Technical report IN-005/2021

Incident on 21 February 2021 involving a CESSNA 525 aircraft operated by ProAir Aviation GmbH, registration D-IPOD, at A Coruña Airport (Spain)

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GOBIERNO DE ESPAÑA
MINISTERIO DE TRANSPORTES, MOVILIDAD Y AGENDA URBANA
UNDERSECRETARIAT
CIVIL AVIATION ACCIDENT AND INCIDENT INVESTIGATION COMMISSION

Notice

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 and its 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 5.6 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 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.

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Abbreviations

° ' "	Sexagesimal degrees, minutes and seconds
°C	Degrees Celsius
AD	Aerodrome
AENA	Spanish Airports and Air Navigation(airport management)
AESA	Spain's National Aviation Safety Agency
AIP	Aeronautical Information Publication
AOC	Air operator certificate
ARC	Authorised Release Certificate
ATC	Air Traffic Control
CAMO	Continuing airworthiness management organisation
CAT	Category
CPL	Commercial pilot license
CPL(A)	Commercial pilot license (aircraft)
DME	Distance Measuring Equipment
EASA	European Aviation Safety Agency
ELT	Emergency location transmitter
FAA	United States Federal Aviation Administration
FOD	Foreign object debris
ft	Feet
h	Hours
HP	Horsepower
hPa	Hectopascals
ILS	Instrument landing system
IR (A)	Instrument Rating
kg	Kilogrammes
KIAS	Knots indicated airspeed
km	Kilometres
km/h	Kilometres/hour
kt	Knots
l, l/h	Litres, Litres/hour
lb	Pounds
LAPL	Light aircraft pilot license
LECO	ICAO code for A Coruña Airport
LECU	ICAO code for Cuatro Vientos Airport – Madrid
LEMD	ICAO code for Adolfo Suárez Madrid-Barajas Airport
LEVC	ICAO code for Valencia Airport

LEVX	ICAO code for Vigo Airport
LIFUS	Line Flying Under Supervision
m	Metres
mm	Millimetres
m/s	Metres/second
m^2	Metres squared
MEHT	Minimum eye height of pilot over the threshold (for visual approach slope indicator systems)
METAR	Aviation routine weather report
MP	Multi-pilot
MTOW	Maximum take-off weight
N	North
s/n	Serial number
O	West
ICAO	International Civil Aviation Organisation
OM	Operating Manual
PAPI	Precision Approach Path Indicator
PF	Pilot flying
PNF	Pilot monitoring
QNH	Altimeter subscale adjustment to obtain elevation while over land (precision adjustment to indicate elevation above mean sea level)
QRH	Quick Reference Handbook
RTO	Rejected take-off
SEI	Fire Extinguishing Service
TAF	Terminal aerodrome forecast
TCDS	Type certificate data sheet
T/O	Take-off
TOAM	Movement area operations technician
TWR	Aerodrome control tower or aerodrome control
EU	European Union
UTC	Coordinated universal time
V_1	Take-off decision speed
V_2	Take-off safety speed
V_A	Manoeuvring speed
V_{FE}	Maximum flaps-extended speed
VFR	Visual flight rules
VHF	Very high frequency (30 to 300 MHz)
V_{LE}	Maximum landing gear extended speed
V_{LO}	Maximum landing gear operating speed

V_{NO}	Maximum speed for normal operations
V_R	Rotation speed
VSI	Vertical speed indicator
VOR	VHF omnidirectional range

Technical report

IN-005/2021

Owner and Operator:	ProAir Aviation GmbH
Aircraft:	CESSNA 525, registration D-IPOD(Germany)
Date and time of incident:	21 February 2021; 19:32 UTC
Site of incident:	A Coruña Airport - LECO (A Coruña-Spain)
Persons on board:	2 (crew)
Type of operation:	Commercial air transport-Other-Emergency medical services
Phase of flight:	Take off - Take-off run
Flight rules:	VFR
Date of approval:	24/11/2021

Synopsis

Summary:

On 21 February 2021, the CESSNA 525 aircraft, registration D-IPOD, took off from A Coruña Airport (LECO) bound for Vigo airport (LEVX) to carry out an organ transport flight. During the take-off run, the aircraft hit and damaged two runway edge lights.

The aircraft sustained minor damage to the nose landing gear.

There were no injuries.

The cause of the incident was the lack of adherence to take-off procedures, in particular, the incorrect execution of the take-off run.

No operational safety recommendations are proposed.

1. THE FACTS OF THE INCIDENT

1.1. Summary of the incident

At 19:20 UTC on 21 February 2021, a CESSNA 525 aircraft operated by commercial air transport company ProAir Aviation GmbH, registration D-IPOD, was preparing to carry out a human organ transport flight from A Coruña Airport (LECO), picking up at Vigo Airport (LEVX), and finally landing to deliver the organ at Madrid-Barajas Adolfo Suarez Airport (LEMD).

The crew, comprising a captain and co-pilot from Atlantic Air Solutions, S.L., followed the instructions from the tower at LECO and went to the head of runway 21 via N, following the taxi line.

The aircraft taxied and lined up at the head of runway 21 for take-off, and the captain handed over the controls to the co-pilot, who had recently started working at the base, to act as PF.

The co-pilot (PF) commenced the take-off run, and the captain (PNF) adjusted the power settings and other parameters. According to the captain's statement, as their speed was approaching V_1[1], he noticed the aircraft deviating from the centre of the runway, and took over the controls to try to correct the alignment.

According to the captain's statement, just as they exceeded the rotation speed of 108 kt and reached the point of rotation at 19:32 UTC, he noticed an unusual impact that felt like they went over a bump and thought perhaps an animal had got onto the runway.

Photograph 1: Aircraft involved in the incident

[1] V_1: Take-off decision speed, beyond which take-off should no longer be aborted.

The crew checked all the aircraft's systems were working correctly and, given that it was a short (17') and urgent flight, decided to continue the journey to LEVX. They immediately informed the tower of the incident in case of implications for the safety of other traffic or users of the runway, and requested an inspection to confirm what had happened.

Subsequently, the tower confirmed the impact and the breakage of two runway edge lights on the west side, which were immediately replaced.

The flight proceeded without further incident, landing at LEVX at 19:55 UTC, where they collected the human organs to be transferred to Madrid. The crew inspected the aircraft and confirmed it was safe to continue with the urgent mission to LEMD, which also passed without incident.

The incident occurred at night with reduced visibility due to the rain that had begun to fall on take-off.

After the Madrid flight, maintenance personnel inspected the aircraft and confirmed minor damage to the nose gear, possibly due to the wheel fork making contact with the broken runway lights.

1.2. Injuries to persons

Injuries	Crew	Passengers	Total in the aircraft	Others
Fatal				
Serious				
Minor				
Unharmed	2		2	
TOTAL	2		2	

1.3. Damage to the aircraft

The aircraft sustained minor damage as a result of the incident, specifically to the nose landing gear wheel fork.

1.4. Other damage

The TOAM personnel[2] who inspected the runway after the crew notified the tower found debris from two broken lights. The pieces came from two raised white/yellow lights on the edge of runway 21, at positions 83A and 85B.

Together with personnel from the Electrical Department and the SEI, they cleaned the area and confirmed that there was no other damage to the runway.

[2] TOAM: Movement Area Operations Technicians.

In regard to the traffic affected by the incident as a result of briefly closing the runway to clean it, only one Iberia A320-200 N aircraft coming from Madrid, registration EC-NDN, was forced to delay its landing.

