

# Technical report

## IN-027/2022

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Incident on 28 May 2022 involving a BOEING 737-8AS aircraft operated by Ryanair, registration EI-EKR, and a CIRRUS SF-50 aircraft, registration N66HR, in the Palma ATZ (Balearic Islands, Spain)

Please note that this report is not presented in its final layout and therefore it could include minor errors or need type corrections, but not related to its content. The final layout with its NIPO included (Identification Number for Official Publications) will substitute the present report when available.

## Notice

This report is a technical document that reflects the point of view of the Civil Aviation Accident and Incident Investigation Commission regarding the circumstances of the accident that is the object of the investigation, its probable causes, and its consequences.

In accordance with the provisions of Article 5.4.1 of Annex 13 of the International Civil Aviation Convention, Article 5.6 of Regulation (EU) No 996/2010 of the European Parliament and of the Council of 20 October 2010; Article 15 of Law 21/2003 on Air Safety; and Articles 1 and 21.2 of RD 389/1998, this investigation is exclusively of a technical nature, and its objective is the prevention of future aviation accidents and incidents by issuing, if necessary, safety recommendations to prevent their recurrence. The investigation is not intended to attribute any blame or liability, nor to prejudge any decisions that may be taken by the judicial authorities.

Therefore, and according to the laws specified above, the investigation was carried out using procedures not necessarily subject to the guarantees and rights by which evidence should be governed in a judicial process.

As a result, the use of this report for any purpose other than the prevention of future accidents may lead to erroneous conclusions or interpretations.

This report was originally issued in Spanish. This English translation is provided for information purposes only.

# CONTENTS

<b>ABBREVIATIONS</b> .....	<b>iv</b>
<b>SYNOPSIS</b> .....	<b>vi</b>
<b>1 FACTUAL INFORMATION</b> .....	<b>8</b>
<b>1.1 History of the flight</b> .....	<b>8</b>
<b>1.2 Injuries to persons</b> .....	<b>11</b>
1.2.1 Aircraft RYR1U.....	11
1.2.2 Aircraft N66HR .....	11
<b>1.3 Damage to aircraft</b> .....	<b>11</b>
<b>1.4 Other damage</b> .....	<b>11</b>
<b>1.5 Personnel information</b> .....	<b>12</b>
1.5.1 Aircraft RYR1U.....	12
1.5.2 Aircraft N66HR .....	13
1.5.3 Controller (local departures LCL DEP).....	14
<b>1.6 Aircraft information</b> .....	<b>15</b>
1.6.1 Aircraft RYR1U.....	15
1.6.2 Aircraft N66HR .....	15
<b>1.7 Meteorological information</b> .....	<b>16</b>
<b>1.8 Aids to navigation</b> .....	<b>16</b>
<b>1.9 Communications</b> .....	<b>16</b>
<b>1.10 Aerodrome information</b> .....	<b>17</b>
1.10.1 General description .....	17
1.10.2 Airspace in the area of the incident .....	17
1.10.3 VFR procedures at LEPA and LESB.....	18
<b>1.11 Flight recorders</b> .....	<b>19</b>
<b>1.12 Wreckage and impact information</b> .....	<b>24</b>
<b>1.13 Medical and pathological information</b> .....	<b>24</b>
<b>1.14 Fire</b> .....	<b>24</b>
<b>1.15 Survival aspects</b> .....	<b>24</b>
<b>1.16 Tests and research</b> .....	<b>24</b>
<b>1.17 Organizational and management information</b> .....	<b>24</b>
1.17.1 Aircraft RYR1U.....	24
1.17.2 Aircraft N66HR .....	24

<b>1.18</b>	<b>Additional information .....</b>	<b>24</b>
1.18.1	Information provided by the ATC personnel and the pilots.....	24
1.18.2	Description of the airspace classes .....	26
<b>1.19</b>	<b>Useful or effective investigation techniques.....</b>	<b>26</b>
<b>2</b>	<b>ANALYSIS.....</b>	<b>27</b>
<b>2.1</b>	<b>General considerations.....</b>	<b>27</b>
<b>2.2</b>	<b>Aspects relating to the operation of the N66HR aircraft .....</b>	<b>28</b>
2.2.1	Prior considerations.....	28
2.2.2	The pilot's licence.....	28
2.2.3	Flight planning.....	28
2.2.4	Progress of the flight .....	29
<b>3</b>	<b>CONCLUSIONS.....</b>	<b>31</b>
<b>3.1</b>	<b>Findings .....</b>	<b>31</b>
<b>3.2</b>	<b>Causes / Contributing factors .....</b>	<b>32</b>
<b>4</b>	<b>RECOMMENDATIONS.....</b>	<b>33</b>

## ABBREVIATIONS

00:00:00	Hours / Minutes / Seconds
°	Sexagesimal degrees
ADI	Aerodrome control instrument rating
ADV	Aerodrome control visual rating
AESA	Spain's National Aviation Safety Agency
AGL	Above ground level
AIP	Aeronautical Information Publication
AIRAC	Aeronautical information regulation and control
AMDT	AIP amendment
AMSL (MSL)	Above mean sea level
AOA	Angle of attack
AOC	Air Operator Certificate
APP	Approach centre or approach service
ARR	Arrival (arriving traffic)
ATC	Air traffic control
ATCO	Air traffic controller
ATPL(A)	Airline transport pilot licence (aircraft)
ATS	Air traffic service
ATZ	Aerodrome transit zone
CIAIAC	Civil Aviation Accident and Incident Investigation Commission
CPL(A)	Commercial pilot license (aircraft)
CTR	Control zone
D	Horizontal distance
DEP	Departure (departing traffic)
E	East
EGCC	ICAO code for Manchester Airport
EMERG	Emergencies
FAA	United States Federal Aviation Administration
FH	Flight hours
ft	Feet
GMS	Ground movement surveillance endorsement
GS	Ground speed
h	Hours
H	Height
IAA	Irish Aviation Authority
IFR	Instrument flight rules

kg	Kilograms
KIAS	Knots of indicated airspeed
kt	Knots
LBA	Luffahrt-Bundesamt (Germany's National Civil Aviation Authority)
LCL	Local air traffic control position
LEIB	ICAO code for Ibiza Airport
LEPA	ICAO code for Palma de Mallorca Airport
LESB	ICAO code for Mallorca-Son Bonet Airport
m	Metres
ME / IR (MPA)	Instrument flight rating for multi-engine aircraft (multi-pilot aircraft)
METAR	Aviation routine weather report
min	Minutes
MHz	Megahertz
N	North
NM	Nautical miles
W	West
ICAO	International Civil Aviation Organisation
OJTI	On-the-job training instructor
OPS	Operations
PPL(A)	Private pilot license (aircraft)
QAR	Quick access recorder
RAD	Aerodrome radar control endorsement
RWY	Runway
s	Seconds
S	South
s/n	Serial number
SERA	Standardised European Rules of the Air
SFC	Surface
SID	Standard instrument departure
TAC	Temporary Airmen Certificate
TCAS	Traffic alert and collision avoidance system
TCAS RA	Traffic collision avoidance system - resolution advisory
TMA	Traffic management area
TWR	Aerodrome control tower endorsement
UTC	Coordinated universal time
VAC	Visual approach chart
VFR	Visual flight rules

# Technical report

## IN-027/2022

	AIRCRAFT 1	AIRCRAFT 2
<b>Owner and Operator:</b>	Ryanair	Private
<b>Aircraft:</b>	BOEING 737-8AS, EI-EKR, s/n 38503	CIRRUS SF-50, N66HR, s/n 0316
<b>Persons on board:</b>	Crew: 6, unharmed  Passengers: 181, unharmed	1 (pilot), unharmed
<b>Type of operation:</b>	Commercial air transport - Scheduled - International - With passengers	General Aviation – Private
<b>Phase of flight:</b>	Take-off – Initial climb	En route
<b>Flight rules:</b>	IFR	VFR
<b>Date and time of incident:</b>	Saturday, 28 May 2022, 10:32 hours <sup>1</sup>	
<b>Site of accident:</b>	Palma ATZ (Balearic Islands, Spain)	
<b>Date of approval:</b>	25 <sup>th</sup> October 2023	

## SYNOPSIS

### Summary:

On Saturday, 28 May 2022, at 10:32:21 h, aircraft EI-EKR (callsign RYR1U) performed a manoeuvre to avoid aircraft N66HR (callsign N66HR), whose flight path converged with that of the former. The incident occurred within the Palma ATZ, as aircraft RYR1U was making its initial climb after taking off from runway 24R at Palma de Mallorca Airport (LEPA), and aircraft N66HR was en-route from Mallorca-Son Bonet Airport (LESB).

