CIAIAC

COMISIÓN DE
INVESTIGACIÓN
DE ACCIDENTES
E INCIDENTES DE
AVIACIÓN CIVIL

Report IN-034/2015

Incident involving two Cessna 172 S aircraft, registrations LY-BCF and D-EXAH, both operated by Aerojet Baltic, in the vicinity of the Valencia Airport (Spain) on 9 November 2015

GOBIERNO DE ESPAÑA
MINISTERIO DE FOMENTO

Report

IN-034/2015

Incident involving two Cessna 172 S aircraft, registrations LY-BCF and D-EXAH, both operated by Aerojet Baltic, in the vicinity of the Valencia Airport (Spain) on 9 November 2015

GOBIERNO DE ESPAÑA
MINISTERIO DE FOMENTO
SUBSECRETARÍA
COMISIÓN DE INVESTIGACIÓN DE ACCIDENTES E INCIDENTES DE AVIACIÓN CIVIL

Edita: Centro de Publicaciones
Secretaría General Técnica
Ministerio de Fomento ©

NIPO: 161-16-337-6

Diseño, maquetación e impresión: Centro de Publicaciones

COMISIÓN DE INVESTIGACIÓN DE ACCIDENTES E INCIDENTES DE AVIACIÓN CIVIL

Tel.: +34 91 597 89 63
Fax: +34 91 463 55 35
E-mail: ciaiac@fomento.es
http://www.ciaiac.es
C/ Fruela, 6
28011 Madrid (España)

Foreword

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

In accordance with the provisions in Article 5.4.1 of Annex 13 of the International Civil Aviation Convention; and with articles 5.5 of Regulation (UE) nº 996/2010, of the European Parliament and the Council, of 20 October 2010; Article 15 of Law 21/2003 on Air Safety and articles 1.4 and 21.2 of Regulation 389/1998, this investigation is exclusively of a technical nature, and its objective is the prevention of future civil aviation accidents and incidents by issuing, if necessary, safety recommendations to prevent from their reoccurrence. The investigation is not pointed to establish blame or liability whatsoever, and it's not prejudging the possible decision taken by the judicial authorities. Therefore, and according to above norms and regulations, the investigation was carried out using procedures not necessarily subject to the guarantees and rights usually used for the evidences in a judicial process.

Consequently, any use of this report for purposes other than that of preventing 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.

Table of contents

Abbreviations

° ' "	Sexagesimal degrees, minutes and seconds
°C	Degrees centigrade
ACC	Area control center
ACS	Area control surveillance rating
ADI	Aerodrome control instrument rating
AEMET	Spain's National Weather Agency
AENA	Spain's Air Navigation Services Provider
AESA	Spain's National Aviation Safety Agency
AIP	Aeronautical Information Publication
AIR	Air control endorsement
AMSL	Above mean sea level
APS	Approach control surveillance rating
ARP	Aerodrome reference point
ATC	Air traffic control
ATPL (A)	Airline transport pilot license
ATS	Air traffic service
ATZ	Aerodrome traffic zone
CAMO	Continuing airworthiness maintenance organization
CAVOK	Ceiling and visibility OK
CPL(A)	Commercial pilot license (airplane)
CTR	Control zone
DH	Decision height
DME	Distance measuring equipment
FI (A)	Flight instructor
FL	Flight level
FP	Flight Plan
ft	Feet
GMC	Ground movement control endorsement
h	Hours
hPa	Hectopascals
IAS	Indicated airspeed
ICAO	International Civil Aviation Organization
IFR	Instrument flight rules
ILS	Instrument landing system
IR	Instruments
IRI	Instrument rating instructor
LEAL	Alicante-Elche airport ICAO code (Spain)
LECL	Valencia ACC
LERE	Requena airport ICAO code (Spain)
LEVC	Valencia airport ICAO code (Spain)
m	Meters
MEP	Multi-engine piston (land) rating
METAR	Airport routine weather report
N/A	Not affected
NDB	Non-Directional Beacon
NM	Nautical mile
PSR	Primary surveillance radar
QNH	Altimeter sub-scale setting to obtain elevation when on the ground
RAD	Aerodrome radar control endorsement
RVR	Runway Visual Range
RWY	Runway
s	Seconds
SACTA	Automated Air Traffic Control System
SEP	Single engine piston (land) rating
SERA	Standardised European Rules of the Air

SGO	Sagunto
SID	Standard instrument departure
TACC	Terminal area control center
TCAS	Traffic alert and collision avoidance system
TMA	Terminal control area
TRI	Type rating instructor
TWR	Control tower
UTC	Universal coordinated time
VFR	Visual flight rules
VLC	Valencia Airport
VMC	Visual meteorological conditions

Synopsis

Owners:	Aerojet Baltic for aircraft LY-BCF
	Private owner for aircraft D-EXAH
Operators:	Aerojet Baltic, for both
Aircraft:	Cessna 172 S, both
Date and time of incident:	9 November 2015 at 12:15[1]
Site of incident:	Vicinity of the Valencia Airport
Persons onboard:	4 (2 in each aircraft, instructor and student), not injured
Type of flight:	General Aviation – Instruction
Phase of flight:	Approach
Date of approval:	27 June 2016

Summary of the event

At 12:15 on Monday, 9 November 2015, two Cessna 172 S aircraft, registrations LY-BCF and D-EXAH, both operated by Aerojet Baltic, experienced a loss of separation in the vicinity of the Valencia airport (Spain).

These aircraft, along with two others (registrations LY-BBF and LY-BCG), all of them operated by Aerojet Baltic, left from the Requena aerodrome on a training flight to practice instrument approaches at the Valencia Airport. Specifically, the training involved doing a low approach to the Valencia Airport, and then a right turn direct to the SGO NDB at an altitude of 4000 ft.

The aircraft with registrations LY-BBF and LY-BCF made the low approach to the Valencia Airport. The aircraft with registration D-EXAH, however, which was behind these two, was unable to make the approach. D-EXAH was instructed by the controller in the Valencia tower to turn right to the SGO NDB during its approach maneuver; in order to not delay a commercial air transport aircraft (ENT592) that was cleared to take off 2 minutes later..

[1] All times in this report are local. To obtain UTC, subtract one hour from UTC time.

[2] A low approach is defined as an approach to an aerodrome or runway using an instrument or VFR approach that includes a go-around maneuver in which the pilot intentionally keeps the aircraft from touching the runway.

The controller in the Valencia TACC, upon noticing the commercial air transport aircraft (ENT592) take off, much faster than the school aircraft, and prevent a loss of separation between ENT592 and LY-BCF aircraft; instructed LY-BCF to maintain an altitude of 3000 ft and asked the controller in the Valencia tower to in turn instruct D-EXAH to maintain 2500 ft to avoid a loss of horizontal separation between aircraft LY-BCF and D-EXAH.

The aircraft came within a distance of 0.3 NM horizontally and 500 ft vertically.

There were no injuries onboard either aircraft, and neither aircraft was damaged in this incident.

The investigation has determined that this incident was caused because the controller in the Valencia tower cleared a commercial air transport aircraft (ENT592) to take off and instructed D-EXAH aircraft to interrupt the low approach without coordination with the Valencia TACC controller and without following the procedures of the letter of agreement between FerroNATs and ENAIRE.

The following contributed to the incident:

1. The fact that the procedures specified in the letter of agreement between FerroNATS and ENAIRE were not observed,

2. The aircraft were transferred improperly, verbally and without indicating the number of school aircraft, without agreeing when and in which conditions the aircraft had to turn right to the SGO NDB and without the required horizontal separation between them, and

3. The controller in the Valencia tower did not have a strip for D-EXAH aircraft neither its updated flight plan in SACTA.

1. FACTUAL INFORMATION

1.1. History of the flight

On Monday, 9 November, the aircraft with registrations LY-BBF, LY-BCF, D-EXAH and LY-BCG, all of them operated by Aerojet Baltic, left from the Requena aerodrome on a training flight to practice instrument approaches at the Valencia Airport.

The training involved doing a low approach to the Valencia Airport followed by a right turn direct to the SGO NDB at an altitude of 4000 ft.

The aircraft with registrations LY-BBF and LY-BCF made the low approach to the Valencia Airport. The aircraft with registration D-EXAH, however, was unable to make the approach. D-EXAH was instructed by the Valencia tower controller to turn right to the SGO NDB in order to not delay a commercial air transport aircraft (ENT592) that was cleared to take off 2 minutes later.

