EUROPEAN AVIATION SAFETY AGENCY

AS 355

ECUREUIL TWINSTAR

(AS 355 E, AS 355 F, AS 355 F1, AS 355 F2, AS 355 N, AS 355 NP).

ORIGINAL

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Introduction

Eurocopter has requested a JOEB process for evaluation of the helicopter AS 355 family (Ecureuil II – Twinstar).

This document is based on:

- A catch up process analysis for AS 355 E, F, F1, F2 and N
- An assessment of the full pilot training course for the AS 355 NP

Note:
All “AS 355 family” is listed in the Type Certificate delivered by EASA under TYPE CERTIFICATE EASA.R.146 for models **(See Appendix 1):**

- AS 355 E
- AS 355 F
- AS 355 F1
- AS 355 F2
- AS 355 N
- AS 355 NP

Revision Record

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Contents

- Introduction 2
- Revision Record 3
- Contents 4
- Joint Operation Evaluation Board – OPS-FCL 5
- Eurocopter Helicopter Experts involved in the process 6
- Acronyms 7
- Preamble and Executive Summary 8

1. Purpose and applicability 9
2. Description of AS 355 10
3. Helicopter Differences 12
4. Operator Differences Requirement (ODR) Tables 13
5. Optional specific equipment 13
6. Master Differences Requirements 13
7. Licence endorsement 14
8. Specification for training 15
9. Specification for checking 19
10. Specification for Flight Simulation Training Devices 19
11. Application of JOEB report 19
12. Appendices 19

- Appendix 1: EASA Type Certificate
- Appendix 2: JAR-FCL2 Type rating requirements
- Appendix 3: Type rating training courses: Summary of Ground Training
- Appendix 4: Type rating training courses: Summary of Flight Instruction
- Appendix 5: Difference Training Levels
- Appendix 6a: ODR Tables
- Appendix 6b: Optional Specific Equipment.

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Acronyms

AEO	All Engines Operating
AFCS	Automatic Flight Control System
AMC	Acceptable Means of Compliance
AOC	Air Operator Certificate
ATPL (H)	Airline Transport Pilot Licence (Helicopter)
CPL	Commercial Pilot Licence
CRM	Crew Resource Management
DGAC	Direction Générale de l'Aviation Civile (French Civil Aviation Authority)
EASA	European Aviation Safety Authority
FADEC	Full Authority digital Engine Control
FMS	Flight Management System
FD	Flight Director
FLI	First Limit Instrument
FNPT	Flight and Navigation and Procedure Trainer
FSTD	Flight Simulation Training Device
FTO	Flight Training Organisation
IEM	Interpretative and Explanatory Material
IFR	Instrument Flight Rules
IR	Instrument Rating
JAA	Joint Aviation Authorities
JAR-FCL 2	Joint Aviation Requirements Flight Crew Licensing (Helicopters)
JAR-OPS 3	Joint Aviation Requirements Operations 3 (Commercial Transport Helicopters)
JOEB	Joint Operational Evaluation Board
MDR	Master Difference Requirements
MEL	Minimum Equipment List
MMEL	Master Minimum Equipment List
N/A	Not Applicable
ODR	Operator Differences Requirements
OE	Operational Evaluation
OEI	One Engine Inoperative
RFM	Rotorcraft Flight Manual
TRTC	Type Rating Training Course
TRTO	Type Rating Training Organisation
VEMD	Vehicle and Engine Multifunction Display
VFR	Visual Flight Rules

Preamble and Executive Summary

The catch up process was conducted to check compliance of the pilot training courses for the AS355 family.

The catch up process was conducted in accordance with the processes detailed in the JAA Administrative and Guidance Material, Section One, Part Two, Chapter 5 and JAR-FCL 2 including associated appendices, AMC and IEM.

One pilot, the chairman of the JOEB team, and Eurocopter helicopter training pilot and experts participated in the training course proposed by Eurocopter for both ground and flight instruction.

As part of this evaluation process, the Normal, Abnormal, and Emergency procedures were reviewed for AS 355F, AS 355N and AS355NP.

The JOEB recommends the pilot training courses included in this report for approval by the JAA NAAs.