According to the information obtained from the flight records, at their closest point, the distance between the aircraft was 0.65 NM horizontally and 116 ft vertically, the RYR1U aircraft flying at 1116 ft AMSL and 175 kt GS, and the N66HR aircraft at 1000 ft AMSL and at least 200 kt GS. The event did not produce a TCAS resolution advisory (TCAS RA) on board the RYR1U aircraft, as it was inhibited below 1000 ft of Radio Altimeter.

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<sup>1</sup> All times in this report are expressed in UTC. Local time can be calculated by adding 2 (two) hours to the UTC.

The investigation has determined that the incident was caused by the unauthorised presence of the N66HR aircraft within the Aerodrome Transit Zone (ATZ) of Palma de Mallorca International Airport (LEPA) due to deficient flight planning.

The following factors are considered to have contributed to the incident:

- The lack of the knowledge and skills of the pilot of the aircraft N66HR to carry out a flight with the characteristics of the one involved in the event.
- The inadequate management of the perceived problem on board the N66HR aircraft due to poor decision-making.
- The fact that the pilot of the N66HR aircraft failed to comply with the VFR communications procedures in force within the Palma TMA by not communicating or listening in on the frequencies established within the Palma ATZ.
- The inadequate language proficiency exhibited by the pilot of the N66HR aircraft during the incident flight, as evidenced by the limited ability to understand the information and instructions received.

The report does not contain any safety recommendations.



# 1 FACTUAL INFORMATION

## 1.1 History of the flight

On Saturday, 28 May 2022, the BOEING 737-8AS aircraft, registration EI-EKR (callsign RYR1U), was operating a commercial passenger air transport flight. The Cirrus SF-50 aircraft, registration N66HR (callsign N66HR), was flying a private general aviation flight.

The N66HR aircraft had taken off from runway 23 at Mallorca-Son Bonet (LESB) Airport (non-controlled) at 10:30:00 h, destined for Ibiza Airport (LEIB). A Z flight plan<sup>2</sup> had been filed, in which the first part of the flight was to be conducted under visual flight rules (VFR) up to the TUKRO<sup>3</sup> waypoint. From that point, the aircraft would fly under instrument flight rules (IFR) to its destination.

The RYR1U aircraft had commenced its take-off run on runway 24R at Palma de Mallorca Airport (LEPA) at 10:30:56 h, bound for Manchester Airport (EGCC), after receiving take-off clearance from the control tower. Afterwards, the aircraft was to follow a standard instrument departure (SID)<sup>4</sup>.

At 10:31:15 h, after taking off and turning to its left, the N66HR aircraft entered Palma ATZ at an altitude of 700 ft AMSL<sup>5</sup>, in climbing attitude. It then turned to its right 24 s later, maintaining a direct course to TUKRO at an altitude of between 1000 ft and 1200 ft AMSL. At the same time, the RYR1U aircraft was on its take-off run. From that moment on, the distance between the two aircraft, which were on converging headings, began to decrease.

Between 10:31:32 h and 10:32:02 h, the tower controller at the LEPA runway 24R departure control position (LCL DEP (RWY 24R)) called the N66HR aircraft three times (twice on the unit frequency<sup>6</sup> and then on the emergency frequency<sup>7</sup>), advising it, on the last call, of the presence of the RYR1U aircraft taking off from runway 24R and instructing it to turn to its right to avoid it. For its part, between 10:31:35 h and 10:32:47 h, the N66HR aircraft had been calling Palma OPS (LEPA air traffic services notification office<sup>8</sup>). Meanwhile, the RYR1U aircraft had rotated at 10:31:47 h and was climbing.

At 10:32:11 h, the RYR1U aircraft initiated an evasive manoeuvre, turning to its right and informing the LCL DEP controller (RWY 24R) of said manoeuvre, while the N66HR aircraft remained on its course for the TUKRO waypoint.

The shortest distance between the aircraft – 0.65 NM horizontally and 116 ft vertically – occurred at 10:32:21 h when the N66HR aircraft was crossing the extension of runway 24R at LEPA and the RYR1U aircraft was continuing its evasive manoeuvre, with the RYR1U aircraft remaining above the other. After this point, the distance between the aircraft began to increase.

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<sup>2</sup> Planned change from VFR to IFR during the flight.

<sup>3</sup> FRA point (“Free Route Airspace”), with the coordinates 39° 14' 46,37" N 2° 36' 38.315" E, located to the south of the island of Palma. (AIP ENAIRE)

<sup>4</sup> Specifically, aircraft RYR1U was to follow the DRAGO 2A SID.

<sup>5</sup> Above mean sea level.

<sup>6</sup> LCL DEP frequency: 118.455 MHz.

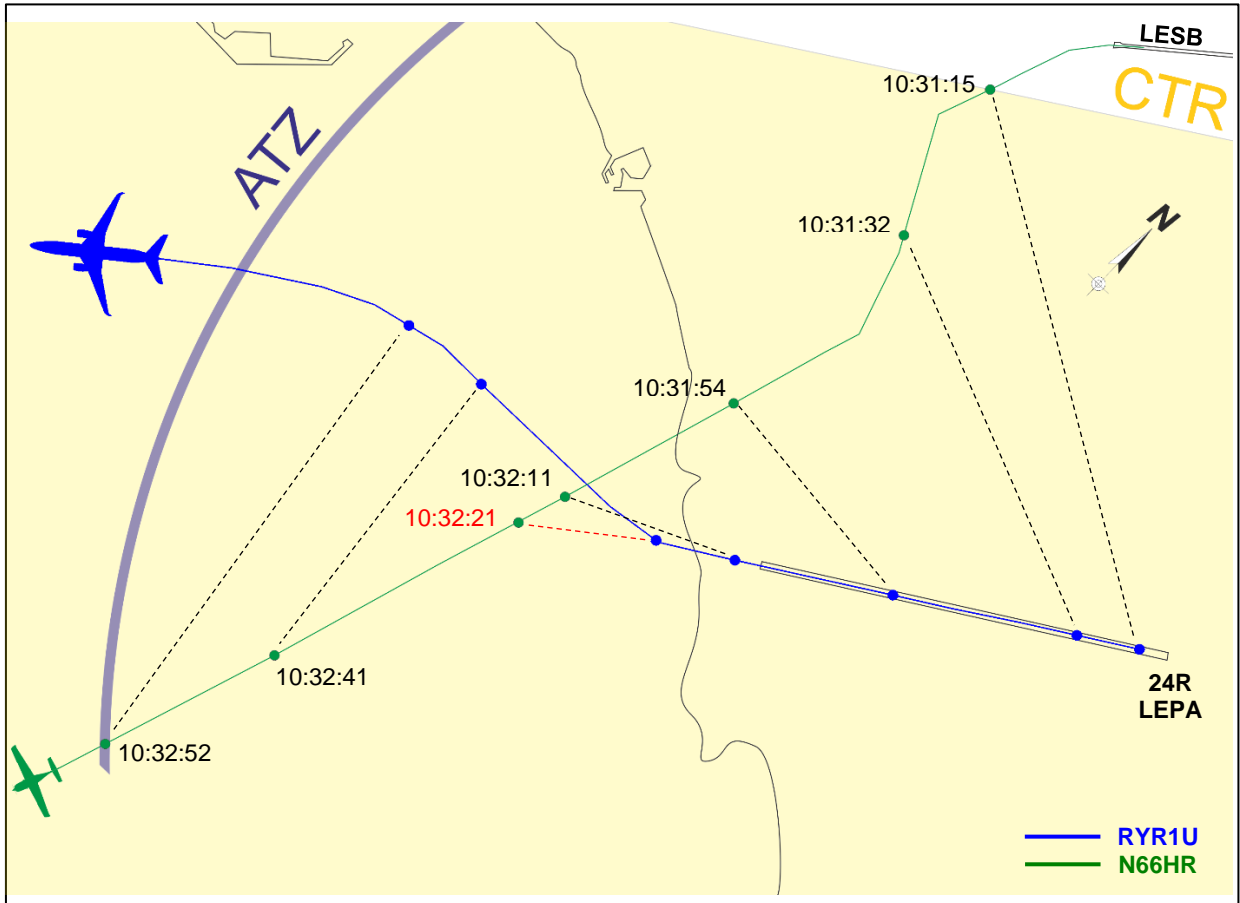
<sup>7</sup> Frequency for emergencies: 121.500 MHz.