While they were in the Valencia ATZ air space[3], the horizontal distance between the LY-BCF and D-EXAHaircrafta was 2 NM for a few seconds. The aircraft were not properly informed of this fact.

It was inside the Valencia CTR air space[4] that the minimum separation between these two aircraft occurred. The controller at the Valencia TACC, upon noticing the commercial air transport aircraft (ENT592) take off, much faster than the school aircraft, and prevent a loss of separation between ENT592 and LY-BCF aircraft; instructed LY-BCF to maintain an altitude of 3000 ft, and asked the controller in the Valencia tower to instruct D-EXAH to hold at 2500 ft to avoid a loss of horizontal separation between LY-BCF and D-EXAH aircraft The aircraft were separated by 0.3 NM horizontally and 500 ft vertically.

All of the aircraft's occupants were uninjured and the aircraft were not damaged in the incident.

[3] The ATZ (aerodrome traffic zone) is an air space of specific dimensions located around an aerodrome to protect traffic at the aerodrome. In the case of the Valencia ATZ, it is the Valencia control tower, under the responsibility of FerroNATS, that provides this service.

[4] The Valencia CTR (control zone) is controlled air space that extends upward from the Earth's surface to a specific upper limit. In the case of the Valencia CTR, it is the responsibility of the Valencia TACC, run by ENAIRE, to provide this service.

1.2. Injuries to persons

1.2.1. Injuries to persons onboard aircraft LY-BCF

Injuries	Crew	Passengers	Total in the aircraft	Others
Fatal				
Serious				
Minor				N/A
None	2			N/A
TOTAL	2			

1.2.2. Injuries to persons onboard aircraft D-EXAH

Injuries	Crew	Passengers	Total in the aircraft	Others
Fatal				
Serious				
Minor				N/A
None	2			N/A
TOTAL	2			

1.3. Damage to aircraft

The aircraft were not damaged.

1.4. Other damage

There was no damage of any kind.

1.5. Personnel information

1.5.1. Information on the crew of aircraft LY-BCF

The instructor, a 25-year old Italian national, had a commercial pilot license (CPL(A)) issued by the Lithuanian civil aviation authority, along with the following ratings:

1. Instrument flight -IR(A)- valid until 31 October 2016.

2. Single-engine piston land class -SEP(land)- valid until 31 October 2017

3. Multi-engine piston land class -MEP(land)- valid until 31 October 2016

4. Instrument rating instructor -IRI(A)- for single-engine piston (SEP) airplanes valid until 31 October 2018.

5. Flight instructor -FI(A)- for single-engine piston (SEP) airplanes valid until 30 June 2018.

He also had several medical certificates, including a class-1[5] certificate that was valid until 16 July 2016.

On the day of the accident he had a total of 656.46 flight hours.

1.5.2. Información sobre la tripulación de la aeronave con matrícula D-EXAH

The instructor, a 51-year old Lithuanian national, had an airline transport pilot license (ATPL(A)) issued by the Lithuanian civil aviation authority, along with the following ratings:

1. Instrument flight -IR(A)- for ATR42/72 aircraft valid until 29 February 2016.

2. Single-engine piston land class -SEP(land)- valid until 30 June 2017

3. Type rating instructor -TRI(A)- for ATR42/72 aircraft valid until 31 July 2017. This rating was restricted.

4. Instrument rating instructor -IRI(A)- for single-engine piston (SEP) airplanes valid until 30 June 2018.

He also had several medical certificates, including a class-1 certificate[6] that was valid until 27 September 2016.

On the day of the accident he had a total of 9677.30 flight hours.

[5] Other commercial operations
[6] Other commercial operations

1.5.3. Information on the control personnel at the Valencia tower

The controller at the Valencia tower involved in the incident had an air traffic controller license with the following rating endorsements:

Unit	Rating/ Rating endorsement	Valid until
LEVC	ADI[7]/ AIR-RAD[8]	31/08/2016
LEVC	ADI/GMC[9]	31/08/2016
LEVC	ADI/TWR-RAD[10]	31/08/2016

He also had a valid class-3 medical certificate that was valid until 16 May 2017.

1.5.4. Information on the control personnel at the Valencia TACC

The controller at the Valencia TACC involved in the incident had an air traffic controller license with the following rating endorsements:

Unit	Sector	Rating/ Rating endorsement	Valid until
LECL		ACS[11]/ RAD	01/03/2016
LECL	LEAL	APS[12]/RAD	01/03/2016
LECL	LEVC	APS/RAD	01/03/2016

The controller was qualified on the unit on 25 March 2003, and had been stationed at this unit continuously since.

He also had an on-the-job practical training instructor endorsement that was valid until 1 March 2017.

He had a class-3 medical certificate that was valid until 17 November 2016.

[7] Aerodrome control instrument rating
[8] Air control endorsement –Aerodrome radar control endorsement
[9] Ground movement control endorsement
[10] Tower control endorsement – Aerodrome radar control endorsement
[11] Air control surveillance rating
[12] Approach control surveillance rating

1.6. Aircraft information

1.6.1. Information on aircraft LY-BCF

The Cessna 172 S aircraft, registration LY-BCF with serial number 172S10319, had a certificate of airworthiness issued by the Lithuanian civil aviation authority on 24 July 2015. It also had an airworthiness review certificate issued by the same authority and valid until 22 July 2016.

According to information provided by the aircraft's owner and operator, before the incident flight the airplane had 1099:12 flight hours, and the engine and propeller had 671:12 flight hours.

1.6.2. Information on aircraft D-EXAH

The Cessna 172 S aircraft, registration D-EXAH and with serial number 172S10264, had a certificate of airworthiness issued by the German civil aviation authority on 8 November 2006. It also had an airworthiness review certificate issued by the ARDEX Aviation Maintenance GmbH CAMO that was valid until 21 April 2016.

According to information provided by the aircraft's operator, before the incident flight the airplane had 1555:25 flight hours, and the engine and propeller had 1279:18 flight hours.

1.7. Meteorological information

The incident occurred at 12:15. The METARs issued by Spain's National Weather Agency (AEMET) at 12:00 and 12:30 were as follows:

METAR LEVC 091100Z 00000KT CAVOK 20/13 Q1033 NOSIGN=

METAR LEVC 091130Z VRB01KT CAVOK 20/14 Q1032 NOSIGN=

There was no wind at 12:00, the temperature was 20º C, the dew point 13º C and the pressure (QNH) was 1,033 hPa.

Half an hour later, at 12:30, the weather conditions had not changed significantly. There was a very light and variable wind of 1 knot, the temperature was 20º C, the dew point 14º C and the pressure was 1,033 hPa.

CAVOK (ceiling and visibility are OK) conditions prevailed during the incident and no significant changes were expected over the next two hours.

1.8. Aids to navigation

Those moments of the radar tracks of the aircraft involved in the incident that are of most significant to the analysis are shown below.

By 12:09:20, LY-BBF had already made its low approach to the Valencia Airport. LY-BCF was descending to make its low approach and D-EXAH was approaching runway 30, followed by LY-BCG. It was then that the horizontal separation between LY-BBF and LY-BCF was lost, the two aircraft being 1.7 NM apart horizontally. Their vertical separation was 1000 ft.