1.5. Information about the personnel

1.5.1. Captain

The 37-year-old captain had a commercial aircraft pilot license, CPL(A), issued by Spain's National Aviation Safety Agency (AESA) on 20/04/2005 with the following ratings:

- Type rating for the C525/MP (Multi-pilot), valid until 31/12/2021.
- IR(A) instrumental flight rating, valid until 31/12/2021

He had a total of 6,000 hours of flying time, of which 4,100 hours were in the type of aircraft involved in the incident.

His recent flight activity was as follows:

- in the last 90 days he had flown: 23:45 h
- in the last 30 days he had flown: 16:55 h
- in the last 24 h: 0 h
- his pre-flight rest was 24 h

The captain had a class 1 medical certificate valid until 27/09/2021, and his class 2 and LAPL were valid until 05/04/2025.

1.5.2. Co-pilot

The 26-year-old co-pilot had a commercial aircraft pilot license, CPL(A), issued by Spain's National Aviation Safety Agency (AESA) on 07/11/2016 with the following ratings:

- Type rating for the C525/MP (Multi-pilot), valid until 31/12/2021.
- IR(A) instrumental flight rating, valid until 31/12/2021

He had a total of 1,500 hours of flying time, of which 39:45 hours were in the type of aircraft involved in the incident. At the time of the event, the co-pilot was new at the operations base and under LIFUS supervision from the captain.

His recent flight activity was as follows:

- in the last 90 days he had flown: 10:10 h
- in the last 30 days he had flown: 07:00 h
- in the last 24 h: 0 h
- his pre-flight rest was 10 days

The co-pilot had a class 1 medical certificate valid until 22/09/2021, and his class 2 and LAPL were valid until 22/09/2025.

1.6. Information about the aircraft

1.6.1. General information

The American designed and manufactured CESSNA 525 Citation Jet (Cessna Aircraft Company) is a twin-engine, low-wing, t-tail aircraft with turbines mounted in the rear part of the fuselage, a pressurised cabin and retractable tricycle-type landing gear. It has an FAA and EASA TCDS EASA IM A.078 Rev. 8 certification, dated 23/06/2014. It can carry a pilot, a co-pilot and 6 passengers.

Structure:

- Length: 12.98 m
- Wingspan: 14.20 m
- Height: 4.19 m
- Wing area: 22.30 m^2
- Empty weight: 4,400 kg
- MTOW: 4,717 kg
- Wing-integrated fuel tanks with a total capacity of 3,220 lb

Performances:

- Maximum speed for normal operations (V_{MO}): 263 KIAS
- Manoeuvring speed (V_A): 199 KIAS
- Maximum speed with flaps extended (V_{FE}): 200 KIAS (flaps 15º), 161 KIAS (flaps 35º)
- Flap positions: 0º, 15º and 35º
- Maximum landing gear extended speed (V_{LO}): 186 KIAS

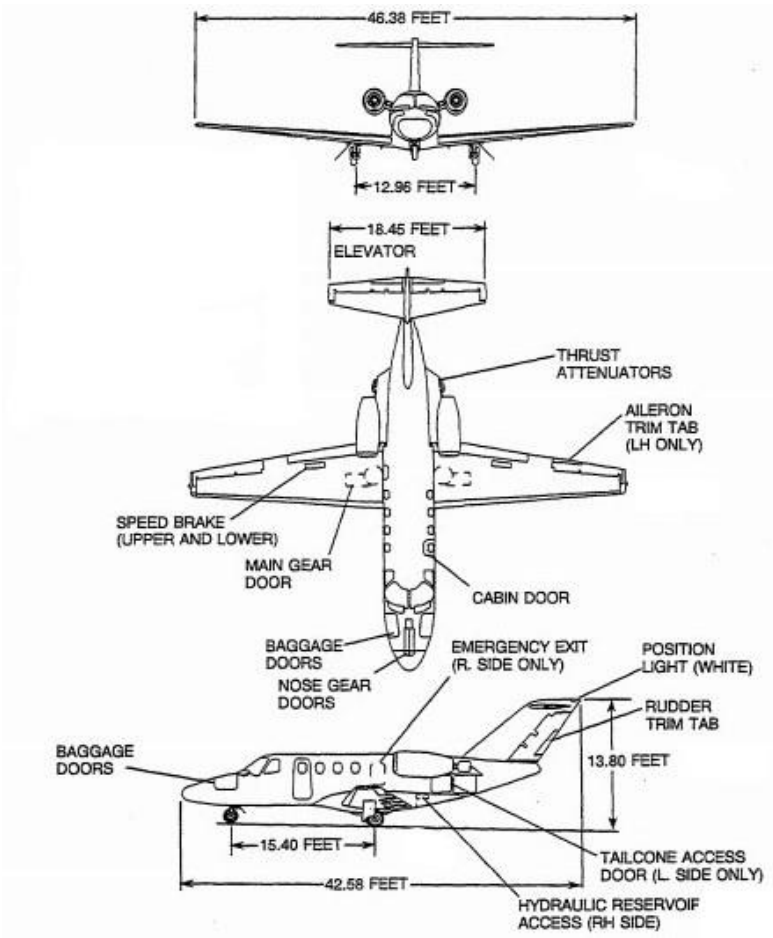


Figure 1: Cessna 525 Citation Jet

Power plant:

Aircraft equipped with two Williams International Co LLC FJ44-1A turbines, s/n: 1392 y 1397, according to TCDS EASA. IM.E.016 rev. 12 dated 23/12/2020.

Instrument panel

Photograph 2: Instrument panel of the incident aircraft

1.6.2. Maintenance information

The Cessna 525 Citation Jet aircraft with series number: 525-0193 was built in 1997. It was maintained by AESA-approved maintenance organisation ATS Aviation, S.L., an EASA Part-145 organisation based at Cuatro Vientos Airport - Madrid (LECU), with line stations at Madrid Barajas - Adolfo Suárez (LEMD) and Valencia (LEVC) airports, and by the EASA Part-145 Cessna Spanish Citation Service Centre (Cessna/Textron) in Valencia.

According to the ARC, the aircraft´s last maintenance overhaul before the incident was carried out at the Cessna Spanish Citation Service Centre on 18/12/2020, when it had 4,903:01 flight hours and 4,538 cycles. This overhaul included corrective maintenance for the audible warning systems and the right-hand VSI[3], which was replaced.

At the time of the incident, the aircraft had accumulated 4,939:47 hours of flight and 4,577 cycles.

1.6.3. Airworthiness status

According to the registration certificate issued by the Federal Office of Civil Aviation of the Federal Republic of Germany, the aircraft was registered on 20/09/2016, with registration number 33644.

[3] VSI: Variometer or vertical speed indicator.

Its Airworthiness Certificate was issued by the Federal Office of Civil Aviation of the Federal Republic of Germany (Luftfahrt Bundesamt) on 20/09/2016 (no.33644) and had indefinite validity with the aircraft categorised as a "Normal Category Aircraft". In addition, it had an airworthiness review certificate ref.: 006/2019/ProAir, issued by the operator's CAMO centre when the aircraft had 4,897:42 flight hours and valid until 17/12/2021.

The aircraft also had the following available authorisations:

- Noise certificate issued on 07/10/2009, with indefinite validity.
- Aircraft station license and ELT ref.: 75 45 7384, valid until 28/08/2026.

1.7. Meteorological information

1.7.1. General situation

On the surface, there was an extensive and deep Atlantic depression, with high relative pressures over the northwest of the Iberian peninsula, following the passage of a cold front during the early hours of the previous day.

