical panel change	Change in overhead panel deleting switch no longer required. Aircraft battery change.	No	Yes	B	A	A
Minor changes in design not affecting Limitations or Procedures		No	No	B	A	A

MANEUVER OPERATOR DIFFERENCE REQUIREMENTS TABLE						
FROM BASE AIRCRAFT: SF50 Vision Jet FL 280 Configuration TO RELATED AIRCRAFT: SF50 Vision Jet FL 310 Configuration				COMPLIANCE METHOD		
MANEUVER	REMARKS	FLT CHAR	PROC CHNG	TRAINING	CHECKING	CURRENCY
Visual and instrument departure	With autothrottle ON.	No	Yes	D	D	A
Climb and descent	With autothrottle ON.	No	Yes	D	D	A
Visual and instrument approach to landing	With autothrottle ON.	No	Yes	D	D	A