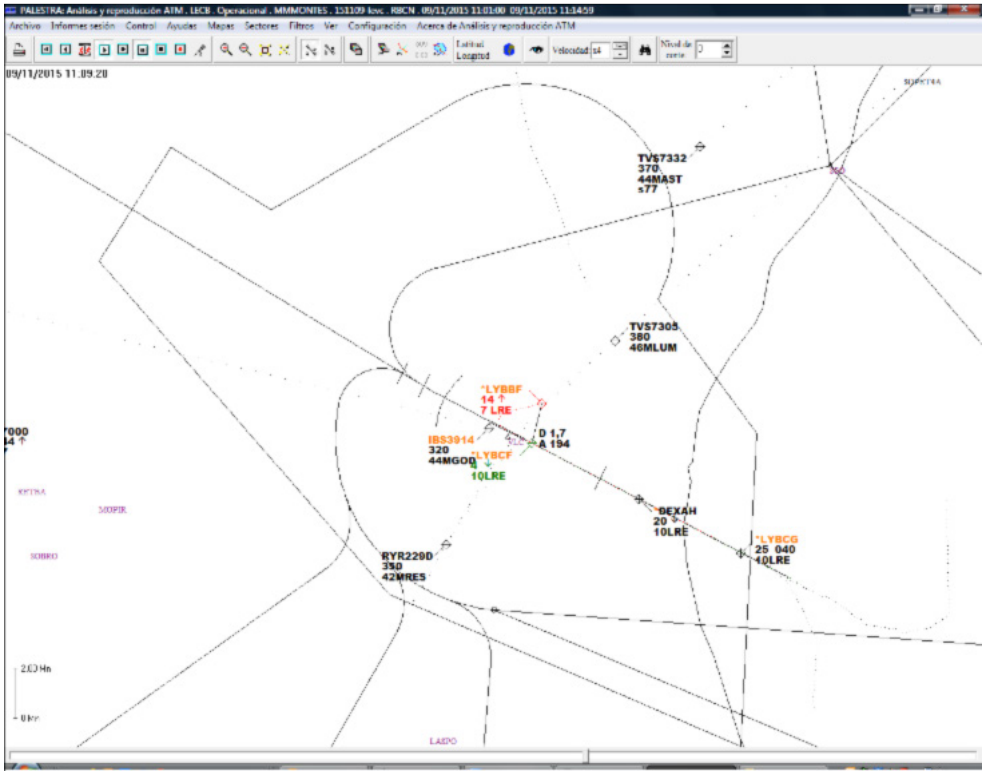

Figure 1. Positions of the aircraft at 12:09:20

At 12:11:26, LY-BCF was climbing after making its low approach and D-EXAH was continuing its approach to runway 30. At that moment, the aircraft were separated by 2.9 NM horizontally and 700 ft vertically.

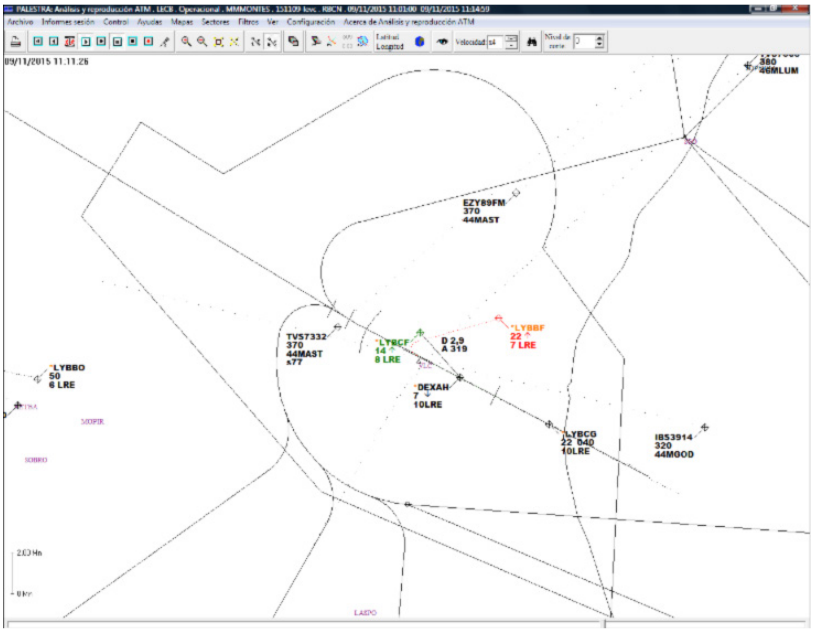

Figure 2. Positions of the aircraft at 12:11:26

At 12:11:45, LY-BCF was still climbing, while D-EXAH made a right turn to interrupt its approach to runway 30 when it was approximately 1 NM away from the threshold at an altitude of 700 ft. The horizontal separation at that time was 2.5 NM, and the vertical separation was 700 ft.

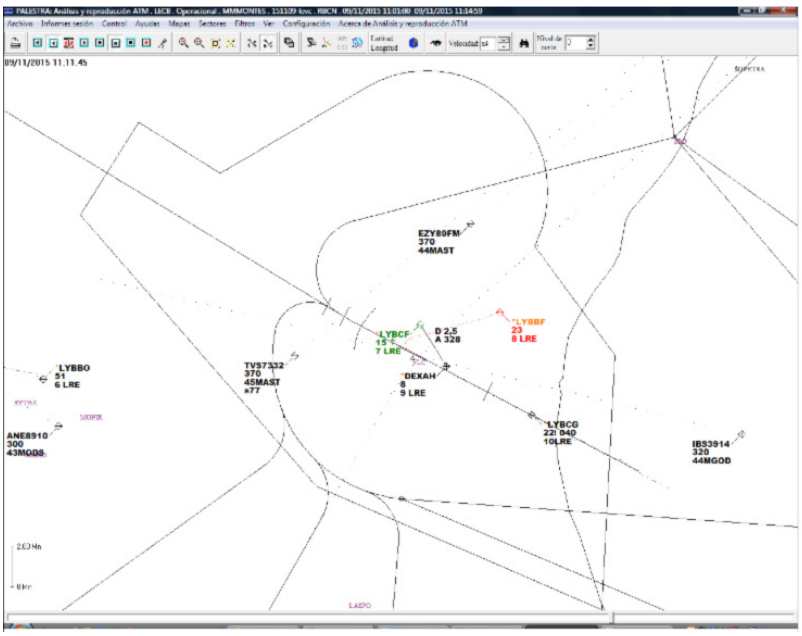

Figure 3. Positions of the aircraft at 12:11:45

At 12:14:22, the aircraft were 1.9 NM apart horizontally and 800 ft vertically. The commercial air transport aircraft (ENT592) was already taken off,

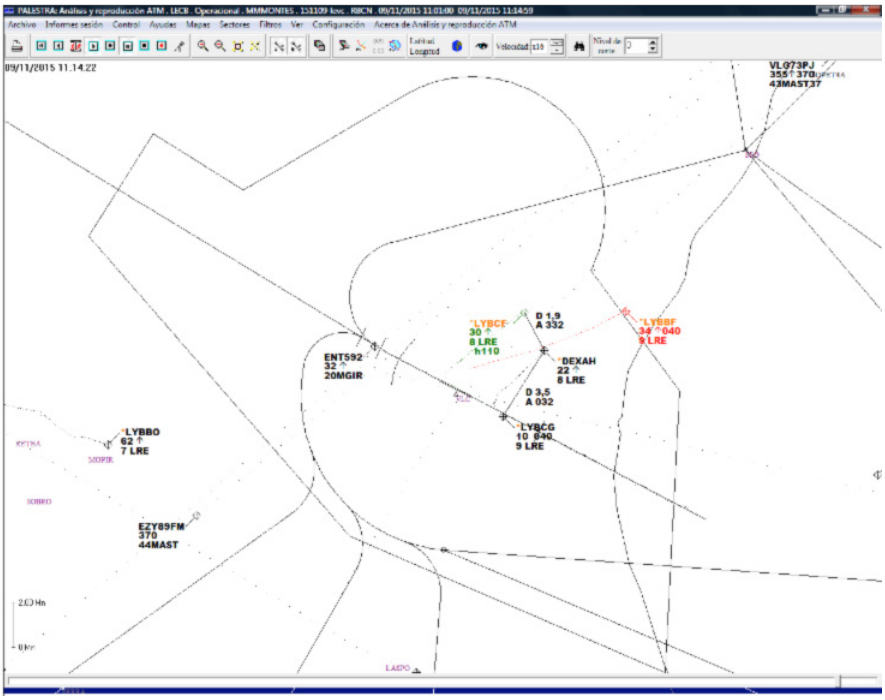

Figure 4. Positions of the aircraft at 12:14:22

At 12:14:42, the aircraft were 1.5 NM apart horizontally and 600 ft vertically.

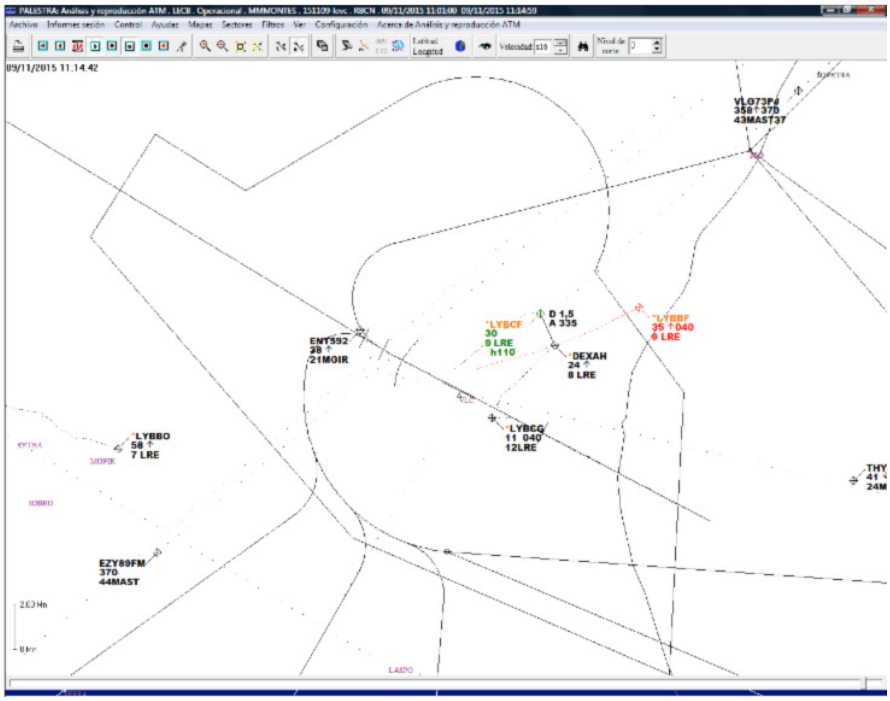

Figure 5. Positions of the aircraft at 12:14:42

At 12:15:25, the minimum horizontal separation of 0.3 NM between the aircraft was reached. The vertical separation at that time was 500 ft.