1.7.2. Conditions in the area of the incident

The incident happened at dusk in nocturnal conditions and with a wet runway. The following aerodrome reports (METAR) were recorded at A Coruña Airport around the time of the incident:

METAR LECO 211930Z VRB02KT 9999 SCT030 09/06 Q1011 NOSIG=
METAR LECO 212000Z 26004KT 230V290 9999 SCT030 09/05 Q1011 NOSIG=

(Decoding: A Coruña Airport, conditions described by the METAR on the 21st between 19:30 and 20:00 UTC were variable 2 kt wind direction between 230º and 290º, and 4 kt from 260º, visibility predominantly in excess of 10 km, partially cloudy sky at 3,000 ft, temperature 9 ºC, good visibility, dew point between 5 and 6 ºC and a QNH of 1,011 hPa.)

And the forecast for the aerodrome at the time (TAF) was:

TAF LECO 211400Z 2115/2215 28007KT 9999 SCT020 SCT035 TX10/2215Z TN02/2207Z
PROB30 TEMPO 2115/2118 34010KT 4000 -RA SHRA SCT030TCU
PROB30 TEMPO 2205/2208 3000 BR BCFG=

(Decoding: A Coruña Airport, conditions described by the TAF on the 21st, at 14:00 h UTC, forecast valid from the 21st at 15:00 h UTC until the 22nd at 15:00 h UTC: 7 kt westerly wind 280º, visibility in excess of 10 km, partially covered sky between 2,000 and 3,500 ft, maximum temperature at 15:00 UTC of 10ºC and minimum temperature at 7:00 UTC of 2ºC; 30% probability of 10 kt northwesterly wind 340º

with 4,000 m visibility on the 21st between 15:00 and 18:00 UTC, heavy rain showers, scattered clouds at 3,000 ft, 30% probability on the 22nd from 05:00 to 08:00 UTC of 3,000 m visibility, mist with fog banks.)

In short, the wind was light and variable, although predominantly from the west, the visibility was good (more than 10 km) and there was cloud at around 3,000 ft. No precipitation or electrical activity was recorded in the area at the time of the incident.

1.8. Aids to navigation

At the time of the incident, the airport was operational and all the human and material resources stipulated by the applicable procedures were functioning and available.

The runway at LECO is equipped with a PAPI 3º system for visual approaches and ILS, DME and VOR radio navigation aids.

1.9. Communications

The transcripts of the communications between the LECO control tower and the D-IPOD aircraft involved in the incident, as well as those between the airport personnel and AENA's operational coordination centre, provided the following information:

- At 19:25:58 UTC, the D-IPOD aircraft was ready to taxi.
- At 19:30:15 UTC, it was cleared to take off from runway 21.
- At 19:30:45 UTC, it commenced the take-off run.
- At 19:31:30 UTC, after take-off, the D-IPOD informed TWR LECO that it might have hit a light approximately halfway along the runway during rotation and requested an inspection to confirm what had happened.
- At 19:34:30 UTC, the T1 movement area operations technician (TOAM) requested clearance to enter the runway via N in order to carry out the inspection.
- At 19:36:37 UTC, the T1 TOAM confirmed there were two broken edge lights on the west side of the runway. The AENA coordination office contacted the Fire Extinguishing Service and the electrical department to get the runway cleaned and the broken pieces of the edge lights removed as quickly as possible because there was a flight due to land imminently.
- The D-IPOD aircraft was listening in on the 118.3 frequency and confirmed that they had copied the information about the impact with the two lights.
- The controller thanked D-IPOD for their cooperation and confirmed the impact with the lights.

At the same time, aircraft IBE05KK (EC-NDN), which was on final for runway 21, contacted TWR LECO. It was informed of what had happened and that it would probably have to abort the landing and be returned to Santiago de Compostela approach due to a contaminated runway.

When the T1 TOAM confirmed that the runway was still contaminated, the IBE05KK traffic was instructed to perform a go-around and transferred back to Santiago de Compostela approach to hold.

- At 19:59 UTC, the runway cleaning was completed.
- At 20:03 UTC, the T1 TOAM confirmed the runway was clean and clear of vehicles and declared it operational.
- At 20:08 UTC, the IBE05KK finally landed without incident.

After this landing, maintenance workers re-entered the runway to inspect it and replace the broken edge lights.

- By 21:21 UTC, all the tasks had been completed, and the edge lights had been replaced.

1.10. Information about the airport

A Coruña Airport (ICAO: LECO) is managed by AENA and located 8 km from the city of A Coruña. Its topographic and climatological characteristics necessitate specific operating procedures and methods, such as the requirement that any landing aircraft surpassing the taxiway exits to the apron must continue taxiing straight ahead in order to make the turn at the runway end.

It has air traffic control services and is equipped with radio navigation aids (ILS, DME and VOR).

Photograph 3. Head of runway 21 at LECO

Its GPS coordinates are: 43º18'07"N – 008º22'38"O

It has an asphalt 03/21 orientated runway measuring 2,188 x 45 m. Its elevation is 101 m.

As there is no taxiway at the end of the runway, it has an apron to facilitate 180º turns for take-off and aircraft have to backtrack on both runways.

The taxi guidance systems on the two runways include signs, runway holding points, stop bars, runway protection lights and parking stands. The runways have markings to indicate the designators, threshold, centreline, lateral strip, aiming point and touchdown zone; and the taxiways have edge, centreline and enhanced centreline markings, as well as centreline markings on the turning apron. These markings comply with ICAO Annexe 14 (Aerodromes) Annexe 1, chapter 5 point 5.2.3 Runway centreline marking and point 5.2.9 Runway turning apron indicator.