<sup>8</sup> Palma OPS frequency: 123.250 MHz.

At 10:32:41 h, the RYR1U aircraft completed the evasive manoeuvre and turned again to resume the SID. 1 s before, the N66HR aircraft had crossed the centreline extension of runway 24L at LEPA while continuing its flight towards TUKRO and eventually left the Palma ATZ at 10:32:52 h. After the event, both aircraft contacted the relevant air traffic control units.

Both aircraft continued their flights without further incident. There were no injuries.

The event did not produce a TCAS resolution advisory (TCAS RA) on board the RYR1U aircraft, as it was inhibited below 1,000 ft of Radio Altimeter.



Time	RYR1U		N66HR	
	Location	Frequency in use	Location	Frequency in use
10:31:15	Take-off run	LCL DEP (RWY 24R)	Entry to the ATZ	Palma OPS
10:31:32	Take-off run		1st call LCL DEP	
10:31:54	Initial climb		3rd call LCL DEP	
10:32:11	Start of evasive manoeuvre		En route to TUKRO	
10:32:21	Minimum distance		Minimum distance	
10:32:41	End of evasive manoeuvre	En route to TUKRO		
10:32:52	Climb	Palma APP DEP <sup>9</sup>	Departure from ATZ	LCL ARR (RWY 24L) <sup>10</sup>

Figure 1. Aircraft trajectories and area in which the incident occurred.

<sup>9</sup> Palma APP DEP frequency: 118.005 MHz.

<sup>10</sup> LCL ARR (RWY 24L) frequency: 118.305 MHz.

## 1.2 Injuries to persons

### 1.2.1 Aircraft RYR1U

<i>Injuries</i>	<i>Crew</i>	<i>Passengers</i>	<i>Total in the aircraft</i>	<i>Others</i>
Fatal	-	-	-	-
Serious	-	-	-	-
Minor	-	-	-	-
Unharmmed	6	181	187	-
TOTAL	6	181	187	-

### 1.2.2 Aircraft N66HR

<i>Injuries</i>	<i>Crew</i>	<i>Passengers</i>	<i>Total in the aircraft</i>	<i>Others</i>
Fatal	-	-	-	-
Serious	-	-	-	-
Minor	-	-	-	-
Unharmmed	1	-	1	-
TOTAL	1	-	1	-

## 1.3 Damage to aircraft

Neither aircraft sustained damage.

## 1.4 Other damage

There was no other damage.

## 1.5 Personnel information

### 1.5.1 Aircraft RYR1U

#### 1.5.1.1 Captain

Age:	35 years
Licence:	Airline transport pilot licence (aircraft) (ATPL(A))
Licence issue date:	25 April 2018
Flying crew licence:	Issued by the IAA, Ireland, on 25 April 2018
Ratings:	
<ul style="list-style-type: none"> <li>▪ B737 300-900</li> </ul>	Valid until 31 March 2023
<ul style="list-style-type: none"> <li>▪ Instrument flight, valid for multi-pilot aircraft Only (ME IR (MPA))</li> </ul>	Valid until 31 March 2023
Language proficiency:	English, level 6, no limitation
Medical certificate:	Class 1, valid until 22 December 2022
Total flight hours:	6400
Flight hours in type:	4300

#### 1.5.1.2 Co-pilot

Age:	26 years
Licence:	Commercial pilot license (aircraft) (CPL(A))
Licence issue date:	10 January 2021
Flying crew licence:	Issued by the IAA, Ireland, on 11 January 2021
Ratings:	
<ul style="list-style-type: none"> <li>▪ B737 300-900</li> </ul>	Valid until 31 December 2022
<ul style="list-style-type: none"> <li>▪ Instrument flight, valid for multi-pilot aircraft Only (ME IR (MPA))</li> </ul>	Valid until 31 December 2022
Language proficiency:	English, level 6, no limitation
Medical certificate:	Class 1, valid until 08 December 2022
Total flight hours:	809

Flight hours in type: 573

### 1.5.2 Aircraft N66HR

The pilot was operating the incident aircraft on a flight crew licence (Temporary Airman's Certificate; TAC) issued by the FAA, United States<sup>11</sup>. The terms of the TAC state that it may be issued on the basis of a flight crew licence issued by a foreign authority (foreign-based certification type). In this case, the foreign licence was issued by the German LBA, and all the limitations and restrictions pertaining to this licence apply.

Following a request for the certificates in force on the date of the incident, the pilot provided the flight crew licence and medical certificate issued by the LBA, as well as the TAC granted by the FAA, which was issued after the date of the incident. In view of this information, the CIAIAC requested the certificates in force on the date of the event from the issuing authorities. The information provided by the FAA and the LBA in regard to the flight crew licence and ratings of the pilot of the N66HR aircraft is set out below:

Age:	67 years
Licence:	Private pilot licence (foreign-based)
Licence issue date:	11 November 2013 <sup>12</sup>
Ratings:	
▪ <i>Airplane Single Engine Land</i>	Valid
▪ <i>Instrument Airplane</i>	Valid
Language proficiency <sup>13</sup> :	
▪ German	Level 6, no limitation
▪ English	Level 4, valid until 31 October 2023
Medical certificate:	Class 2, valid until 15 September 2022 <sup>14</sup>
Total flight hours <sup>15</sup> :	1,500 (last seven years)
Flight hours in type:	108

<sup>11</sup> 14 CFR Part 61, Section 61.75.

<sup>12</sup> Information based on the licence issued by the LBA, Germany.

<sup>13</sup> Information based on the licence issued by the LBA, Germany.

<sup>14</sup> Information based on the medical certificate issued by the LBA, Germany.

<sup>15</sup> Information on total and in-type flight experience as reported by the pilot (not cross-checked against the pilot's flight log).

- **Regarding the ratings required to operate the model of the aircraft involved in the incident:**

As regards the ratings required to operate the N66HR aircraft:

- After consultation with the FAA, the Airplane Single Engine Land rating qualifies the pilot to operate single-engine piston aircraft, while a type rating is required to operate turbine-powered aircraft.
- According to the provisions of the FAA<sup>16</sup> regulations, the type rating that enables the operation of the aircraft model is the SF-50.

The TAC provided by the pilot, issued after the date of the incident, included the SF-50 type rating. However, based on the information available, the pilot's TAC did not include this rating on the date of the event.

### 1.5.3 Controller (local departures LCL DEP)

Licence:	Air traffic controller (ATCO)
Last issue of the licence:	09 September 2021
Ratings:	
<ul style="list-style-type: none"> <li>▪ Aerodrome control visual (ADV)</li> </ul>	First issue 21 September 2017
<ul style="list-style-type: none"> <li>▪ ADI (aerodrome control instrument)</li> </ul>	First issue 21 September 2017
Rating endorsements:	Control tower (TWR), Ground movement surveillance (GMS), and Aerodrome radar control (RAD).
Unit endorsements (Rating / Rating endorsements):	LEPA unit (ADI/TWR/GMS/RAD), valid until 25 October 2022
Other endorsements:	
<ul style="list-style-type: none"> <li>▪ On-the-Job Training Instructor (OJTI)</li> </ul>	Valid until 20 July 2024
Language proficiency:	
<ul style="list-style-type: none"> <li>▪ Spanish</li> </ul>	Level 6, no limitation
<ul style="list-style-type: none"> <li>▪ English</li> </ul>	Level 5, valid until 21 March 2027

<sup>16</sup> Order 8900.1, Volume 5, Chapter 2, Section 19, Pilot Type Rating Certification; the document consulted was the 28 June 2021 version.