1.9. Communications

The communications of most relevance to the analysis of the incident are provided below.

At 12:02:50, the controller in the Valencia tower and the controller in the Valencia TACC contacted one another to coordinate the transfer of flights. The controller in the control center informed the tower controller that the distance between aircraft is small (specifically, "they're a little bunched up"), and asked if he would accept them, which the tower controller did. They both agreed to have them depart toward SGO at 4000 ft.

At 12:04:22, the controller in the Valencia TACC again contacted the Valencia tower controller to ask if LY-BBF and LY-BCF had contacted him. The tower controller replied that LY-BCF had not contacted him yet. The Valencia TACC controller asked the tower controller to let him know when it contacted him, since it was not replying to his calls.

At 12:05:47, LY-BCF contacted the controller in the Valencia tower, informing him that it was tuned in to the runway 30 ILS and was 7 NM out. The controller cleared it to continue the approach, informing it that it was number two in the sequence and where number one in the sequence was[13].

At 12:06:50, D-EXAH contacted the controller in the Valencia tower to report that it was at the runway 30 localizer. The controller cleared it to continue the approach.

At 12:07:10, the control tower controller contacted the Valencia TACC controller to inform him that he was unaware that D-EXAH was inbound and that he did not have a strip for it.

At 12:07:39, the TACC controller asked if he had the strip, stating that he coordinated several aircraft inbound from Requena for him and that he must not have copied them.

At 12:07:54, the Valencia tower controller contacted D-EXAH and cleared it again to continue the approach, informing it that it was number 2 in the sequence and reporting the location of number 1[14].

At 12:09:43, the commercial air transport aircraft (ENT592) contacted the Valencia tower controller to indicate that was ready to take off. After which, the Valencia tower controller contacted D-EXAH to instruct it to interrupt its approach upon reaching the minimum ap-

[13] Traffic number 1 refers to LY-BBF, which is ahead of LY-BCF.
[14] Traffic number 1 refers to LY-BCF, which is ahead of D-EXAH.

proach altitude and distance, and to proceed direct to SGO at 4000 ft. He then instructed it to report turning right to SGO. The communication is intermittent and D-EXAH does not acknowledge this last instruction, requesting the tower to repeat it.

At 12:11:45, the Valencia tower controller again contacted D-EXAH to inform it of traffic at its 11 o'clock at 3 NM and 1600 ft and climbing, requesting it to report it when in sight. The response of the pilot was garbled. After which, the controller cleared the commercial air transport aircraft (ENT592) to take off.

At 12:13:01, the controller contacted LY-BCF to instruct it to contact the Valencia TACC. He then signed off.

At 12:13:51, the Valencia TACC controller instructed LY-BCF to hold 3000 ft.

At 12:14:16, the Valencia TACC controller asked the tower controller to hand off control of D-EXAH. The controller contacted the aircraft, instructing it to contact the Valencia TACC, and signed off.

Six seconds later, at 12:14:22, the Valencia TACC asked the tower controller to keep D-EXAH at 2500 ft. Seven seconds later, at 12:14:29, the controller contacted the aircraft and instructed it to maintain 2500 ft and to contact the Valencia TACC. The pilot correctly acknowledged the instruction.

At 12:14:41, the Valencia TACC asked the tower controller to hand off control of D-EXAH, to which the tower controller replied that he had already done so.

At 12:15:02, D-EXAH contacted the Valencia TACC to report its intention to make a new approach to runway 30 at the Valencia Airport. The controller instructed him to continue heading to the SGO.

At 12:16:19, the Valencia TACC controller instructed D-EXAH to climb to 4000 ft and proceed to the SGO.

1.10. Aerodrome information

The Valencia Airport (ICAO code LEVC) has one asphalt runway (12/30) measuring 3215 x 45 m. At the time of the incident, runway 30 was in use.

The control tower is north of the runway, as shown in the map below, taken from the AIP (Aeronautical Information Publication).

As noted above, the aircraft from the school were practicing ILS (instrument landing system) approaches at the Valencia Airport. The ILS is a precision horizontal and vertical guidance system for making approaches to a runway. The Valencia Airport has a Category I ILS. A standard Category I ILS allows continuing the ILS approach after establishing a visual reference at a decision height (DH)[15] of 200 ft (60 m) above the threshold elevation, with a runway visual range (RVR)[16] in excess of 550 m (1800 ft).

Below is the ILS approach chart for runway 30 at the Valencia Airport, taken from the AIP. The chart shows the obstacle clearance altitude/height for different aircraft categories (A, B, C or D)[17]:

[15] Altitude specified in a precision approach at which a go-around maneuver must be initiated if the required visual reference to continue the approach has not been established.
The required visual reference means that section of visual aids or the approach area that must have been in sight long enough for the pilot to assess the aircraft's position and rate of change of position in relation to the desired flight path.

[16] Distance over which a pilot of an aircraft on the centerline of the runway can see the runway surface markings delineating the runway or identifying its center line.

[17] The lowest altitude or the lowest height above the threshold elevation of the relevant runway or above the aerodrome elevation, as appropriate, used to establish compliance with the corresponding obstacle clearance criteria.