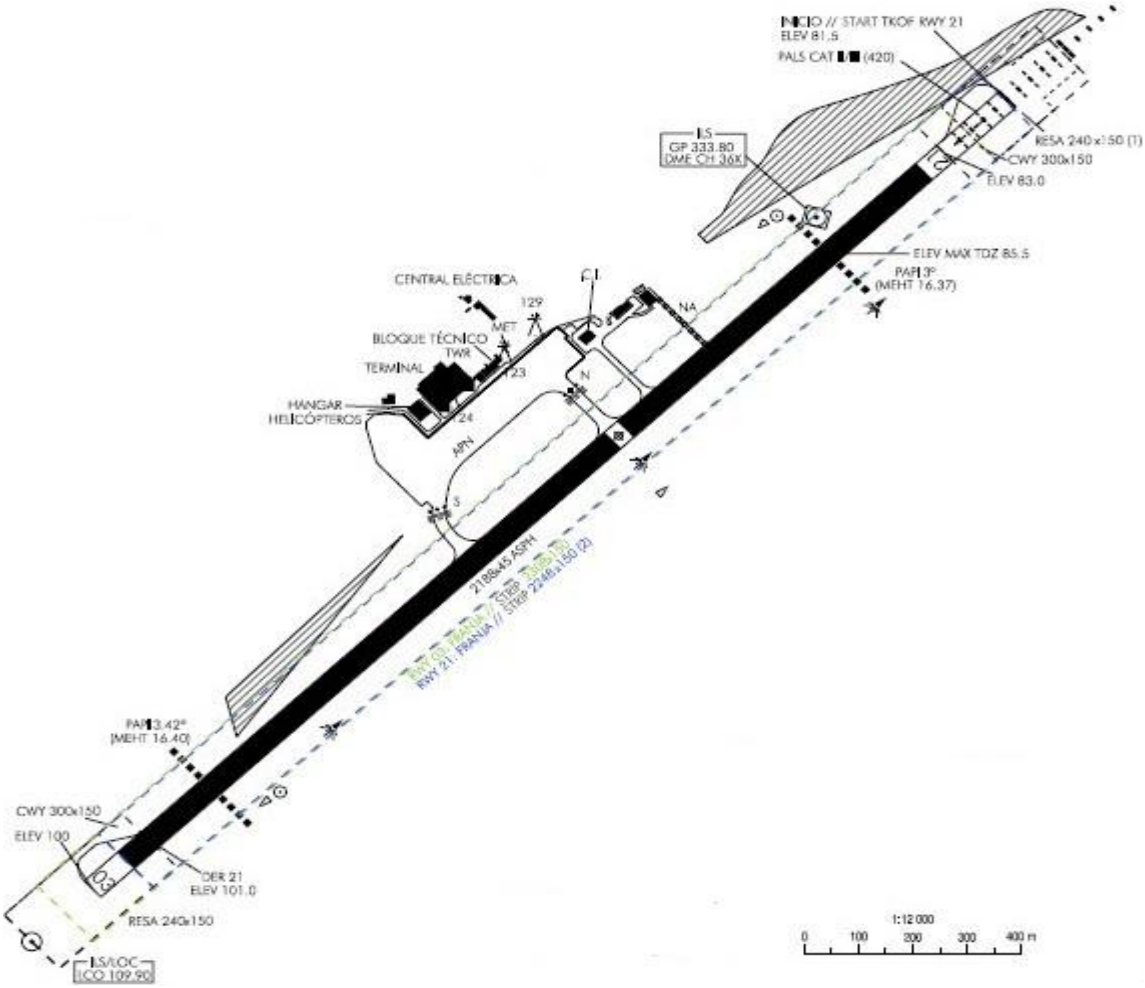


Figure 2: Plan of A Coruña Airport

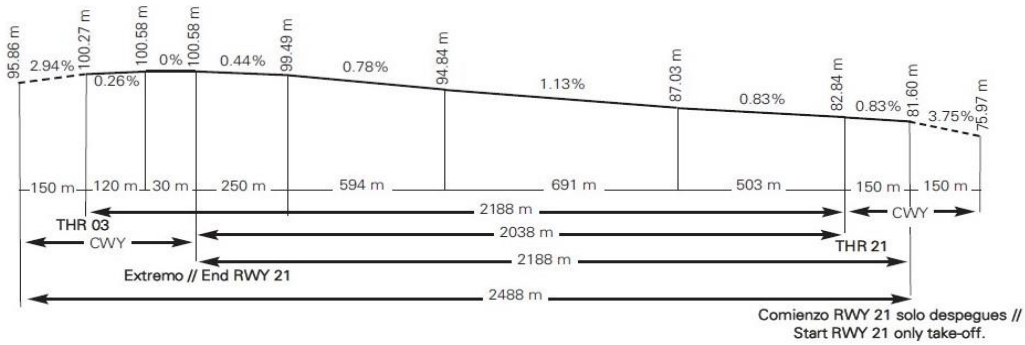


Figure 3: Profile of runway 21

1.11. Flight recorders

According to the operator, the aircraft was not equipped with a flight data recorder or a cockpit voice recorder.

1.12. Aircraft damage information

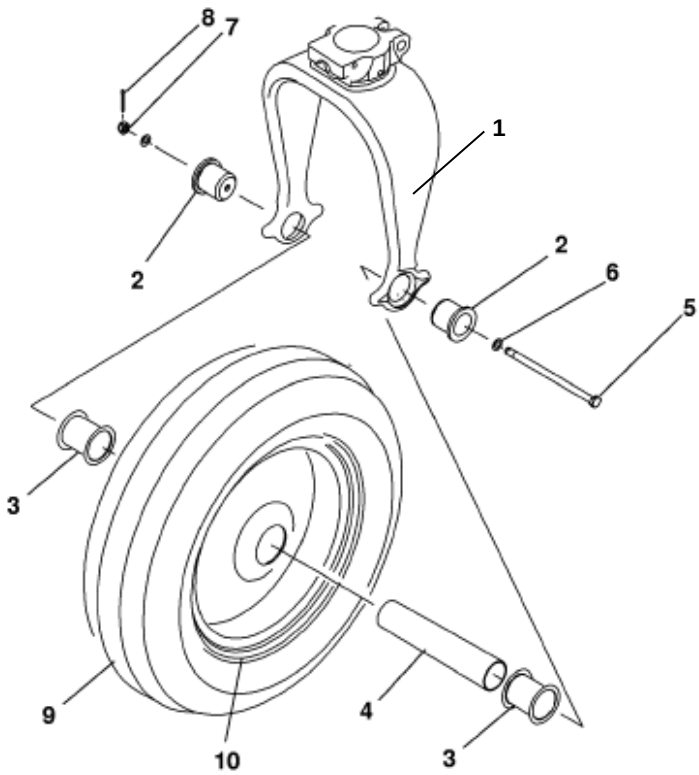
Given the nature of the event and the fact that the CIAIAC was not informed until 17 days after it happened, we were not able to inspect the aircraft or the runway edge lights to verify the damage.

Two runway edge lights on the west side were left broken and unserviceable, with debris, such as pieces of steel and small and medium-sized pieces of glass scattered over a large area of the runway. Small pieces of glass were also found along the edge of the runway, which was cleaned with a pressure hose.

Photograph 4: FOD found on the runway

The damage reported by the aircraft operator was minor and restricted to scratches and small notches on the outer arm of the nose gear fork.

Photograph 5: Damaged edge lights



Above - Figure 4. Assembly diagram of the nose gear leg

1. Wheel fork	6. Washer
2. Bucket	7. Nut
3. Spacer	8. Cotter pin
4. Axle	9. Tyre
5. Tube	10. Wheel Assembly

Right - Photograph 6. Damage to the nose wheel fork

1.13. Medical and pathological information

Not applicable.

1.14. Fire

Not applicable.

1.15. Survival aspects

Not applicable.

1.16. Tests and research

Not applicable.

1.16.1. Tests and Inspections

1.16.1.1. Information about the runway lighting

The lighting on runway 03 is composed of variable intensity threshold identification lights with the following characteristics:

- PAPI (MEHT): 3.42° (16.40 m/54 ft).
- Threshold: Green, with wing bars.
- Touchdown zone: None.
- Runway centreline: 2,188 m: 1,288 m white + 600 m red and white + 300 m red. (variable intensity).
- Distance between lights: 15 m.
- Runway edge: 2,188 m: 1,588 m white + 600 m yellow. (variable intensity).
- Distance between lights: 50 m.
- Runway end: Red.
- Distance between lights: 2.80 m.
- Stop zone: None.