Medical certificate: Class 3 ATCO, valid until 13 December 2022

## 1.6 Aircraft information

### 1.6.1 Aircraft RYR1U

The RYR1U aircraft, manufactured by The Boeing Company (United States), is a twin-engine B737-8AS with a retractable tricycle-type landing gear. It has two CFM56-7B/3 engines.

Registration number:	EI-EKR
Serial number (airframe):	38503
Year of manufacture:	2010
Date of registration:	03 October 2016

The aircraft had an airworthiness certificate issued by the IAA (Ireland) on 10 March 2010. It was renewed on 10 February 2022, and was valid until 7 March 2023.

At the time of the event, the airframe had 38504:41 FH.

### 1.6.2 Aircraft N66HR

The N66HR aircraft, manufactured by Cirrus Design Corporation (United States), is a six-passenger, single-pilot, SF-50 model. It is a single-engine turbine, low-wing, V-tail, monoplane aircraft equipped with a retractable tricycle landing gear. The aircraft was fitted with a Williams FJ33-5A turbofan engine.

Registration number:	N66HR
Serial number (airframe):	0316
Year of manufacture:	2021
Date of registration:	15 December 2021

The aircraft had a certificate of airworthiness issued by the FAA (United States) on 30 November 2021, effective for as long as maintenance, preventive maintenance and modifications are performed in accordance with applicable Federal Aviation Regulations and the aircraft is registered in the United States.

At the time of the event, the airframe had 108 FH.

The basic features of this model are shown below:

Wingspan:	11.79 m
Height:	3.32 m
Length:	9.42 m



Empty weight:	1610 kg
Maximum take-off weight:	2727 kg
Maximum speed (cruise):	311 kt

## 1.7 Meteorological information

Neither flight was limited by any type of meteorological conditions. The METAR for Palma de Mallorca Airport (LEPA)<sup>17</sup> revealed the absence of adverse weather and/or significant phenomena in the area and period in which the event occurred.

## 1.8 Aids to navigation

N/A.

## 1.9 Communications

The communications between the different control units and the aircraft were recovered for the investigation. In relation to the control units at Palma de Mallorca Airport (LEPA), the information was extracted from the following available frequencies<sup>18</sup>:

Available frequencies	Service provided
118.305 MHz	LCL ARR (RWY 24L) (Palma TWR)
118.455 MHz	LCL DEP (RWY 24R) (Palma TWR)
130.250 MHz	Palma OPS (LEPA OPS)
118.005 MHz	Palma APP DEP (Approach)
121.500 MHz	EMERG (Emergencies)

The most relevant information extracted from these communications in relation to the event in question is set out in section 1.11, together with the data obtained from the radar trace of the N66HR aircraft and the flight data recorder of the RYR1U aircraft. English was the language used for these communications by the pilots of both aircraft, Palma OPS personnel and ATC personnel involved in the incident.

It should be noted that, according to the information published by ENAIRE in the AIP, the 130.250 MHz Palma OPS (Operations) frequency is not intended for use by the air traffic control service:

- According to the Palma de Mallorca Airport aerodrome data sheet (LEPA)<sup>19</sup>, this frequency coordinates the apron services, provides information about slots and flight

<sup>17</sup> METAR LEPA 281030Z 22010KT CAVOK 26/18 Q1014 NOSIG

<sup>18</sup> AD 2-LEPA/LESJ; information last revised in AIRAC AMDT 10/21. (AIP ENAIRE)

<sup>19</sup> AD 2-LEPA/LESJ; information last revised in AIRAC AMDT 10/21. (AIP ENAIRE)

plans and conducts monitoring of arriving and departing flights at Mallorca/Son Bonet Airport (LESB).

- According to the Mallorca/Son Bonet Airport aerodrome data sheet (LESB)<sup>20</sup>, departures and arrivals from/at LESB must be reported to LEPA on this frequency.

## 1.10 Aerodrome information

### 1.10.1 General description

Palma de Mallorca Airport (LEPA) is in Palma (Mallorca). It is a controlled aerodrome. Its elevation is 27 ft. The airport has two parallel runways with an 06/24 orientation. Runway 06L/24R measures 3270 x 45 m, while runway 06R/24L measures 3000 x 45 m.

Mallorca/Son Bonet Airport (LESB) is in Mallorca, about 3.3 NM northwest of Palma de Mallorca Airport. It is a non-controlled aerodrome. Its elevation is approximately 153 ft. The airport has a single paved runway with a 05/23 orientation measuring 1299 m x 23 m.

### 1.10.2 Airspace in the area of the incident

The event occurred inside the Palma ATZ. According to the information contained in ENAIRE's AIP, the airspace in the ATZ and CTR is structured as follows:

Type of airspace	Unit responsible	Airspace class	Limits
ATZ Palma <sup>21</sup>	Palma TWR	A	1000 ft AGL – 3000 ft AGL (or up to the cloud ceiling, whichever is lower)
		D	Surface (SFC) – 1000 ft AGL (or up to the cloud ceiling, whichever is lower)
CTR Palma de Mallorca	Palma APP	D	SFC – 1000 ft AGL

<sup>20</sup> AD 2-LESB; information last revised in AIRAC AMDT 08/21. (AIP ENAIRE)

<sup>21</sup> Information relating to ATZ Palma and to CTR Palma extracted from AD 2-LEPA/LESJ; information last revised in AIRAC AMDT 10/21. (AIP ENAIRE)