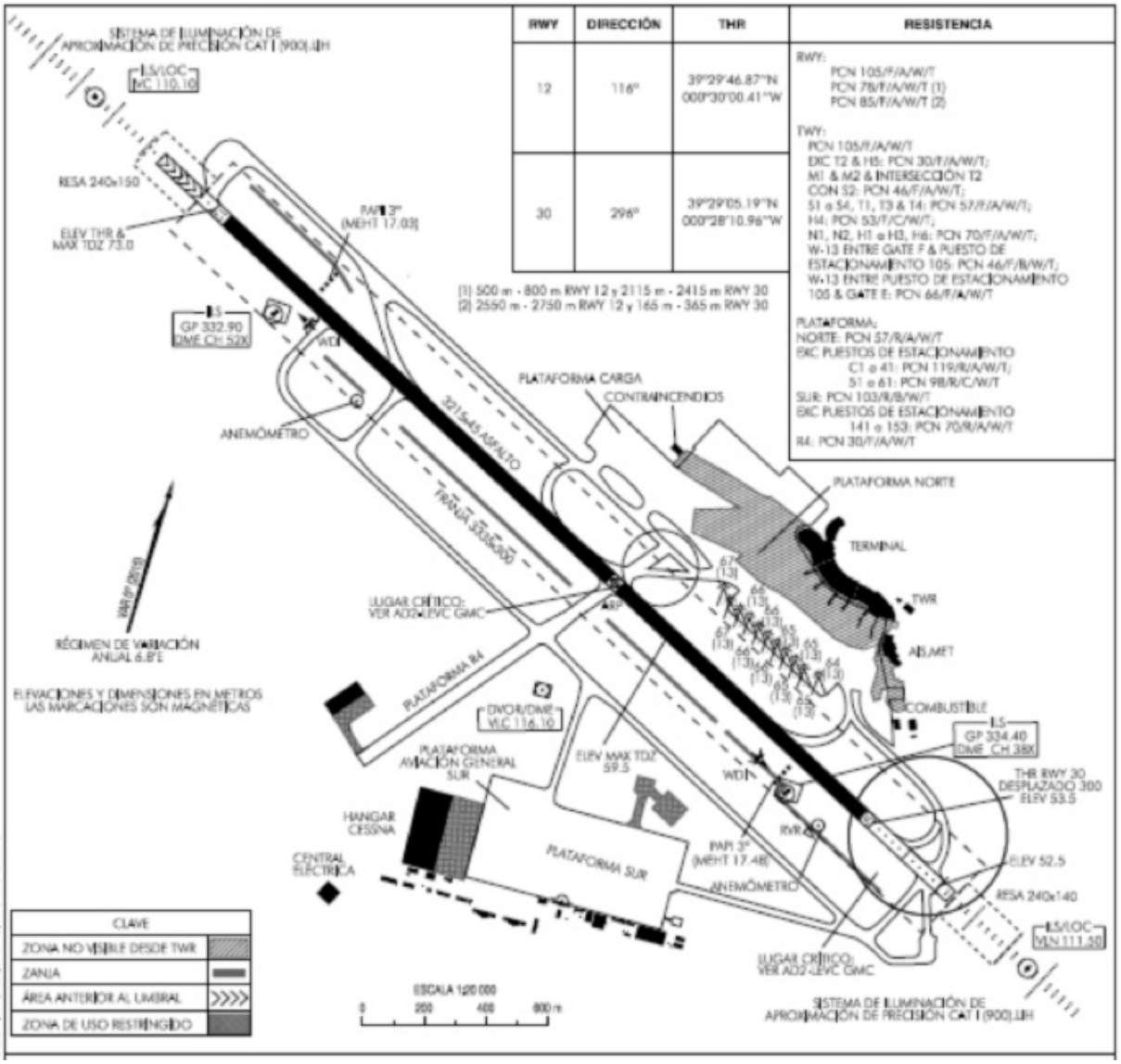

Figure 6. Valencia Airport runway

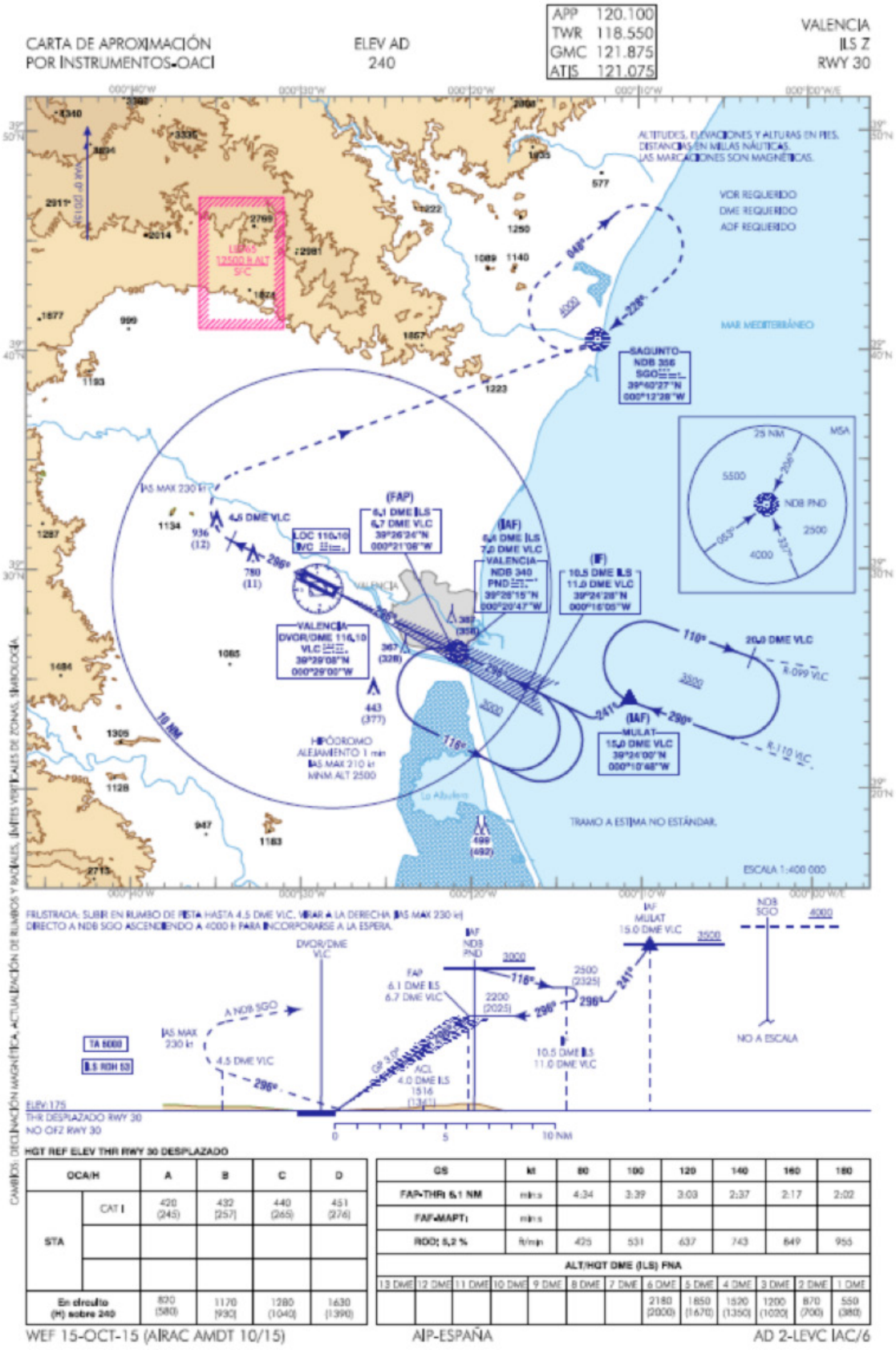

Figure 7. ILS approach chart for runway 30

1.11. Flight recorders

The aircraft involved in the incident did not have flight recorders.

1.12. Wreckage and impact information

The aircraft involved in the incident did not sustain any damage.

1.13. Medical and pathological information

There are no indications that the actions of any of the flight crew members were affected by physiological factors or by any impairment.

1.14. Fire

There was no fire in the aircraft or in the surrounding area.

1.15. Survival aspects

Not applicable.

1.16. Tests and research

1.16.1. Statement from the crew of aircraft LY-BCF

The instructor stated that they were on a training flight to practice instrument approaches at the Valencia Airport with a Cessna 172 S. The flight was under instrument flight rules in visual meteorological conditions (VMC).

According to his statement, after being cleared by ATC to continue the approach, and past the minimums, the controller asked him to turn right toward SGO at an altitude of 4000 ft in contact with the ground. He strictly adhered to the controller's instructions and headed to SGO.

Since his aircraft did not have a TCAS, he stated that he was unaware of the position of the other aircraft. He did not receive any reports on the radio regarding the event and noticed nothing unusual during the flight.

1.16.2. Statement from the crew of aircraft D-EXAH

The instructor stated that on 9 November, he was on a training flight; specifically, practicing instrument approaches at the Valencia Airport on a Cessna C-172.

According to his account, there were no technical problems with the aircraft he was piloting. Moreover, he did not hear any instructions from ATC or other aircraft pilots about any abnormal or unusual situations.

1.16.3. Statement from the Valencia control tower controller

The controller in the Valencia control tower stated that all four of the school's instrument flights (LY-BBF, LY-BCF, D-EXAH and LY-BCG) were transferred without proper separation between them, as per the letter of agreement between FerroNATS and ENAIRE. What is more, D-EXAH was transferred without first sending the strip and without the flight plan data being updated in SACTA, as also required by the letter of agreement.

He further stated that the first two (LY-BBF and LY-BCF) had been coordinated like instrument departures, after the low fly-by, with a right turn direct to SGO in contact with the ground at a maximum altitude of 4000 ft.

As per his statement, he cleared LY-BCF to do the low fly-by since there were no commercial aircraft ready for departure. However, after checking with the tower supervisor, he instructed D-EXAH to turn right at the approach minimums without making the low fly-by, since at that time there was a commercial flight ready to take off.

He realized that LY-BCF and D-EXAH could "be traffic" (as per his exact words), so he informed the latter of the former. He stated that since he was focusing on other tasks, he did not recall whether D-EXAH reported traffic in sight or not. He also did not have time to ensure that it could maintain separation with LY-BCF or to coordinate with the Valencia TACC controller a limit altitude for the second aircraft (D-EXAH) so as to avoid a reduced separation.

1.16.4. Statement from the Valencia TACC controller

According to his statement, there were four instrument flights from the school (LY-BBF, LY-BCF, D-EXAH and LY-BCG) practicing instrument approaches at the Valencia Airport.