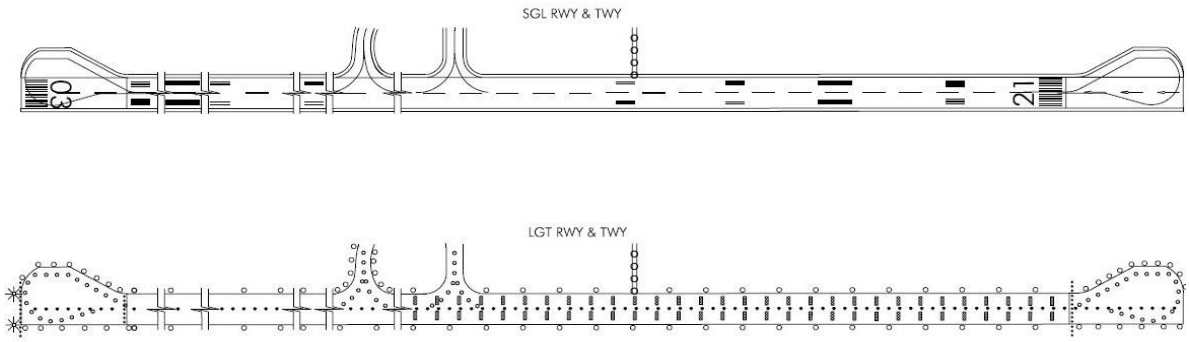


Figure 5. Runway layout and lighting

And on runway 21:

- Approach: Precision CAT II/III, 420 m.
- Runway entrance lights, 210 m (variable intensity).
- PAPI (MEHT): 3° (16.37 m/54 ft).
- Threshold: Green, with wing bars.
- Touchdown zone: 900 m white.
- Runway centreline: 2,188 m: 1,288 m white + 600 m red and white + 300 m red. (variable intensity).
- Distance between lights: 15 m.
- Runway edge: 2,188 m: 150 m red + 1,438 m white + 600 m yellow. (variable intensity).
- Distance between lights: 50 m.
- Runway end: Red.
- Distance between lights: 2.80 m.
- Stop zone: None.

The incident aircraft took off from runway 21 at LECO. According to the information outlined above, that runway has white runway centreline and edge lights, with 15 metres between each of the centreline lights and 50 metres between the edge lights. Given that the width of the runway is 45 metres, the distance between the runway centreline lights and the runway edge lights is 22.5 metres.