Note on references and reference texts:
Where references are made to requirements and where extracts of reference texts are provided, these are at the amendment state at the date of publication of the report. Readers should take note that it is impractical to update these references to take account of subsequent amendments to the source documents.

Evan Nielsen
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I. Purpose and applicability

This report follows an evaluation of the AS 355 family of helicopter based on differences training courses from AS 355F1 to AS 355N and from AS 355N to AS 355NP. The JOEB chairman followed the **DGAC approved** courses.

This document:

- Defines the Type Rating assigned to the **AS 355** family
- Makes recommendations for initial type rating training
- Makes recommendations for additional type training
- Makes recommendations for familiarisation/ differences training, checking and currency for the AS 355 family.
- Proposes **AS 355 NP** in the existing License Endorsement AS 355 / 355N

The JOEB performed a T3 test, according to the JOEB guidance material.

Helicopter variants addressed are AS 355E, AS 355F, AS 355F1, AS 355F2, AS 355N and AS 355NP.

AS 355E was not considered by the catch-up analysis separately , due to the fact there is only one helicopter still flying today, this variant is merged with the AS 355F.

AS 355F, AS 355F1 and AS 355F2 are considered as the base helicopter for this analysis process and designated “AS 355”.

Comparisons have been done in both directions between:

- AS 355 (F,F1,F2) and AS 355N,
- AS 355 (F,F1,F2), and AS 355NP,
- AS 355N, and AS 355NP,

2. Description of AS 355

2.1 General description

The **AS 355** is a small twin engine helicopter with 5/7 seats and powered by 2 turbo-shaft engines. Its commercial designation is: ECUREUIL II / TWINSTAR..

This helicopter, received its first Type Certification in 1980, in category, Small rotorcraft, based on FAR/JAR 27. It is basically approved for VFR by day and night operation. It has also been certificated for IFR operation when an IFR supplement is included in the Rotorcraft Flight Manual. Minimum crew is one pilot in the starboard seat. The helicopter is fitted with one Starflex type semi –rigid main rotor head and three blades of glass-resin laminate flexible construction. Viewed from the top, the main rotor turns clockwise. It has one classic tail rotor of two blades and a main central gear box.
The main rotor controls are of the rigid type (control rod) and the tail rotor controls are of two types: rods and ball-type control cables. Built mainly of conventional aluminium alloys, the AS 355 uses advanced composites in different areas.

The AS 355 avionics suite is built around proven standard equipment for general aviation:
AS 355 E, F, F1, F2 and AS 355N are fitted with conventional classic instrument.
AS 355NP has received a Vehicle and Engine Multifunction Display, which is installed as basic equipment. It includes a First Limit Instrument (FLI).
Both AS 355N and AS 355NP engines are fitted with Full Authority Digital Engine Control and a Training mode.

2.2 AS 355 (E, F, F1, F2): the base version

The AS 355 (E, F, F1, F2) have the following main characteristics:

- 2 Turbo-Shaft engines / Rolls-Royce ALLISON 250.C20F
- Maximum Operating altitude : 16000 ft
- Identical fuselage, main rotor and tail rotor

The slight differences between AS 355 E, F, F1 and F2 models are summarised in table 1 below.

The AS 355 that includes models E, F, F1, F2 is considered the base version considering the very slight differences between the models and because only familiarisation training (reading of the Flight Manual) is necessary to convert from one of these aircraft to another. The base version will be called "**AS 355"** as it is already mentioned in the helicopter Type Rating List and includes models E, F, F1 and F2.

2.3 AS 355N version

The AS 355N version has differences comparing to the AS 355 as follows:

- 2 Turbo-Shaft engines / Turbomeca **ARRIUS 1A** with Full Authority Digital Engine Control
- Training mode (Free turbine speed governed at lower value) for each engine
- Maximum Operating altitude: 20000 Ft.

2.4 AS 355NP version

The last version of AS 355, the "AS 355NP", compared to the "N" version, consists of the following items:

- 2 Turbo-Shaft engines / Turbomeca **ARRIUS 1A 1** which are an upgraded version of ARRIUS 1A, and the main differences are :
  increased OEI rating
  increased AEO rating
- Avionic improvement (integration of VEMD)
- Main gear box (MGB) improvement
- Engine and main gear box oil cooling system displacement
- The MTOW with external load is increased from 2600KG to 2800Kg

2.5 Equivalent Category "A "

The AS 355F, AS 355N and AS 355NP are not certificated according to Part 29 category A requirements A dedicated Supplement in the RFM deals with the procedures and performances allowing the aircraft to be operated in "Equivalent Category A" conditions. This dedicated Supplement to the RFM for AS 355N and NP also includes instructions and procedures for Category A training.