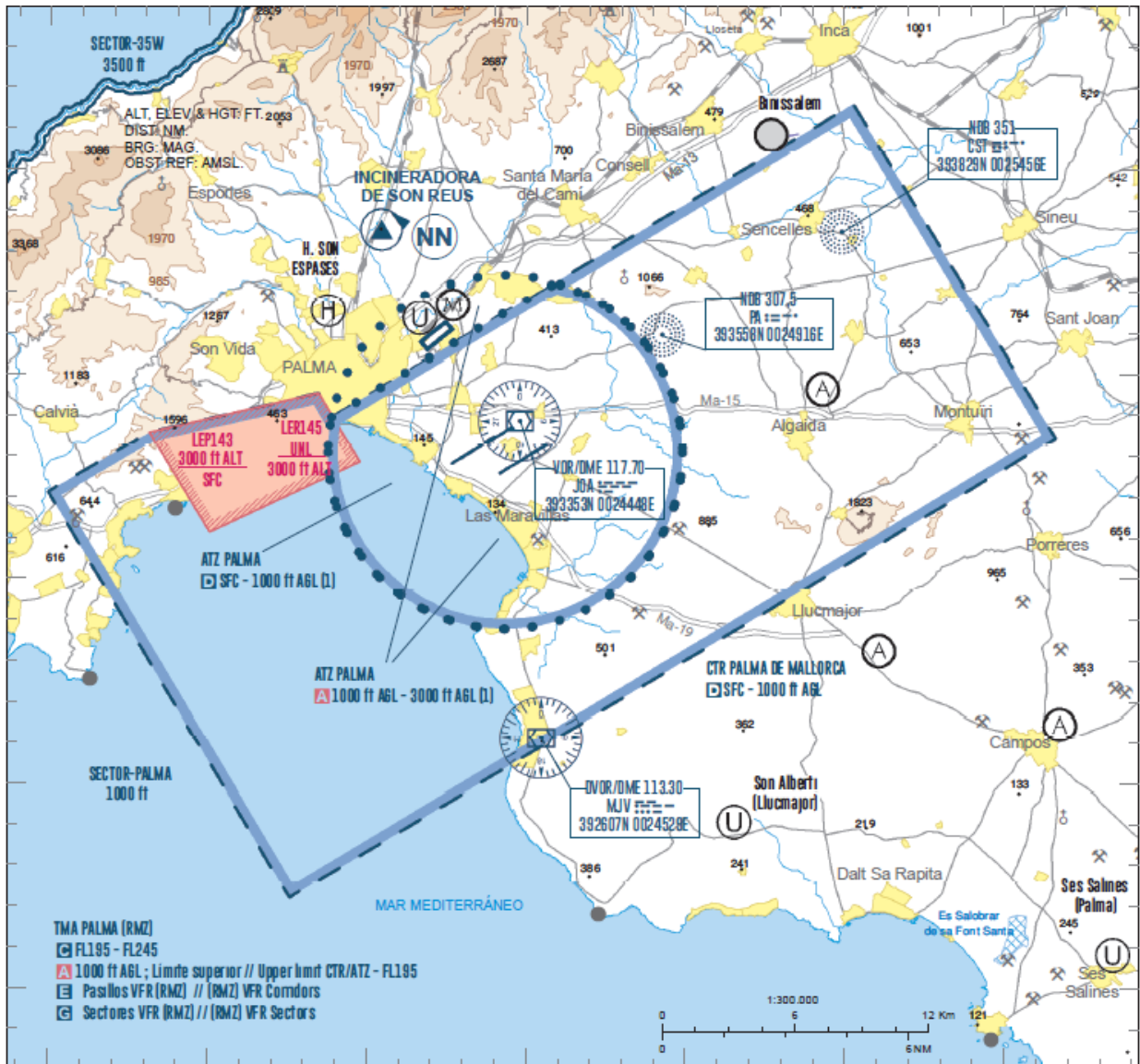


Figure 2. Detail of the airspace around LESB and LEPA. Source: LESB visual approach chart (AD 2-LESB VAC; information last revised in AIRAC AMDT 03/22; AIP ENAIRE).

### 1.10.3 VFR procedures at LEPA and LESB

- **Information relative to LEPA in the AIP:**

The VFR procedures document for Palma TMA<sup>22</sup> establishes that aircraft will communicate or be listening on the frequencies corresponding to each zone. In the case of LEPA, these frequencies are (those relevant to the investigation are shown):

TWR	Language	Emergency
118.305 MHz	Spanish/English	121.500 MHz 243.000 MHz

<sup>22</sup> ENR 6.10-7; information last revised in AIRAC AMDT 08/21. (AIP ENAIRE)

- **Information relative to LESB in the AIP:**

The visual approach chart for LESB<sup>23</sup> establishes the following:

- All aircraft taking off from LESB shall establish radio contact with Palma OPS (LEPA OPS) to report their take-off time.
- Traffic between LESB and LEPA, aircraft coming from LESB bound for LEPA or those wishing to cross the CTR, shall need clearance from Palma TWR (LEPA TWR) before entering the ATZ or CTR of LEPA.
- Under no circumstances shall the CTR of Palma de Mallorca or the final approach areas to the runways of Palma de Mallorca AD be crossed without permission from ATC.
- No flights shall be conducted in the ATZ of Palma de Mallorca without prior authorisation from Palma TWR (LEPA TWR).

### 1.11 Flight recorders

For aircraft RYR1U, the operator provided the data recorded by the quick access recorder (QAR). For aircraft N66HR, the investigation had access to the radar trace of the incident flight.

The following section sets out the information relative to the event, framed between the moment aircraft RYR1U received the take-off clearance until moments after the end of the evasive manoeuvre it subsequently performed. The information available in regard to both flights after the aforementioned period is not relevant to the investigation and, therefore, is not shown in this report. The following information was used:

- The parameters recorded by the QAR on aircraft RYR1U and those recorded by the radar trace of the flight of aircraft N66HR. Specifically:
  - Position (coordinates),
  - Altitude (ft AMSL),
  - Heading,
  - Attitude, and
  - Speed (GS).
- Relative distance between the aircraft, according to horizontal distance (D) and altitude (H).
- The communications between:
  - Aircraft N66HR and Palma OPS,
  - The air traffic control units and aircraft N66HR, and
  - The air traffic control units and aircraft RYR1U.

The information of relevance to the investigation is shown chronologically, representing, on the one hand, the actions carried out by each aircraft and, on the other hand, the communications made, marking the instant at which each of them occurred and their duration. The spaces shaded in grey mark the periods of time in which no communication took place.

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<sup>23</sup> AD 2-LESB VAC; information last reviewed in AIRAC AMDT 03/22. (AIP ENAIRE)

hh:mm:ss	Actions of the aircraft		Communications between the ATS units and the aircraft	
	RYR1U	N66HR	LCL DEP (RWY 24R) (118.455 MHz)	Palma OPS (130.250 MHz)
10:30:40	RYR1U positioned at the head of runway 24R at LEPA.	No radar information.	The LCL DEP controller clears aircraft RYR1U for take-off on LEPA runway 24R, receiving a readback from the aircraft.	
10:30:49				
10:30:56	RYR1U commences its take-off run.	First appearance of the N66HR aircraft on the radar trace after taking off from LESB runway 23 and then turning to its left.		
10:31:15	RYR1U on its take-off run.	N66HR enters Palma ATZ. Subsequently, the aircraft follows a heading almost perpendicular to 24R at LEPA		
10:31:32	RYR1U on its take-off run.	N66HR continues to follow a heading almost perpendicular to LEPA runway 24R while flying within the Palma ATZ. (Distance between the aircraft and runway 24R of 1.65 NM).		
10:31:35				
10:31:39	RYR1U on its take-off run.	N66HR turns to its right while flying within the Palma ATZ. Afterwards, the aircraft proceeds on course to the TUKRO waypoint. (Distance between the aircraft and runway 24R of 1.36 NM).	LCL DEP calls N66HR for the second time but does not receive a reply.	N66HR contacts Palma OPS for the first time, indicating that it had just taken off from LESB, and was on course for the TUKRO waypoint.
10:31:41				
10:31:44				

hh:mm:ss	Actions of the aircraft		Communications between the ATS units and the aircraft	
	RYR1U	N66HR	LCL DEP (RWY 24R) (118.455 MHz)	Palma OPS (130.250 MHz)
10:31:47	RYR1U rotates.	N66HR proceeds on course to the TUKRO waypoint inside the Palma ATZ.		Palma OPS confirms to N66HR that its flight plan has been activated and instructs it to contact Palma TWR on the LCL ARR (RWY 24L) frequency at LEPA.
10:31:54	RYR1U on initial climb.	N66HR proceeds on course to the TUKRO waypoint inside the Palma ATZ.	LCL DEP calls N66HR on the emergency frequency, warning it of the presence of RYR1U on take-off and instructing it to turn to its right to avoid it.	
10:31:59				
10:32:02				N66HR requests a repetition of the frequency specified by Palma OPS, which is then repeated by Palma OPS.
10:32:11	RYR1U initiates an evasive manoeuvre to its right.	N66HR proceeds on course to the TUKRO waypoint inside the Palma ATZ.		N66HR then reads back the repeated frequency incorrectly.
10:32:15			RYR1U notifies LCL DEP that it is deviating from its flightpath to its right.	
10:32:21	RYR1U continues the evasive manoeuvre to its right.	N66HR crosses the centreline extension of LEPA runway 24R, while continuing course to the TUKRO waypoint inside the Palma ATZ.	LCL DEP then informs them that there is an aircraft at 1000 ft in front of them, that they do not have it on frequency and that they do not know its intentions.	
10:32:22	RYR1U continues the evasive manoeuvre to its right.	N66HR proceeds on course to the TUKRO waypoint inside the Palma ATZ.	RYR1U is then transferred to the Palma APP DEP frequency.	
10:32:35				N66HR requests a further repetition of the frequency specified by

hh:mm:ss	Actions of the aircraft		Communications between the ATS units and the aircraft	
	<b>RZR1U</b>	<b>N66HR</b>	<b>LCL DEP (RWY 24R) (118.455 MHz)</b>	<b>Palma OPS (130.250 MHz)</b>
10:32:40	<b>RZR1U</b> continues the evasive manoeuvre to its right.	<b>N66HR</b> crosses the centreline extension of LEPA runway 24L, while continuing course to the TUKRO waypoint inside the Palma ATZ.		<b>Palma OPS</b> , which is again repeated by the latter and finally read back correctly by <b>N66HR</b> .
10:32:41 10:32:44	<b>RZR1U</b> ends the evasive manoeuvre, changing course again to resume the course it was on prior to the evasive manoeuvre.	<b>N66HR</b> proceeds on course to the TUKRO waypoint inside the Palma ATZ.		
10:32:47				
10:32:52	<b>RZR1U</b> continues its turn to resume the initial course.	<b>N66HR</b> leaves the Palma ATZ, while continuing course to the TUKRO waypoint.		
10:33:04	<b>RZR1U</b> resumes its initial course.	<b>N66HR</b> proceeds on course to the TUKRO waypoint.		