He stated that these four aircraft were coordinated verbally with the Valencia control tower, and they were being tracked on radar. He thus assumed that the controller in the Valencia tower was aware of their presence and would have to have their strips, as per the letter of agreement between FerroNATS and ENAIRE.

He stated that to intersperse them between instrument arrivals, he coordinated a reduced separation and received permission from the controller in the Valencia control tower, as per the exchange that took place between them at 12:02:50.

The school aircraft LY-BCF made a low approach to the Valencia Airport. As per the letter of agreement and the arrangement with the tower controller, he cleared the aircraft to make SID SOPET, limit clearance to SGO at an altitude of 4000 ft.

According to the letter of agreement, after a low approach, the next departing aircraft must be coordinated with the control center. However, the Valencia control tower cleared ENT592 for departure SOPET4A to SGO without requesting authorization. Due to the speed difference between LY-BCF and ENT592, there was a high collision risk. To avoid this, he decided to remove LY-BCF from the departure route and maintain it at 3000 ft so as to achieve lateral and vertical separation as quickly as possible.

In addition, the Valencia control tower further violated the letter of agreement by interrupting the approach maneuver of D-EXAH. Assuming that D-EXAH was heading to SGO at 4000 ft, he realized it was on a collision course with LY-BCF, so he asked the tower controller to stop the climb of D-EXAH at 2500 ft and transfer it to his frequency. This way he managed to ensure 500 ft of vertical separation. The controller is aware that 500 ft is not the regulatory vertical separation, but he urgently applied it due to the lack of time to provide more instructions. He applied this emergency vertical separation to avoid a possible collision.

Furthermore, the Valencia control tower controller again violated the letter of agreement by allowing VLG3953 to take off on departure Orvus1H with visual traffic in the W corridor.

1.17. Organizational and management information

1.17.1. Information about FerroNATS

FerroNATS started providing air traffic control services at the Valencia control tower on 6 July 2013. FerroNATS is a certified air traffic services provider, as per the European regulation in effect.

1.17.2. Information about ENAIRE

The state-owned company Aeropuertos Españoles y Navegación Aérea (AENA, Air Navigation Services Provider), created by Article 82 of Law 4/1990 of 29 June on General State Budgets, was renamed ENAIRE on 5 July 2014.

The state-owned company ENAIRE, part of the Ministry of Development, is the manager of air traffic control, of aeronautical information and of the communications, navigation and surveillance networks for Spain's air space.

Pursuant to Law 09/2010, ENAIRE is the company designated by the State to supply air traffic control services during the en route and approach phases.

Thus, ENAIRE is responsible for providing air traffic control services during the approach phase to the Valencia Airport.

1.17.3. Letter of agreement between FerroNATS and ENAIRE

At the time of the incident, there was a Letter of Agreement between ENAIRE and FerroNATS to define the applicable coordination procedures between the Valencia TACC (LECL) and the Valencia TWR (LEVC) when providing air traffic services to general air traffic and to operational air traffic (IFR, special VFR and VFR).

The letter includes the following points:

1.- Areas of Responsibility.

- The Valencia TACC is responsible for the Valencia TMA and the Valencia CTR, except for the Valencia ATZ. The Valencia CTR[18] is that air space that extends vertically from the ground to an elevation above mean sea level (AMSL) of 6000 ft, as shown in the figure below taken from the visual approach chart.

- The Valencia TWR is responsible for the Valencia ATZ. The ATZ, or aerodrome traffic zone, for the Valencia Airport is the air space defined by a 5-NM radius circle centered at the aerodrome reference point (ARP), whose vertical limits extend from the ground to 2,500 ft AMSL.

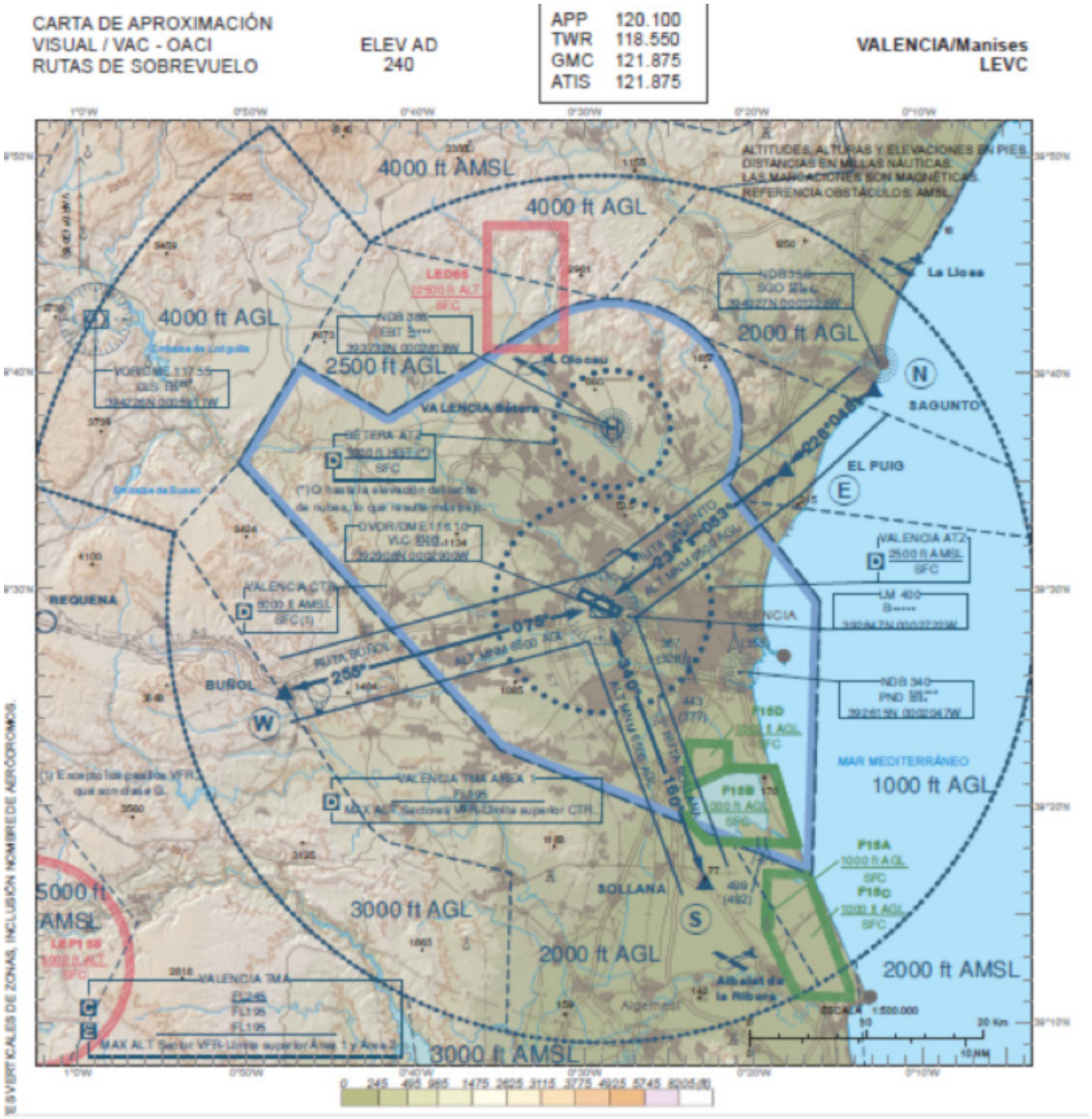

Figure 8. Visual approach chart

[18] Controlled Traffic Region

2.- Air Space Classification. The air space is class D, except for the visual corridors in the Valencia CTR, which are class G.

3.- Exchange of Flight Plan Information.

- Every message, including updated Flight Plan data, shall be sent by the transferring station to the relevant sector/position in the receiving station using the SACTA system or via telephone (Point C.1.2 Updated Flight Plan Information).

- If the accepting ATS station does not have the basic Flight Plan information, the transferring ATS station shall provide the necessary information (Point C.1.3 Flight Plan not available).

4.- Sequence between arriving/departing traffic and clearances (Point D.2.1.1 Separation between ARRIVALS):

- Unless wake turbulence concerns require a different separation, LECL shall establish between successive aircraft in the approach sequence a radar separation no fewer than 7 NM for RWY30.

- In the absence of VFR traffic in the ATZ and of departing traffic, and if requested by LECL, or if proposed by TWR, LEVC TWR may authorize a reduction in the separation between successive arrivals specified in the previous point to 5 NM for both thresholds.