The AS 355NP "Equivalent Category A" Supplement includes more information and more take-off and landing profiles than AS 355 and AS 355N as follows:

- Clear Heliport
- VTOL / Surface level and elevated Helipad
- VTOL / Short field take off
- VTOL / Confined Heliport

The minimum size of the heliport/helideck for which approval was granted is 15m by 15m or 20 m in diameter.

3. Helicopter differences:

Summary of the differences between all models of the AS 355 helicopter:

			AS 355E	AS 355F	AS 355F1	AS 355F2	AS 355N	AS 355NP
Dimensions	Fuselage	Length	10.93m	identical	identical	identical	identical	identical
		Width	1.87m	identical	identical	identical	identical	identical
		Height	3.14m	identical	identical	identical	identical	identical
	Main rotor	Diameter	10.69m	identical	identical	identical	identical	identical
	Tail rotor		1.86m	identical	identical	identical	identical	identical
Engines			Rolls-Royce ALLISON 250.C20F	Rolls-Royce ALLISON 250.C20F	Rolls-Royce ALLISON 250.C20F	Rolls-Royce ALLISON 250.C20F	Turbomeca ARRIUS 1A	Turbomeca ARRIUS 1A1
Fuel tanks			736.7 L	identical	identical	identical	identical	identical
Air Speed	Power ON	Absolute VNE	150Kt	identical	identical	identical	identical	identical
	Power OFF		120Kt	identical	identical	identical	identical	identical
Rotor Speed	Power ON	AOE	390 (+4, -5) 375 to 394	identical	identical	identical	identical	identical
	Autorotation	OEI	425 330	identical	identical	identical	identical	identical
Maximum Operating		Pressure Altitude	16000ft	16000ft	16000ft	16000ft	20000ft	20000ft
MTOW with Internal load			2100 Kg	2300 Kg	2400 Kg	2540 Kg	2600 Kg	2600 Kg
MTOW with External load					2500 Kg	2600 Kg	2600 Kg	2800 Kg
Equivalent Category A	Density Altitude	Clear Heliport		7400ft	7400ft	7400ft	7400ft	8500ft
		VTOL operations		7400ft	7400ft	7400ft	7400ft	9000ft

-Table 1-

4. Operator Difference Requirement (ODR) Tables:

Operator difference requirement are provided in detail in appendix 6a.

5. Optional specific equipment:

Optional specific equipment are provided in detail in appendix 6b.

6. Master Differences Requirements:

6.1 Difference Level Summary.

Difference levels are summarised in the table below for training, checking, and currency. This table is an extract only and complete descriptions of difference levels for training, checking and currency are given in OPS/FCL Common Procedures for conducting Operational Evaluation Boards document (See Appendix 5).

DIFFERENCE LEVEL TABLE

DIFFERENCE LEVEL	TRAINING	CHECKING	CURRENCY
A	SELF INSTRUCTION	NOT APPLICABLE (OR INTEGRATED WITH NEXT PC)	NOT APPLICABLE
B	AIDED INSTRUCTION	TASK OR SYSTEM CHECK	SELF REVIEW
C	SYSTEMS DEVICES	PARTIAL CHECK USING DEVICE	DESIGNATED SYSTEM
D	MANOEUVRE DEVICES**	PARTIAL PC USING DEVICE *	DESIGNATED MANOEUVRE(S)
E	SIMULATOR C/D OR AIRCRAFT #	FULL PC USING SIMULATOR C/D OR AIRCRAFT *	AS PER REGULATIONS (TAKEOFFS & LANDINGS IN SIMULATOR C/D OR THE AIRCRAFT)

AT LEVEL E – NEW TYPE RATING IS NORMALLY ASSIGNED
* = IOE/SLF/LIFUS/line indoc MAY BE REQUIRED ACCORDING TO REGULATIONS
PC = PROFICIENCY CHECK
**FFS or aircraft may be used to accomplish specific manoeuvres

Note: The OPS/FCL Common Procedures for conducting Operational Evaluation Boards document requires the use of FFS or the aircraft may be used to accomplish specific manoeuvres. As no FFS for the AS 355 family currently exists , the aircraft has to be used to accomplish specific manoeuvres.