At 10:32:55 UTC, the **N66HR** aircraft notified the **LCL ARR (RWY 24L) (118.305 MHz)** controller that it was on course to the TUKRO waypoint at 1000 ft. The controller instructed it to immediately contact the **Palma APP DEP (118.005 MHz)** frequency. The pilot of the **N66HR** aircraft read back the frequency incorrectly, so the controller repeated it again, getting no response from the pilot.

At 10:33:41, the **N66HR** aircraft contacted **LCL ARR (RWY 24L)** again, reporting, once more, that it was on course to the TUKRO waypoint at 1000 ft. The controller replied that he should contact **Palma APP DEP**, receiving a correct readback from the pilot of the **N66HR** aircraft.

At 10:34:06 UTC, the **N66HR** aircraft contacted **Palma APP DEP** to report that it was on course to the TUKRO waypoint at 1000 ft. The controller informed him that he had crossed the path of a departing aircraft without communicating with the tower when leaving Mallorca-Son Bonet Airport (LESB). The pilot stated that he had taken off from said aerodrome and was proceeding to the TUKRO waypoint at 1000 ft. The controller informed him of the danger of the manoeuvre carried out by the aircraft, reminding him that he had to make contact before crossing Palma de Mallorca Airport (LEPA) and that crossing it in the way he had done was not allowed. After the information on the procedure for crossing LEPA had been reiterated, the pilot of the **N66HR** aircraft acknowledged receipt of the information. The controller then provided him with traffic information.

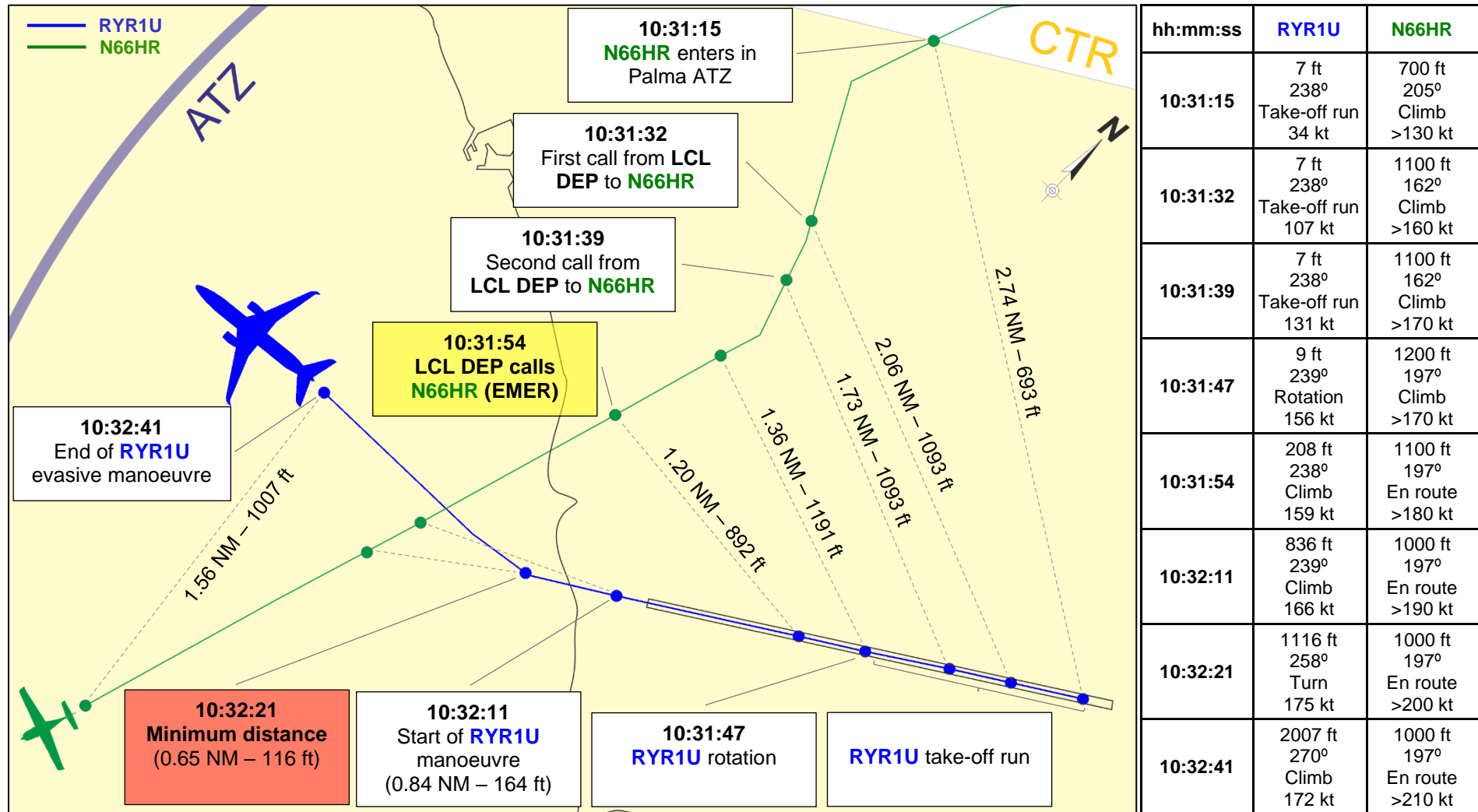


Figure 3. Trajectories of the aircraft within the Palma ATZ, flight parameters of the aircraft (altitude, heading, phase, GS) and separation between them.



## **1.12 Wreckage and impact information**

N/A.

## **1.13 Medical and pathological information**

N/A.

## **1.14 Fire**

N/A.

## **1.15 Survival aspects**

N/A.

## **1.16 Tests and research**

N/A.

## **1.17 Organizational and management information**

### **1.17.1 Aircraft RYR1U**

The operator of the RYR1U aircraft was Ryanair, which carries out commercial passenger air transport operations under an Air Operator Certificate (AOC) issued by the IAA (Ireland), with a last issue date of October 2020.

### **1.17.2 Aircraft N66HR**

Not applicable given that it was a private flight.

## **1.18 Additional information**

### **1.18.1 Information provided by the ATC personnel and the pilots**

Additional information about the event provided to the CIAIAC by the ATC personnel and the pilots of the aircraft involved is detailed below:

- **ATC personnel:**

The information provided by the controller at the LCL DEP position (RWY 24R) is consistent with the sequence of events shown in section 1.11.