- LECL shall coordinate with LEVC TWR early enough, and in no case after transferring communications, any approaches that conclude with a touch and go or a low approach, as well as the subsequent clearance to continue the flight, updating the flight plan data in the SACTA if necessary. After a touch and go or a low approach, the next departing traffic shall be coordinated with LECL.

- When an aircraft on an instrument or visual approach initiates a go-around maneuver, the station in radio contact with said aircraft at that moment shall immediately inform the other and avoid issuing clearances that are contrary to the published maneuver without first coordinating it with the other station. After a go-around, the next departing traffic shall be coordinated with LECL.

5.- Sequence between arriving/departing traffic and clearances (Point D.2.2.1 Separation between DEPARTURES):

- Unless wake turbulence concerns require a different separation, LEVC TWR shall space successive departures as per the criteria contained in the table below:

	Preceded by the same or superior performance, except slow	Fast performance behind medium performance
Same SID[19]	3 NM	7 NM
Different SID	3 NM	5 NM

Piston aircraft and helicopters are regarded as slow performance aircraft.

The separation to be applied between a slow performance aircraft followed by a slow, medium, fast or very fast performance aircraft shall always be coordinated.

6.- Sequence between arriving/departing traffic and clearances. (Point D.2.2.2 Clearances for departing traffic):

- For IFR school aircraft whose required route takes place entirely in the TMA, the LEVC TWR, independently of the route proposed in the FP, shall clear the aircraft to the SO-PET SID for the runway in use. The limit clearance in every case shall be to SGO at an altitude of 5000 ft. Any other arrangements shall be coordinated.

1.18. Additional information

1.18.1. Applicable regulation

The regulation in effect (Spain's Air Traffic Regulation[20], along with Implementing Regulation (EU) no. 923/2012 – SERA) applies.

For **class-D air space** it specifies that:

"IFR and VFR flights are permitted and all flights are provided with air traffic control service. IFR flights are separated from other IFR flights, receive traffic information in respect of VFR flights and traffic avoidance advice on request. VFR flights receive traffic information in respect of all other flights and traffic avoidance advice on request. Continuous air-ground voice communications are required for all flights and a speed limitation of 250 kts IAS applies to all flights below 3 050 m (10 000 ft) AMSL, except where approved by the competent authority for aircraft types, which for technical or safety reasons, cannot maintain this speed. All flights shall be subject to ATC clearance."

[19] TATOS, SOPET, ODSEN (Conventional) and OVRUS (Conventional) are regarded as the same departure for runway 30.

[20] Spain's Air Traffic Regulation was approved by Royal Decree 57/2002 of 18 January. It was later amended and recently modified pursuant to Royal Decree 552/2014 of 27 June, which lays down the common rules of the air and operational provisions regarding services and procedures in air navigation.

The **minimum vertical separation** provided by Air Control Services is regulated in requirement SERA.8005, letter c), number 1), which states "The vertical separation minimum shall be a nominal 300 m (1000 ft) up to and including FL 410". Approach Control Services may reduce separation in the vicinity of aerodromes when, among other circumstances, "the aerodrome controller can provide adequate separation when all the aircraft are constantly in sight".

The regulation also specifies, as shown below, **the pilot's obligation to acknowledge instructions completely, and the controller's obligation to listen to the pilot's acknowledgment and take measures to correct any discrepancies.**

1) "The flight shall acknowledge with the air traffic controller every part involving the safety of air traffic control (ATC) clearances and any instructions transmitted by voice.

2) Other clearances or instructions, including conditional clearances, shall be completely acknowledged or their receipt shall be acknowledged, clearly indicating that they have been understood and will be obeyed.

3) The controller shall listen to the acknowledgment to ensure that the flight crew has correctly received the clearance or instruction and shall take immediate measures to correct any discrepancy revealed by the acknowledgment."

Spain's Air Traffic Regulations establish the need to provide essential local traffic information, as well as the content of said information. Essential traffic information is that pertaining to any aircraft, vehicle or person that is in or near the maneuvering area, or to one operating in the vicinity of the aerodrome, that may constitute a hazard to the aircraft in question. Moreover, the essential local traffic shall be described in a way that facilitates its recognition. Messages containing information on essential local traffic shall contain the following text:

a) Identification of the aircraft to which the information is transmitted;

b) The words TRAFFIC IS or ADDITIONAL TRAFFIC IS, if necessary;

c) Description of the essential local traffic such that it can be recognized by the pilot; namely, the type, speed category and/or color of the aircraft, type of vehicle, number of persons, etc.;

d) Position of the essential local traffic with respect to the aircraft in question and direction of motion.

1.18.2. Applicable minimum separation

The AIP (Aeronautical Information Publication) indicates that the applicable minimum separation for the Valencia TWR is as follows:

Unit	Radar Environment		Applicable minimum separation
Valencia TWR	Normal and self-contained multiradar	Nominal	3
		Degraded	5
	Self-contained monoradar	Main	3
		Not main	5

And for the Valencia TACC it is as follows:

Unit	Radar Environment		Applicable minimum separation		ARP used
			From 0 to 30 NM ARP	From 30 to 60 NM ARP	
Valencia TACC	Normal and self-contained multiradar	Nominal with PSR	3		LEVC
		Nominal w/o PSR	3	5	
		Degraded	5		
	Self-contained monoradar	Main	3	5	
		Not main	5		

1.18.3. Standard instrument departure (SID) chart.

An extract from the SID chart for runway 30 is provided. The procedure to be used for the SOPET4A 0 SID is:

1. Climb on runway heading to 4.0 DME VLC.

2. Turn right to intercept and follow magnetic bearing 075º SGO direct to cross SGO NDB at 4500 ft or higher.

3. Proceed on magnetic bearing 045º SGO direct to SOPET.

Figure 9. Stantard instrument departure (SID) chart

1.19. Useful or effective investigation techniques

No special investigation techniques were used.

2. ANALYSIS

2.1. General

On Monday, 9 November, the aircraft with registrations LY-BBF, LY-BCF, D-EXAH and LY-BCG, all of them operated by Aerojet Baltic, left from the Requena aerodrome on a training flight to practice instrument approaches at the Valencia Airport. The training involved making a low approach to the airport and then a right turn direct to the SGO NDB at an altitude of 4000 ft.

The aircraft with registrations LY-BBF and LY-BCF made the low approach. The aircraft with registration D-EXAH, however, was unable to make it. D-EXAH was instructed to turn right to SGO during its approach maneuver in order to not delay a commercial air transport aircraft (ENT592) that was cleared to take off 2 minutes later.

While they were in the Valencia ATZ air space, the horizontal distance between the LY-BCF and D-EXAH aircraft was 2 NM for a few seconds. The D-EXAH aircraft was not properly informed of this fact by the controller in the Valencia control tower, who, despite providing incomplete essential local traffic information to D-EXAH, did not receive the pilot's acknowledgment and did not take measures to ensure that the aircraft were aware of the loss of separation between them.

It was inside the Valencia CTR air space that the minimum separation between these aircraft took place. The controller in the Valencia TACC, upon noticing the commercial air transport aircraft (ENT592) take off, much faster than the school aircraft, and prevent a loss of separation between ENT592 and LY-BCF aircraft; instructed LY-BCF to maintain an altitude of 3000 ft, and asked the Valencia tower controller to instruct D-EXAH to maintain 2500 ft to avoid a loss of horizontal separation between aircraft LY-BCF and D-EXAH. The vertical distance between the aircraft was 500 ft and the horizontal distance was 0.3 NM.

2.2. Analysis of the transfer of control from the Valencia TACC to the Valencia TWR

The two aircraft involved in the incident had a type-Z local flight plan with the same aerodrome of departure and arrival, Requena (ICAO code LERE). According to the letter of agreement, the flight plan information is to be sent using the SACTA system or via telephone.

On the day of the incident, as per the statement from the Valencia TACC controller, the flight plan information was sent via telephone and not via the SACTA system. This controller assumed that the controller in the Valencia TWR was aware of the aircraft and had their flight progress strips since, in addition to the verbal coordination, the aircraft were active on radar.

The controller in the Valencia TWR, however, was surprised by the arrival of D-EXAH, for which he did not have a flight progress strip, as he informed the controller in the Valencia TACC. In his statement he noted that the flight progress strip had not been sent earlier, nor had the flight plan been updated on the SACTA system for this aircraft.

Therefore, the verbal coordination to send the flight data information was not adequate. The analysis of the communications revealed that the Valencia TACC controller did not indicate the number of aircraft from the flight school that he was transferring to the Valencia TWR controller, which is why the latter was caught off guard by the arrival of D-EXAH.