6.2 Training, Checking, currency difference requirements:

The master Differences requirements are from levels A to D.

		FROM HELICOPTER					
		AS 355E	AS 355F	AS 355F1	AS 355F2	AS 355N	AS 355NP
TO HELICOPTER	AS 355 E		A / A / A	A / A / A	A / A / A	D / D / B	D / D / B
	AS 355 F	A / A / A		A / A / A	A / A / A	D / D / B	D / D / B
	AS 355 F1	A / A / A	A / A / A		A / A / A	D / D / B	D / D / B
	AS 355 F2	A / A / A	A / A / A	A / A / A		D / D / B	D / D / B
	AS 355 N	D / D / B	D / D / B	D / D / B	D / D / B		D / C / B
	AS 355 NP	D / D / B	D / D / B	D / D / B	D / B / B	D / C / B	

7. Licence endorsement

The proposal of this JOEB process is to include the AS 355NP helicopter as a variant of the AS 355 family as follows:

1 Manufacturer	2 Helicopter	3	4 Licence endorsement
Eurocopter			
-ME Turbine -	AS 355 E AS 355 F AS 355 F1 AS 355 F2	(D)	**AS 355 / 355N**
	AS 355 N		
	AS 355 NP		

8. Specification for Training

8.1 Training Courses

The Type Rating Training Courses proposed by Eurocopter for the AS 355 / Ecureuil II /TWINSTAR family fulfils the JAR-FCL 2 requirements.
During the evaluation process, the JOEB has adopted the same structure proposed by the manufacturer for differences training courses and proposed some change as mentioned in this report.

The courses are divided into the following phases:

- Student pre-entry requirements
- Theoretical ground program and test(s)
- Helicopter flight training program
- Skill test(s)

Note: The TRTC is recommended for approval in FTO, TRTO and for operator specific training provided the operator specific documentation is used throughout the course.

8.2 Student pre-entry requirement

All students must fulfil the pre-entry requirements in JAR-FCL 2 for an initial multi-engine helicopter training course.
(See Appendix 2)

Note: Appendix 1 to JAR FCL 2.261(b) requires for:

- an initial type rating on a SPH, MET (H) JAR/FAR 27 and 29 an approved flight instruction (excluding skill test) **at least 8 flight hours on the helicopter**.
- an additional type rating from MET(H) to MET(H) (excluding skill test) **at least 3 flight hours on the helicopter**
- Multi Engine differences training (excluding skill test) **at least 1 flight hour on the helicopter**

8.3 Type rating and difference training programmes summary

- TR1 corresponds to the training for initial type rating
- TR2 corresponds to the training for additional type rating
- D corresponds to the difference training programme from AS 355F to AS 355N
- D1 corresponds to the difference training programme from AS 355F to AS 355NP
- D2 corresponds to the difference training programme from AS 355N to AS 355NP
- D3 corresponds to the difference training programme from AS 355NP to AS 355N
- D4 corresponds to the difference training programme from AS 355N to AS 355F
- D5 corresponds to the difference training programme from AS 355NP to AS 355F

QUALIFICATION HELD	TR1		TR2		D	D3	D1	D2	D5	D4
	AS 355 F and N	AS 355NP	AS 355 F and N	AS 355NP	AS 355 N		AS 355 NP		AS 355 F	
SINGLE ENGINE ------ >>>	V	V								
MULTI-ENGINE -------- >>>			V	V						
AS 355 E,F,F1,F2 ------ >>>					V		V			
AS 355 N ------- >>>								V		V
AS 355 NP ------- >>>						V			V	
TOTAL THEORETICAL GROUND TRAINING + TEST	42h00	45h00	38h00	41h00	19h00	16h00	22h00	11h00	18h00	14h00
FLIGHT TRAINING	8h00		4h00		2h00	1h30	2h00	1h00	1h30	1h00