- **Crew of aircraft RYR1U:**

- During the landing gear retraction, the crew of aircraft RYR1U heard ATC staff instructing an aircraft to make an immediate turn due to the presence of a Ryanair aircraft on take-off.
- The commander observed nearby traffic slightly above and to the right of them, flying from their right to their left. They performed an evasive manoeuvre, which consisted of turning right while climbing.
- **Pilot of aircraft N66HR:**
  - After take-off, the pilot stated that he perceived a loud knocking noise in the aircraft, which intensified with increasing speed and what appeared to be some jerking of the rudder, the origin of which he was not able to identify until the end of the flight. He checked to see if any warnings had been triggered in the cockpit. As a precaution, the pilot disengaged the autopilot to see if the issue detected might be related to that system and switched to manual control of the aircraft.
  - He tried to maintain the flight level at 1000 ft AGL.
  - He considered turning back to LESB because of the problem but decided to proceed to his destination as it was a short journey, and returning to the originating aerodrome would have caused more difficulties.
  - During the incident, he was focused on the perceived knocking noise and its possible solution, being fully occupied with flying the aircraft and maintaining manual navigation, leaving the communication to a secondary priority. After the flight, the pilot reported that he found the AOA (angle of attack) sensor had probably been inadvertently disturbed.
  - He remained listening on frequency 130.250 MHz (Palma OPS) until he was transferred to the next frequency. He had no recollection of receiving any notices of problems with his flight from the Palma OPS staff, specifically about he had failed to maintain level flight at 1000 ft AGL.
  - In regard to Palma OPS, he thought that the personnel on that frequency were assigned to air traffic control and, therefore, that the aircraft was under radar control.

Additionally, the pilot of aircraft N66HR was asked by the CIAIAC about the following issues:

- Whether he had planned the flight and the factors taken into account when doing so,
- If he was familiar with the procedures at Mallorca-Son Bonet Airport (LESB),
- What his intentions were after take-off from LESB, and
- Any evidence of the problems reported by the pilot, i.e., the perceived knocking noise during the flight and the inadvertent manipulation of the AOA sensor.

After several reiterations by the CIAIAC, no response was obtained from the pilot to any of the above issues.

### 1.18.2 Description of the airspace classes

In accordance with Appendix 4, "ATS airspace classes - services provided and flight requirements" of Regulation (EU) No 923/2012<sup>24</sup>, the characteristics of Class A and Class D airspaces are, among others, as follows:

Airspace class	Characteristics
Class A	<ul style="list-style-type: none"> <li>- IFR flights only are permitted,</li> <li>- Separation between aircraft is provided,</li> <li>- All flights are provided with air traffic control service,</li> <li>- The capacity to maintain radio communications is obligatory,</li> <li>- Bidirectional air-ground voice communication is required,</li> <li>- All flights are subject to ATC clearance.</li> </ul>
Class D	<ul style="list-style-type: none"> <li>- IFR and VFR flights are permitted,</li> <li>- IFR flights are separated from other IFR flights. For VFR flights separation between aircraft is not provided,</li> <li>- For IFR flights, air traffic control service and traffic information on VFR flights (and traffic avoidance advice on request) is provided. For VFR flights, air traffic control service and IFR/VFR and VFR/VFR traffic information (and anti-collision advice on request) is provided,</li> <li>- Both IFR and VFR flights are subject to a speed limitation of 250 KIAS below 3050 m (10000 ft) AMSL,</li> <li>- For both IFR and VFR flights, the capacity to maintain radio communications is obligatory,</li> <li>- Bidirectional air-ground voice communication is required,</li> <li>- All flights are subject to ATC clearance.</li> </ul>

### 1.19 Useful or effective investigation techniques

N/A.

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<sup>24</sup> Commission Implementing Regulation (EU) No. 923/2012 of 26 September 2012, laying down the common rules of the air and operational provisions regarding services and procedures in air navigation (SERA).

## 2 ANALYSIS

On Saturday, 28 May 2022, aircraft EI-EKR (callsign RYR1U) executed a manoeuvre to avoid aircraft N66HR (callsign N66HR), whose flight path converged with that of the former.

The event occurred during the initial climb phase of aircraft RYR1U and the en-route phase of aircraft N66HR. Both aircraft were inside the Palma ATZ, an airspace associated to Palma de Mallorca International Airport (LEPA), for which Palma TWR is responsible. While the aircraft were inside the ATZ, they were always each in radio contact with a frequency other than those associated with Palma de Mallorca Airport (LEPA).

Palma TWR detected the unauthorised presence of the N66HR aircraft inside the Palma ATZ at 10:31:32 h (17 s after it entered the ATZ and 49 s before the moment of minimum distance between the two aircraft). However, the controller was unable to prevent the N66HR aircraft from continuing on its trajectory, which was convergent with that of the RYR1U aircraft, because the N66HR was not using the frequencies established for the ATZ. At 10:32:11 h (10 s before the moment of minimum distance between the aircraft), the RYR1U aircraft initiated a manoeuvre to avoid the other aircraft, turning right while continuing its initial climb.

At 10:32:21 h, the minimum distance between the two aircraft of 0.65 NM horizontally and 116 ft vertically was reached, the RYR1U aircraft flying at 1116 ft AMSL and 175 kt GS, and the N66HR aircraft at 1000 ft AMSL and at least 200 kt GS. Both aircraft were inside the Palma ATZ Class A airspace.

The event did not produce a TCAS resolution advisory (TCAS RA) on board the RYR1U aircraft, as it was inhibited below 1000 ft of Radio Altimeter.

In view of the above, the first conclusion that can be drawn is the principal contribution of aircraft N66HR in the origin and development of the incident. Therefore, the analysis of this event focuses primarily on aspects relating to the operation of the N66HR aircraft:

- General considerations, and
- Aspects relating to the operation of the N66HR aircraft.

### 2.1 General considerations

- **Meteorology:**

The weather conditions in the area of the two airports did not contribute in the incident, nor did they affect the conduct of any of the flights flown by the aircraft, as they did not in any way limit their operation.

- **Actions of aircraft RYR1U:**

The actuation of the crew of aircraft RYR1U was appropriate: they were attentive to the communications being made, which enabled them to identify the other aircraft and perform an evasive manoeuvre to avoid a possible collision. Therefore, any contribution to the causes of the incident by the RYR1U aircraft has been ruled out.

- **Actions of the air traffic control service:**

Although the actions taken by the ATC personnel did not prevent the conflict (given that the N66HR aircraft was not using the frequencies specified for the Palma ATZ whilst in the ATZ), they acted proactively to prevent the collision between the two aircraft from the moment it was

detected that the N66HR aircraft was inside the ATZ until the aircraft reached the point of minimum distance from one another. Therefore, any contribution to the causes of the incident by the RYR1U aircraft has been ruled out.

## **2.2 Aspects relating to the operation of the N66HR aircraft**

### **2.2.1 Prior considerations**

It is considered that the event originated from the unauthorised presence of the N66HR aircraft within the Aerodrome Transit Zone (ATZ) of Palma de Mallorca International Airport (LEPA). As a result, an analysis of the aspects that led to this situation, as well as of the progress of the flight while it was inside the ATZ, was deemed relevant. With regard to this section of the analysis, it should be noted that the CIAIAC did not obtain a response from the pilot of the N66HR aircraft regarding:

- The Temporary Airmen Certificate (TAC) in force on the date of the event,
- The flight planning carried out and the factors taken into account when doing so,
- His familiarity with the procedures at Mallorca-Son Bonet Airport (LESB),
- The pilot's intentions after taking off from LESB, and
- Any evidence of the problems reported by the pilot, i.e., the perceived knocking noise during the flight and the inadvertent manipulation of the AOA sensor.

Therefore, the analysis of the operational aspects relating to aircraft N66HR is based mainly on the information provided by the FAA and LBA, the radar trace record of the flight and the communications made by the aircraft and the ATS units, focusing on the following:

- The pilot's licence,
- Flight planning, and
- The progress of the flight.

### **2.2.2 The pilot's licence**

After examining the flight crew licence held by the pilot of the N66HR aircraft, the investigation concluded that he was not in possession of the rating required to operate the aircraft at the time of the event. Therefore, the pilot did not hold the rating to fly said aircraft.

### **2.2.3 Flight planning**

Despite the fact that a flight plan was filed, the investigation concluded that the planning of the flight was deficient, resulting in the pilot being unaware of the environment in which he was operating. This lack of awareness of the operating environment was reflected in the following aspects:

- **Unauthorised entry into the ATZ:**

The radar trace and communications confirm that the aircraft entered the Palma ATZ immediately after take-off and crossed the extension of runways 24R and 24L at LEPA without requesting or having prior clearance from Palma TWR, which was required under the LESB visual approach chart.