That is why it will be recommended that both ENAIRE and FerroNATS, as part of their respective Operational Safety Management Systems, evaluate the procedure for "Exchanging Flight Plan Information" and take the mitigating measures deemed appropriate in order to ensure that the accepting control unit receives the relevant parts of the updated flight plan, as well as all the control information involving the requested transfer.

Furthermore, the flight school aircraft entered the Valencia ATZ air space without the proper separation between them, as required by the letter of agreement (point "D.2.1.1 Separation between ARRIVALS"). The letter of agreement requires a 7-NM separation, which can be lowered to 5 NM under certain circumstances. The aircraft entered the ATZ air space separated by fewer than 5 NM. Even though the Valencia TACC controller notified the Valencia TWR controller that the flight school aircraft were very close, he did not observe the requirements of the letter of agreement in terms of the separation between arrivals.

Again, as part of their Operational Safety Management Systems, it will be recommended that both ENAIRE and FerroNATS analyze the consistency between the minimum separation applicable in the Valencia TACC, the Valencia TWR and that specified in point "D.2.1.1 Separation between ARRIVALS" in the letter of agreement. The goal is to identify operational safety aspects and adopt the mitigating measures deemed appropriate so as to ensure the minimum separation between aircraft while on approach to the Valencia Airport.

Moreover, the controllers did not agreed when and in which conditions the controller in the Valencia TWR could instruct the aircraft to turn right to the SGO NDB. The letter of agreement establish that IFR school aircraft shall be cleared to the SOPET SID and the limit clearance in every case shall be to SGO at an altitude of 5000 ft. The Valencia TACC controller, according with its statement, intended to coordinate the procedure established in the letter of agreement but with a limit altitude of 4000 ft. However, the controller in the Valencia control tower understood that after the low approach he has to instruct aircraft to right turn direct to the SGO NDB at an altitude of 4000 ft.

2.3. Analysis of the air traffic service provided by the Valencia TWR

Based on the analysis of the communications transcript and the radar track, the Valencia TWR controller instructed D-EXAH to abort its approach maneuver to the Valencia Airport after it reached the minimum approach altitude and distance. He took this decision after the commercial air transport aircraft (ENT592) indicated him that was ready to take off. The D-EXAH aircraft aborted its approach maneuver two minutes after receiving the instruction, when it was at an approximate altitude of 700 ft and 1 NM away from the runway threshold.

The controller then incompletely informed D-EXAH that there was traffic (referring to LY-BCF) within 3 NM; however, the pilot did not acknowledge this information and the controller did not repeat it to ensure that the pilot had received the information, as required by the applicable regulation. Moreover, a minute and a half later, the separation between D-EXAH and LY-BCF fell to 2.2 NM horizontally and 800 ft vertically. The controller did not inform the aircraft of this additional loss of separation.

What is more, the controller did not adequately inform the aircraft of this circumstance, as he was obligated to do, because, according with its statement, he was busy with other traffic. While it is true that he accepted the flight school traffic transferred to him by the Valencia TACC controller, it is also true that he did not have complete information on their flight plan, he did not know how many aircraft were being transferred and the school aircraft entered in the Valencia ATZ airspace with a separation less than 5 NM. This improper hand-off could have resulted in his acceptance of more flights than he was able to control, and thus increasing its workload, that could cause his failure to provide information to these aircraft about the loss of separation.

2.4. Analysis of the transfer of control from the Valencia TWR to the Valencia TACC

The controller in the Valencia control tower cleared the commercial air transport aircraft (ENT592) to take off 2 minutes later than he had instructed the D-EXAH aircraft to abort its approach maneuver without coordination with the Valencia TACC controller as required by the letter of agreement: "After a touch and go or a low approach, the next departing traffic shall be coordinated with LECL"

Moreover, the point "D.2.2.1 Separation between DEPARTURES" in the letter of agreement specifies that the separation to be applied between a slow performance aircraft and the one behind it must be coordinated. At no time did this coordination take place between the Valencia TWR and Valencia TACC controllers.

Furthermore, the controller in the Valencia control tower interrupted the instrument approach of one of the aircraft (D-EXAH) without informing the Valencia TACC controller, as required by the letter of agreement.

Once more, this lack of coordination between the controllers was probably due to the fact that the controller in the Valencia tower was busy with more traffic than he could adequately control, and did not have time to inform the Valencia TACC controller of the successive departures.

As a result, it will be recommended that both ENAIRE and FerroNATS, as part of their respective Operational Safety Management Systems, analyze the procedure for coordinating the separation between both departures and arrivals, and adopt the mitigating measures deemed necessary so as to ensure said coordination.

2.5. Analysis of the air traffic service provided by the Valencia TACC

The AIP states that the minimum applicable separation in the Valencia TACC shall be 3 NM. This minimum separation can, in certain circumstances, be increased to as much as 5 NM. Inside the Valencia CTR air space, the minimum applicable separation published in the AIP on the day of the incident was not maintained.

At 12:14:17, the Valencia TACC controller asked the Valencia tower controller to transfer control of D-EXAH to him. At that time the horizontal separation between this aircraft and LY-BCF was approximately 2 NM. D-EXAH did not contact the Valencia TACC controller until 12:15:02, by which time the horizontal separation between the two aircraft had fallen to 0.9 NM. This separation fell to 0.7 NM a few seconds later. Therefore, the aircraft left the Valencia ATZ air space without proper separation between them and the controller in the Valencia TACC did not have time to increase this distance.

The minimum vertical separation of 1000 ft was also not maintained. The transcript of the conversations reveals that at 12:13:51, the Valencia TACC controller instructed LY-BCF to hold 3000 ft, and at 12:14:22 he asked the Valencia tower controller to instruct D-EXAH to hold 2500 ft. In his statement, the controller indicated that .upon noticing the commercial air transport aircraft (ENT592) take off, much faster than the school aircraft, and prevent a loss of separation between ENT592 and LY-BCF aircraft; instructed LY-BCF to maintain an altitude of 3000 ft and asked the controller in the Valencia tower to in turn instruct D-EXAH to maintain 2500 ft to avoid a loss of horizontal separation between aircraft LY-BCF and D-EXAH. Although the minimum vertical separation was loss, the controller did not have more options to avoid a possible collision that applying a 500 ft vertical separation.

On the other hand, at no time did the Valencia TACC controller report this loss of minimum separation to the aircraft, as he was required to do. This could have been due to the fact that he was caught off guard by the clearance to take-off of the commercial air transport aircraft (ENT592) and the interruption of the instrument approach by one of the aircraft (D-EXAH), and to the lack of time to report the event to the aircraft.

3. CONCLUSIONS

3.1. Findings

- The instructors in aircraft LY-BCF and D-EXAH had valid licenses and medical certificates.
- The controllers in both units had valid licenses, unit endorsements and medical certificates.
- The aircraft's documentation was valid and they were airworthy.
- While transferring control between the two units, controllers in both violated the letter of agreement between them.
- At 12:15, LY-BCF and D-EXAH experienced a loss of separation in the Valencia CTR. The minimum distance required is 3 NM horizontally and 1000 ft vertically, and the aircraft were within 0.3 NM horizontally and 500 ft vertically.
- The controller in the Valencia TACC applied a vertical separation of 500 ft to avoid a possible collision.
- At no time were the aircraft informed of this loss of separation.

3.2. Causes/Contributing factors

The investigation has determined that this incident was caused because the controller in the Valencia tower cleared a commercial air transport aircraft (ENT592) to take off and instructed D-EXAH aircraft to interrupt the low approach without coordination with the Valencia TACC controller and without following the procedures of the letter of agreement between FerroNATs and ENAIRE.

The following contributed to the incident:

1. The fact that the procedures specified in the letter of agreement between FerroNATS and ENAIRE were not observed,

2. The aircraft were transferred improperly, verbally and without indicating the number of school aircraft, without agreeing when and in which conditions the aircraft had to turn right to the SGO NDB and without the required horizontal separation between them, and

3. The controller in the Valencia tower did not have a strip for D-EXAH aircraft neither its updated flight plan in SACTA.

4. SAFETY RECOMMENDATIONS

Due to the inadequate coordination in the transfers between the controllers in the Valencia tower and the Valencia TACC, the following safety recommendations are issued:

REC 29/16. It is recommended that ENAIRE, as part of its Safety Management System, implement and manage the change of its Letter Of Agreement that introduces a new procedure to manage IFR training flights.

REC 30/16. It is recommended that FerroNATS, as part of its Safety Management System, implement and manage the change of its Letter Of Agreement that introduces a new procedure to manage IFR training flights