8.4 Theoretical ground programmes and test(s) summary

	TR1 F/N	TR1 NP	TR2 F/N	TR2 NP	D	D3	D1	D2	D5	D4
Type Rating										
*1. Presentation of the aircraft, structure, transmission, rotors and equipment, normal and contingency operation of the systems **(*)***	29h00		25h00		9h00	6h00	9h00	3h00	8h00	4h00
2. Limitations	2h00							0h30	2h00	
3. Performance, preparation and flight control	3h00				2h00			0h30	2h00	
4. Weight and balance, operation	1h00							0h30	1h00	
5. Emergency procedures	3h00				2h00			0h30	2h00	
6. Special conditions required for helicopters equipped with electronic instrumentation systems - (VEMD-355NP).	N/A	3h00	N/A	3h00	N/A	N/A	3h00	3h00	N/A	N/A
7. Optional equipment	1h00									
TOTAL THEORETICAL GROUND TRAINING	**39h00**	**42h00**	**35h00**	**38h00**	**17h00**	**14h00**	**20h00**	**09h00**	**16h00**	**12h00**
Theoretical test	3h00				2h00					
TOTAL THEORETICAL GROUND TRAINING + TEST	**42h00**	**45h00**	**38h00**	**41h00**	**19h00**	**16h00**	**22h00**	**11h00**	**18h00**	**14h00**

8.5 Helicopter flight training programmes and skill test(s) summary

Type Rating	TR1 F/N/NP	TR2 F/N/NP	EXT. IFR	D F⇒N	D3 NP⇒N	D1 F⇒NP	D2 N⇒NP	D5 NP⇒F	D4 N⇒F
1.General Handling	1h15	1h00							
2. Various touch-downs	1h15								
*3.**Emergency Procedures***	1h15	1h00							
4.Engine operating envelope	1h30	0h45		1h00	0h45	1h00	0h30	0h45	0h30
5.OEI Procedures	1h15	1h15		1h00	0h45	1h00	0h30	0h45	0h30
*6. Nav (VFR or ** IFR) (**)Applicants who satisfy FCL 2.185*	1h30								
*7.Flight 1 (single pilot IFR extension**)*			1h15						
*8. Flight 1 (single pilot IFR extension**)*			1h15						
FLIGHTTRAINING	**08h00**	**04h00**	**2h30**	**2h00**	**1h30**	**2h00**	**1h00**	**1h30**	**1h00**

SKILL TEST	**Required**	**required ******	**N/A**
In accordance with appendix 3 of FCL 2.240 on completion of single pilot VFR type rating training or ** on completion of single pilot IFR privileges extension type rating training. In case of differences training no skill test is required.			

8.6 Familiarisation training

HELICOPTER		Content of theoretical subjects	Duration	Reference
AS 355E AS 355F AS 355F1 AS 355F2		**Significant differences in the following parts :** • Presentation of the aircraft, structure, transmission, rotors and equipment, normal and contingency operation of the systems • Limitations • Performance, preparation and flight control • Weight and balance, operation • Optional equipment	**4.00 hours**	**RFM and Pilot Operating Handbook**

Note: Additional familiarisation training may depend on optional equipment installed on specific variants, and must be completed in accordance with the appropriate level of training.

9. Specification for checking

9.1 Skill test

As required by JAR-FCL 2.240, JAR-FCL 2.262 and Appendix 3 to JAR FCL 2.240

9.2 Proficiency Checks

As required by JAR-FCL 2.245 and Appendix 3 to JAR FCL 2.240

10. Specification for Flight Simulation Training Devices

When this report has been finalised no **AS 355** Flight Simulation Training Device where available. By the future if any **AS 355** FSTD are built, they will be qualified in accordance with JAR-FSTD (H) and compliant with EASA requirements .

11. Application of JOEB report

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

12. Appendices

- Appendix 1 : EASA / Type Certicate
- Appendix 2 : JAR-FCL2 Type rating requirements
- Appendix 3 : Type rating training courses: Summary of Ground Training
- Appendix 4 : Type rating training courses: Summary of Flight Instruction
- Appendix 5 : Difference Training Levels.
- Appendix 6a: ODR Tables
- Appendix 6b: ODR Tables (Optional Specific Equipment.