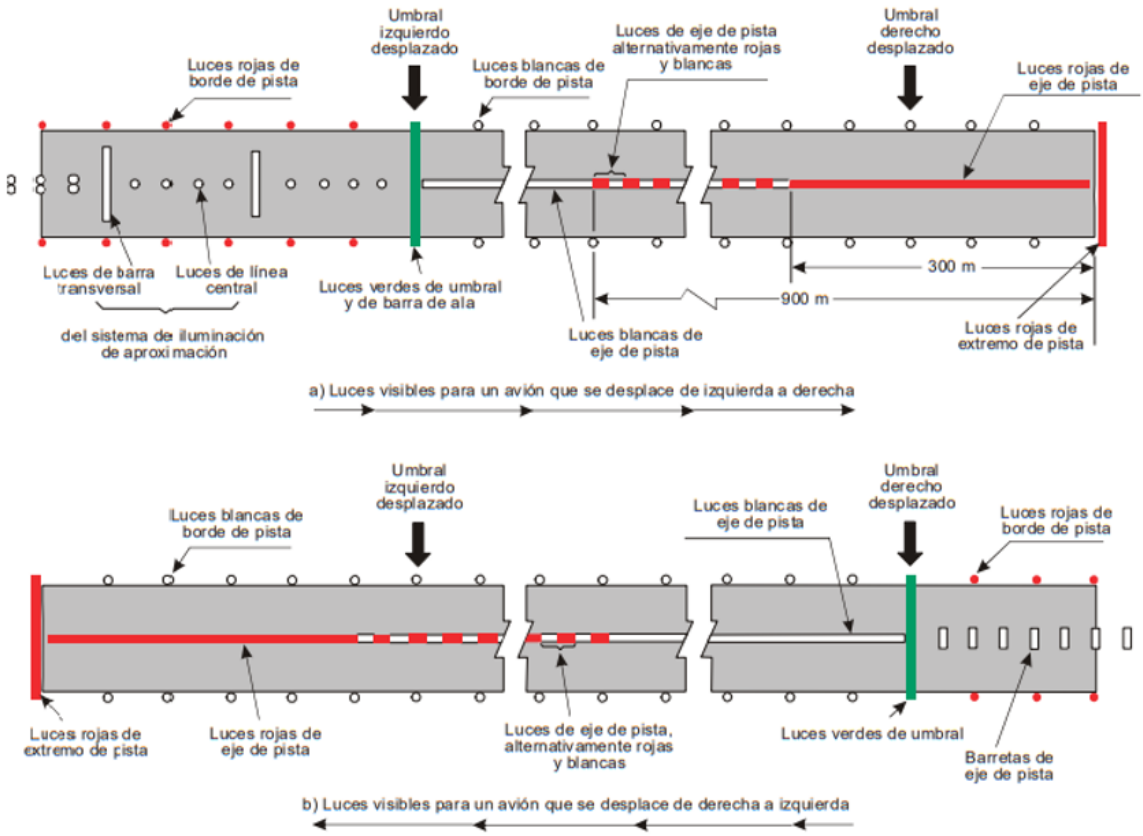


Figure 6. Detail of the runway lighting

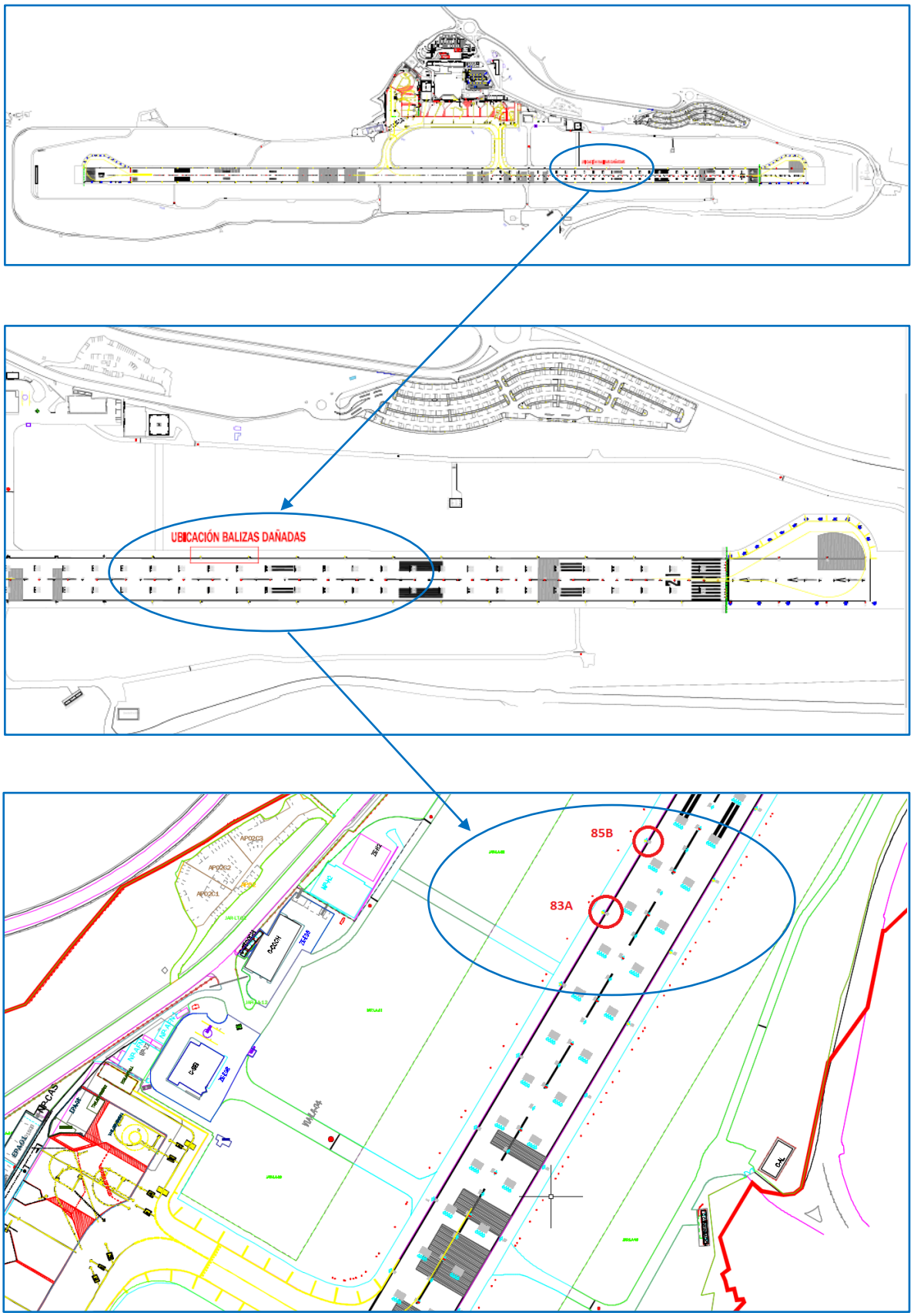


Figure 7. Location of the damaged lights

Consequently, both the runway edge lights and the centreline lights comply with the provisions of ICAO Annexe 14 (Aerodromes) Annexe 1, chapter 5, point 5.3.9 Runway edge lights and point 5.3.12 Runway centreline lights, respectively.

Secondary power sources are provided by a static uninterruptible power supply that provides a maximum switch-over time of 1 second for the approach, runway and taxiways, and engine generators that provide a maximum switch-over time of 15 seconds for the apron lighting, as per the provisions of Annexe 14.

According to the aerodrome data published by the AIP AD 2-LECO 1 in force on 27-FEB-20, A Coruña airport in operating hours and when there is no probability that regular or emergency operations will be carried out, applies energy-saving procedures that involve the shutdown of the runway and taxiway centreline, edge lights, and PAPI. The airport manager confirmed that there were no energy-saving measures in effect at the time of the event and that the aeronautical surface lights had not been switched off at any time for this reason.

The airport's Electrical Department, responsible for maintaining the runway lighting, had carried out the daily lighting inspection on the morning of the incident. According to the records of the Electrical Department and the Coordination Office, no anomalies had been detected, and, therefore, the runway lighting was in good working order at the time of the event.

The runway was illuminated at the time of the incident, and according to the records, the brightness of the runway edge lights was within the admissible limits.

1.16.1.2. **Airport operator’s report**

In its incident report, the airport manager, AENA, stated that due to the night conditions and the distance from the camera, the only thing that could be confirmed by the images captured by the airport surveillance systems was that the aircraft collided with two runway edge lights during the take-off run, after which it contacted TWR to inform it of what had happened. However, they could not confirm or rule out a possible lateral runway excursion onto the unpaved area. The aircraft continued the run and took off. When the crew contacted TWR to report the incident, they did not notify it of any damage to the aircraft.

After considering the information provided by the daily service reports from the different airport departments (the SEI, the TOAM on duty, etc.) and the crew’s statements, AENA’s operational coordination office analysed the event in conjunction with other similar incidents recorded between 2014 and 2021.

The typologies in which the event could be classified were selected, which were those corresponding to "B9-Other incidents involving aircraft in motion" and "M4-Incidents involving fixed or mobile obstacles during the approach, take-off and traffic pattern phases". Nine were identified in the former category and one in the latter.

They convened a Special Operational Safety Committee with all the parties involved to assess what had happened, concluding that the events were not representative enough to

warrant additional measures. However, they also agreed that any re-occurrence of this type of incident would be monitored and analysed.

1.17. Organisational and management information

At the time of the event, the aircraft's operator had a valid air operator certificate (AOC) for the transport of passengers and cargo issued by the competent German authority on 10/09/2020, with the inclusion of the aircraft with registration D-IPOD on 01/02/2021. The authorised area of operations included, among others, that of the event.

The operator of the aircraft is also its owner, who operates it according to Commission Regulation (EU) No 965/2012[4].

The crew involved in the event were employed by another organisation, responsible for the operator's marketing and sales of the incident aircraft.

1.17.1. Operating procedures

The following operating procedures included in the operator's Operating Manual Part B (OM-B) are relevant to this investigation:

- Before take-off:

PF	PNF
Review departure and emergency briefings and query: "Any Question?"	Confirm: "Negative" or as required
Request "Before Take-off" Check List Respond as required	Read "Before Take-off" Check List Respond as required
State: "We´re ready for departure"	Report ready

- Runway alignment:

PF	PNF
When cleared into position:	
Check and call: "Approach/runway clear" as applicable	Check and call: "Approach/runway clear" as applicable
Request "Line-up" Check List while aligning aircraft with runway centreline, and Respond as required	Read "Line-up" Check List Respond as required
When aircraft is aligned with centreline and Heading is crosschecked:	
	Call: "Check List completed"

[4] Commission Regulation (EU) No 965/2012 of 5 October 2012 laying down technical requirements and administrative procedures related to air operations pursuant to Regulation (EC) No 216/2008 of the European Parliament and of the Council.

- Take-off:

The normal take-off procedure is included in Annexe 1.0 of OM-B, although it can be modified as necessary to guarantee operational safety when the presence of obstacles, possible noise abatement requirements or instrument departure routes require it.

The captain will make the decision to take off when:
1) The aircraft's performances are critical.
2) Directional control of the runway is marginal.
3) The braking effect on the runway is marginal.
4) The crosswind or tailwind values are within the permissible limits.

The entire length of the runway must be used, especially if take-off performances are limited by its length or the presence of obstacles.

After taxiing to the take-off position, the aircraft must align with the centreline of the runway, equidistant from the runway edges, to allow for the aircraft to veer to either side should there be an incident involving the tyres/wheels or an engine failure. The compass heading and the aircraft’s position should be verified to ensure the runway has been correctly identified. Power should not be applied until the aircraft is aligned correctly.

The following initial steps in the take-off procedure are relevant to the event:

1) After aligning with the runway, the throttle should be advanced to the position necessary for the engines to stabilise while keeping pressure on the brakes. The engine instruments and, if applicable, those of the engine anti-ice system should be checked to ensure they are working.

After stabilising the engine, the brakes should be released, and the throttle advanced to the take-off position. The aircraft must be at take-off power before it reaches 60 kts. Sufficient control must be applied to keep the nose wheel firmly on the runway. The PF will be responsible for moving the throttle to V. The PNF will monitor the engine instruments, observe the aircraft's general condition and performance and alert the PF to any anomaly.

As a guide, the procedure indicates that aborting take-off should only be considered as an option in the event of an engine fire, an engine failure, the loss of all electrical systems, or the loss or questionable operation of the aircraft’s control systems, always giving maximum priority to safety.

The airspeed indicator must then be checked to ensure it is at 80 kt.

2) Once V_1 has been exceeded, the PF must control the aircraft’s attitude and, at V_R, lift the nose wheel off the ground to commence rotation, bringing the aircraft into a take-off attitude. Once airborne, the rotation will continue to the initial climb attitude. At 35 feet above the ground, the airspeed should be above V_2 with the nose pointing up. Once above V_2, the speed can be stabilised according to the temperature, altitude and mass of the aircraft.

The procedure continues describing the remaining steps until take-off is completed. The remaining steps are not included in this section because they are not considered relevant to the analysis of the event.