Therefore, it is concluded that the pilot was unaware of the requirement for prior clearance from Palma TWR for entry and operation within the Palma ATZ.

- **Lack of knowledge in regard to the ATC units involved in the planned flight:**

According to the information provided by the pilot, he believed that Palma OPS was an air traffic control unit and that it was under radar control. However, this belief is inaccurate as Palma OPS is not intended for air traffic control, and Palma TWR is the unit that authorises flights within the Palma ATZ, as stated on the LESB visual approach chart.

Therefore, the pilot did not know which units he would have to interact with during the planned flight.

- **Lack of knowledge in regard to the frequencies to be used in the planned flight:**

During the time spent inside the Palma ATZ, the pilot did not communicate on or listen to any of the frequencies specified for the area, as established in the VFR procedures for the Palma TMA. If he had, he would have at least received the warning from Palma TWR on the emergency frequency about the impending conflict with the RYR1U aircraft, which could have prevented it from escalating.

Therefore, the pilot did not know which frequencies he would have to communicate on and listen to during the flight.

- **Probable lack of knowledge in regard to the characteristics of the airspace:**

While crossing the ATZ and the CTR, the pilot indicated that he was focused on maintaining the flight level at 1000 ft AGL. This premise is not based on any prior instruction given by air traffic control personnel. Consequently, it is concluded that maintaining this altitude was a decision taken by the pilot, the motivation for which could not be confirmed as the pilot did not provide any information on his intentions after take-off from LESB.

As a hypothesis, the possibility that the pilot tried to stay below the Class A<sup>25</sup> airspace while crossing the ATZ to avoid entering an area where only IFR flights are allowed cannot be ruled out. If this were the case, it's possible the pilot thought he was free to proceed through Class D<sup>26</sup> airspace without the requirement to submit to radar control. This hypothesis is consistent with the pilot's statement about entering Class A airspace without receiving any warning from the Palma OPS personnel (the latter being a mistaken assumption, as mentioned above).

However, although VFR flights are allowed in Class D airspace, all flights are subject to ATC clearance. In view of the hypothesis put forward, it could be concluded that the pilot was probably unaware of the characteristics of the airspace in which he was going to operate.

## 2.2.4 Progress of the flight

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<sup>25</sup> Class A airspace limits in the Palma ATZ: 1000 ft AGL – 3000 ft AGL (or up to the cloud ceiling, whichever is lower)

<sup>26</sup> Class D airspace limits in the Palma ATZ and CTR: Surface (SFC) – 1000 ft AGL (or up to the cloud ceiling, whichever is lower)

The N66HR aircraft flew over Palma de Mallorca International Airport (LEPA), a controlled aerodrome with an established ATZ and CTR, which has two large parallel runways and hosts and manages a high volume of operations, mostly associated with commercial air transport.

The pilot acknowledged that, while the aircraft was moving within the ATZ, he was focused on the loud knocking noise he had noticed on the aircraft and its possible solution. He was fully occupied with flying the aircraft and maintaining manual navigation, leaving communication to a secondary priority.

Given the scenario described above, an analysis of the management of the perceived noise problem in the aircraft and the contribution of the communications made by the pilot of aircraft N66HR were deemed relevant.

- **Inadequate handling of the perceived aircraft problem during the flight:**

The problems reported by the pilot could not be confirmed (perceived knocking noise during the flight and the inadvertent manipulation of the AOA sensor) as he did not provide any evidence of their existence. However, it is believed the pilot's handling of the perceived noise in the aircraft was inadequate, based on the following:

- He decided to continue the flight instead of returning to the aerodrome of origin, thus increasing the risk of the technical problem worsening.
- He decided to switch off the autopilot to determine whether it was related to the noise issue in the aircraft. The disconnection of this system contrasts with the fact that, after the aircraft turned to set a course for the TUKRO waypoint, the heading remained constant, and once it was established at 1000 ft AGL, it maintained that altitude invariably, with speeds from 170 kt GS.
- He decided to fly over Palma de Mallorca Airport, crossing the extension of both runways, consequently increasing the risk to other aircraft. Given the proximity of aircraft N66HR to runway 24R as it moved within the ATZ, it seems unlikely that he would fail to notice the presence of aircraft RYR1U on its take-off run.
- The perceived noise problem in the aircraft was not reported to the air traffic control units in any of the communications made by the pilot to the different units; communications in which, by contrast, the tone of voice used by the pilot was calm, with no signs of stress.

- **Poor language proficiency:**

Shortcomings in the radio communication were identified, which may have aggravated the conflict. The deficiencies were associated with the pilot's linguistic competence, specifically in regard to his reduced ability to understand the information and instructions received. This was evidenced by:

- The reiterated need to request the repetition of the information and instructions received, and
- The repeated incorrect readback of the information and instructions received.

- **Conclusion on the pilot's actions during the flight:**

A possible contribution to the incident in terms of the language used in the communications by the ATS personnel was ruled out, as these were conducted in English.

The conduct of the pilot of aircraft N66HR reveals a lack of the knowledge and skills required to manage the essential functions of flight (flying, navigating and communicating) in an operating environment such as Palma de Mallorca International Airport (LEPA). In conclusion, the pilot was probably not qualified to perform a flight with these characteristics.

### 3 CONCLUSIONS

#### 3.1 Findings

- **Aircraft N66HR:**
  - The pilot of aircraft N66HR did not held the rating to operate the model of aircraft involved in the incident.
  - The pilot of aircraft N66HR repeatedly requested the repetition of the information and instructions received.
  - The pilot of aircraft N66HR readback incorrectly, on several occasions, the information and instructions received.
- **Regarding the incident:**
  - At 10:31:15 h, the N66HR aircraft entered the Palma ATZ (class D) without prior authorisation from ATC. The aircraft left the ATZ at 10:32:52 h.
  - The N66HR aircraft was detected inside the Palma ATZ by Palma TWR 17 s after it entered the ATZ, at which time the controller made the first call to the aircraft.
  - The second call from Palma TWR to the N66HR aircraft was made 24 s after it entered the Palma ATZ while the aircraft was turning right to set its course to the TUKRO waypoint. From that moment on, the aircraft maintained a constant heading to that point, and the altitude remained unchanged once it was established at 1000 ft AGL.
  - The RYR1U aircraft rotated 34 seconds before the moment of minimum distance between the aircraft.
  - The last call from Palma TWR to the N66HR aircraft was made on the emergency frequency 39 s after it entered the Palma ATZ and 27 s before the moment of minimum distance between the aircraft while the N66HR aircraft was flying on course to the TUKRO waypoint.
  - The RYR1U initiated an evasive manoeuvre 10 s before the moment of minimum distance between the aircraft.
  - At 10:32:21 h, the minimum distance between the two aircraft of 0.65 NM horizontally and 116 ft vertically was reached as aircraft N66HR aircraft was crossing the extension of runway 24R at LEPA and aircraft RYR1U was continuing its evasive manoeuvre. Both aircraft were in the class A airspace inside the Palma ATZ.
  - The event did not produce a TCAS resolution advisory (TCAS RA) on board the RYR1U aircraft, as it was inhibited below 1000 ft of Radio Altimeter.



### 3.2 Causes / Contributing factors

The investigation has determined that the incident was caused by the unauthorised presence of the N66HR aircraft within the Aerodrome Transit Zone (ATZ) of Palma de Mallorca International Airport (LEPA) due to deficient flight planning.

The following factors are considered to have contributed to the incident:

- The lack of the knowledge and skills of the pilot of the aircraft N66HR to carry out a flight with the characteristics of the one involved in the event.
- The inadequate management of the perceived problem on board the N66HR aircraft due to poor decision-making.
- The fact that the pilot of the N66HR aircraft failed to comply with the VFR communications procedures in force within the Palma TMA by not communicating or listening in on the frequencies established within the Palma ATZ.
- The inadequate language proficiency exhibited by the pilot of the N66HR aircraft during the incident flight, as evidenced by the limited ability to understand the information and instructions received.

## **4 RECOMMENDATIONS**

No operational safety recommendations are issued.