Lastly, it should be noted that the rejected take-off procedure (RTO) is included as an option in the aircraft's QRH procedures, but only before the decision speed, V_1, has been reached. In this instance, the PF should apply the brakes to reduce power to idle and use the rudder to steer the nose wheel in a controlled manner. The PNF should deploy the aerodynamic brakes (never the flaps when on the ground) and contact the ATC service to inform them of the situation.

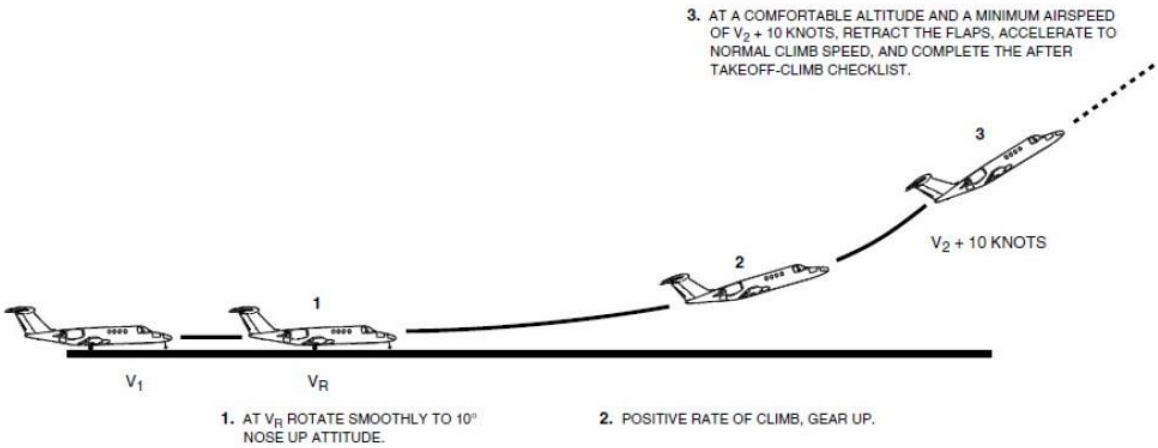


Figure 8: Normal take-off procedure

- Take-off and initial ascent tasks

PF	PNF
Set power to about 60 %, holding the brakes, then Release brakes and increase power to approximate maximum, and command: "Adjust takeoff power" relaxing his grip on the power levers. Resume full control of power levers	Make power adjustment (power should be set prior to reaching 80 KIAS) and call: "Take of power set". Back up power levers.
Checks IAS and call: "Checked"	Observe IAS and call: "Speed alive"
Check IAS and call: "Checked"	Observe IAS and Call: "100 knots"
PF	**PNF**
When passing V_1	
Release power levers	Call: "V one"
When passing V_R	
Rotate aircraft to normal takeoff pitch angle	Call: "Rotate"
Command: "Gear UP"	When observing positive climb on both Altimeter and VSI call: "Positive rate of climb" Raise gear
Command: "Yaw damp ON"	Engage yaw damper
Climb at 15° deck angle maximum or as required for V_2 + 30 KIAS and T/O Power to Thrust Cutback altitude 1500 ft	Call departure when appropriate
Maintain MCT and accelerate to normal climb speed	Check gear is up and retract flaps
Command: "Flaps UP"	Acknowledge: "Flaps UP" and retract flaps

- Aborted take-off tasks:

PF	PNF
Whoever sees any malfunction shall call it loud and clear	
Call: "STOP" Retard power levers to idle Apply brakes as required Maintain direction by rudder and brakes	
If possible turn off the runway	
After coming to a full stop	
Determine whether an evacuation is in order. If so order evacuation and proceed according to procedure. If not revert to normal operation	Inform ATC

1.17.2. Actions taken by the organisation after the incident

As a consequence of the event, the operator, ProAir Aviation, temporarily suspended the crew involved from service and assigned them additional training and verification in compliance with its safety policies.

The co-pilot, who was the PF during the incident, was new to the Cessna 525 aircraft type and under supervision (LIFUS) from the captain, who was acting as PNF and had more than 4,000 flight hours in type. He indicated that he probably had too much confidence in the PF because he had more than 1,500 hours of flight experience, albeit in different aircraft from the one involved in the incident.

According to the statements given by the crew, the operator's assessment of the incident concluded that the PF was too late in realising the aircraft was deviating from the centreline of the runway, probably due to its rapid acceleration. Furthermore, it concluded the PNF took longer than desirable to react and correct the aircraft's trajectory because he did not have his feet on the rudder pedals and was, therefore, unable to prevent the collision with the runway edge lights. Nonetheless, the take-off was completed without further incident, as was the mission.

As a result of the conclusions above, the organisation proposed the following additional training as a corrective measure:

- For the co-pilot, additional take-off and landing training was scheduled, focusing on positioning the aircraft on the centreline of the runway.
- For the captain, the extra training consisted of executing the rejected take-off manoeuvre while keeping the aircraft on the centreline of the runway and practising the corrections required to return to the centreline in the event of possible deviations during take-off. He would also practise the backtrack manoeuvre to align the aircraft for take-off.

The organisation's operating manual states that in order for a pilot to be judged as having performed the take-off correctly, the training must ensure the manoeuvre is executed with the nose gear on the centreline of the runway (with a maximum allowable deviation of 1 m to the left or right), that they must be especially alert to the flight controls to minimise reaction time, and that the wings are kept level to avoid any contact with the ground. If the pilot fails to operate the aircraft within the required limits, they must be removed from flight service immediately.

The additional training proposed by the organisation during the investigation was appropriate to the circumstances of the incident, and, therefore, we have concluded the corrective measures were adequate.

The operator proceeded to arrange the additional training focused on aligning the aircraft on the centreline of the runway, correcting deviations and the rejected take-off procedure (RTO) for both pilots.

For the co-pilot, as part of his Landing Base Training, and for the captain as part of his Line Training Captain, with the aim of minimising the chance of this type of event reoccurring.

The co-pilot's training took place on 23/03/2021, and, according to the records of the evaluator responsible for supervising it, he successfully executed the take-off and landing runs on the centreline of the runway with the wings levelled and within the parameters stipulated in the organisation's operating manual, with no need for any additional corrective action. The in-flight training lasted for 25' and included 4 take-offs and landings, plus 1 hour 15' of pre and post-flight meetings for analysis and evaluation.

The captain's training also took place on 23/03/2021, and he successfully passed the evaluation without requiring, according to the evaluator, any additional corrective action. His training consisted of taxiing the aircraft through 3 complete circuits and backtracks, aligning on the centre of the runway, and two RTOs before reaching V_1. It lasted for 11' plus 1 hour of pre and post-flight meetings for analysis and evaluation.

As confirmed by the operator, the captain did not have his feet on the pedals during the operation. Given that common sense dictates an instructor captain should take special care with pilots in training, on 18/03/2021, the operator reviewed and changed the training documentation to prevent confusion. Specifically, it modified the information in the Operating Manual part D - Annexe L-1 "Conversion course First Officer", to emphatically state that instructor captains must be attentive to the aircraft controls to minimise reaction time should there be a deviation from the standard in take-offs and landings.

The amendment included the text:

"Instructor Captains *strictly advised to ensure take-offs and landings shall carry out with the front gear on runway center line. Deviations more than 1 m to left or right must be corrected without delay. Training* captains *as well advised to be standby on controls (brakes, rudder, elevator, aileron) to minimize the reaction time if the applicant deviates from standard. Ensure for take-offs and landings wings in level in order to avoid any ground contact".*

1.18. Additional information

Not applicable.

2. ANALYSIS

2.1. Analysis of the meteorological conditions

The incident happened at dusk in nocturnal conditions and with a wet runway. The wind was light (between 2 and 4 kt) and variable, although predominantly from the west, visibility was good (more than 10 km), and there were clouds at approximately 3,000 ft. No precipitation was recorded in the area at the time of the event.

Consequently, the investigation has concluded that the meteorological conditions at A Coruña Airport around the time of the event were suitable for the flight, and there were no significant meteorological phenomena that could have contributed to the incident.

In his report, the captain stated that as it was night, visibility was reduced due to the rain that was beginning to fall and that, above all, the brightness of the runway centreline and edge lights, which were both white, made it difficult to navigate. He also said that the low height of the cockpit in this type of aircraft could have caused the co-pilot to lose the correct reference point during the take-off run, thus producing the impact with the lights on the edge of the runway.

2.2. Analysis of the aircraft damage

After completing the assigned organ transport mission from LECO to LEVX and from LEVX to LEMD, the aircraft was inspected by maintenance personnel at its Madrid base. They confirmed that the damage to the aircraft was minor and limited to the nose landing gear wheel fork.

The minor impacts and scratches on the outer metal arm of the fork and the remains of the broken lights are consistent with the crew's statements and with the nose gear impacting runway edge lights 83A and 85B, located approximately halfway along the runway, during rotation.

After the impact, the nose gear continued to function as expected, no other incidents or malfunctions were detected in it or any of the aircraft’s other performances, and the mission was completed successfully. Therefore, the crew’s decision to continue the flight is considered appropriate.

2.3. Operational analysis

The flight began without incident and in accordance with ATC instructions, taxiing to the head of runway 21 via N. The aircraft followed the taxi line and, once on the runway, continued until lined up for take-off in compliance with the established operational procedures.

Once the aircraft was aligned at the head of runway 21, the co-pilot, who was new to the base and only had a few hours of flight time on the aircraft type, took over the role of PF

under the supervision (LIFUS) of the captain. As the captain pointed out in his report, he judged that as the co-pilot had more than 1,500 flight hours in other aircraft, he was sufficiently experienced to act as PF on the incident flight.

Indeed, the aircraft must have been correctly aligned with the runway centreline, because if it had been incorrectly aligned, for example, with the runway edge lights instead of the centreline, it would have been more likely to hit the lights close to the threshold and not those in the middle of the runway. This is also consistent with the captain's statement, in which he recalled visually observing the two rows of white lights on the sides of the centreline and stated that given that this was his usual base and the edge lights were raised, if the aircraft had been incorrectly aligned, he would have said something. All the evidence suggests that the aircraft was indeed correctly aligned at the head of the runway.

The co-pilot (PF) started the take-off run according to the procedure; the captain (PNF) adjusted the power (to 80 kts), and the PF retook control of the throttle until V1, as per the procedure, to continue the take-off run.

According to the captain's statement, when their speed was almost at V_1, he noticed they had deviated from the runway centreline and took over the controls to correct the alignment. At that point, approximately halfway down the runway, they reached rotation speed.

The PF probably didn't realise they had deviated from the runway centreline until it was too late, perhaps, as indicated by the operator in its analysis, due to the rapid acceleration of the aircraft, of which he had little experience. The captain (PNF) was unable to redirect the aircraft to the central axis of the runway as he reacted too late, and as a consequence, the aircraft deviated from the centreline to such an extent that it reached the right side of the runway.

Just before rotation, they noticed an unusual impact that they perceived as a bump. This moment and position on the runway are consistent with the aircraft's nose gear hitting runway edge lights 83A and 85B. Given the 50 metre distance between the two lights, it's highly likely that at the moment of impact the main gear wheels (12.96 ft between them) were on either side of the edge lights because the captain (PNF) was trying to correct the deviation and bring the aircraft back to the runway centreline. At that moment, the aircraft reached rotation speed and the captain decided to take off.

The captain checked all the aircraft's systems to ensure they were functioning correctly and, given that it was a short (17') and urgent flight, decided to continue.

The captain's decision to retake the controls in an attempt to correct the aircraft's alignment was appropriate but insufficient because the action was too late to be effective enough to prevent the impact with the runway edge lights. As the operator later confirmed, the captain did not have his feet on the rudder pedals when he noticed the deviation from the runway centreline. Therefore, it took him too long to react, and he was unable to correct the aircraft's trajectory before rotation. Both pilots must have their feet correctly positioned on the pedals during the take-off run.

According to the captain's statement, this was caused by an overconfident in the co-pilot, who, although he did not have much experience in the type of accident's aircraft, did have extensive flight hours in other types. This was not an acceptable criterion on the part of the captain in the exercise of his work of supervision of the co-pilot.

According to the operating procedures for runway centreline misalignment, having reached decision speed and immediately afterwards rotation speed, aborting take-off was not an option. Therefore, the decision to proceed with the take-off was correct.

After checking that all the systems were functioning correctly and that the flight could proceed safely, they decided to continue to LEVX, where they would check the aircraft before deciding whether to complete the mission with the second flight to LEMD.

The crew immediately informed the tower of what had happened so that the runway could be inspected for any FOD that may affect subsequent traffic, and ATC confirmed there were two broken runway edge lights on the W side.

The crew's decision to immediately communicate with ATC to notify them of the incident was correct, allowing any FOD that would undoubtedly have affected other traffic to be quickly removed from the runway and the broken lights to be replaced. This, and the rapid response and successful coordination of the airport services, meant the runway was brought back into service in a minimum amount of time.

After landing at LEVX, they were able to verify that the aircraft had not sustained any significant damage and decided to continue the flight to LEMD to complete the assigned mission.

From an operational point of view, the aircraft was aligned with the runway centreline when it started the take-off run. Subsequently, an attempt was made to correct the deviation that occurred during the run, and, once the decision speed was exceeded, the crew correctly decided to continue the take-off. Despite this, the pilots' actions demonstrated a lack of adherence to procedures. More specifically, a poorly executed take-off run involving a greater than acceptable deviation from the runway centreline, which could not be recovered because the captain (PNF) did not have his feet correctly placed on the pedals, excessively delaying his reaction time and eventually resulting in the impact with two runway edge lights.

2.4. Analysis of the organisation and management

The organisation promptly investigated the incident and, consequently, temporarily suspended the crew involved from service and assigned them additional training and verification in compliance with the organisation's safety policy.

This additional training was carried out quickly and duly passed by the pilots.

The organisation's operating manual covers, in detail, the applicable procedures and compliance requirements for the manoeuvres involved in the incident.

The additional training proposed by the organisation as a corrective measure in response to the incident is deemed adequate, with documentation confirming its completion being supplied.

3. CONCLUSION

3.1. Findings

- The crew were in possession of the up-to-date and valid licenses required for the type of operation affected by the event, as well as the corresponding valid medical certificates.
- At the time of the incident, the co-pilot was flying under the supervision of the captain (LIFUS).
- The captain did not have his feet on the pedals at the time of take-off.
- At the time of the event, the runway was wet.
- The investigation has found that the breakage of runway edge lights 83A and 85B, located approximately halfway along the length of the runway, coincided with the aircraft's path during its take-off run from the head of runway 21 to the point of rotation.

3.2. Causes

The cause of the incident was the lack of adherence to take-off procedures, in particular, the incorrect execution of the take-off run.

4. RECOMMENDATIONS

Given that the measures adopted by the operator during the investigation are deemed to be sufficient, no operational safety recommendations are issued.