RNSA

Rannsóknarnefnd samgönguslysa

Final report on aircraft accident

Case number: **2015-089-F-026**

Date: **12. November 2015**

Location: **Hafnarfjarðarhraun**

Description: **Aircraft collided with the ground during a training flight**

Contents

1. FACTUAL INFORMATION

Factual information	
Place:	Hafnarfjarðarhraun 64°00'26.3''N, 022°00'54.3''V
Date:	November 12th, 2015
Time[1]:	14:43[2]
Aircraft type:	Tecnam P2002JF
Registration:	TF-IFC
Year of manufacture:	2015
Type of flight:	Training flight
Persons on board:	Two
Injuries:	Two fatally injured
Nature of damage:	Aircraft was destroyed
Short description:	During training flight in a training area, the aircraft most likely went into a spin and collided with the ground
Owner:	Flugtak ehf
Operator:	Flugskóli Íslands
Weather:	Visual Meteorological Conditions (VMC)

[1] All times in the report are local times (UTC+0)

[2] According to radar information – see chapter 1.9

1.1. About the flight

On November 12th 2015, two pilots working as flight instructors were conducting a training flight in order for one of them to get familiar with the aircraft TF-IFC, for his future flight instructions on this type of aircraft.

According to the flight plan, the one who was being familiarized with the aircraft was listed as a student and is therefore categorized as a student in this report.

TF-IFC, Tecnam P2002JF, was a new aircraft within their flight school as well as a newly built aircraft from the factory. The aircraft had been flown for a total of 16 flight hours.

The flight plan was for 30 minutes of touch and go's at Reykjavik Airport (BIRK) with an endurance of 3 hours. According to records from Reykjavik Tower, the aircraft took off at 14:10 and made three touch and go's.

After the last touch and go at the airport, the aircraft headed towards the MIÐSVÆÐI Training Area, see Figure 1.

According to radar readout, the aircraft was flown at 1.000 feet from the airport to the training area and then the altitude was increased to approximately 2.000 feet[3].

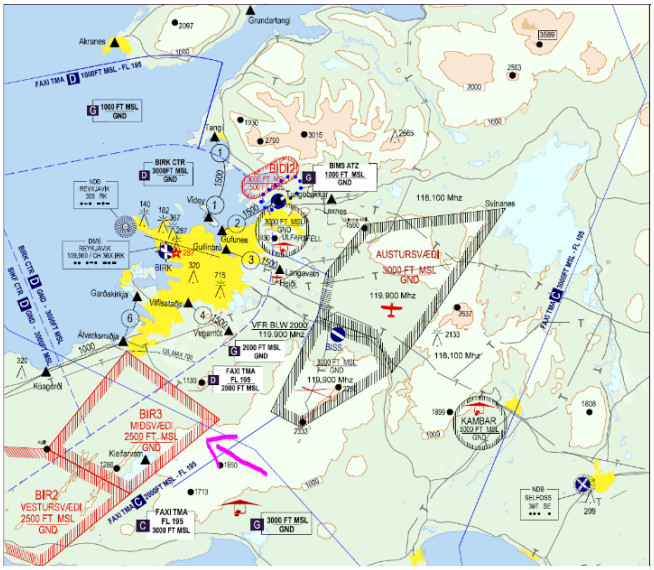


Figure 1: Training areas - The arrow points at MIÐSVÆÐI

At the training area, two 180° turns were executed at low speed. The last radar readout indicates that the aircraft was flown close to its minimum safe airspeed.

[3] All altitudes in the report are Mean Sea Level (MSL) unless otherwise stated

At 15:01, COSPAS/SARSAT[4] detected an ELT signal.

At 15:06, Reykjavik TWR activated uncertainty phase for aircraft TF-IFC, since the flight was overdue by more than 25 minutes.

At 15:08 the Icelandic coast guard (ICG) received an alert message from the COSPAS/SARSAT that had been detected seven minutes earlier. The ICG activated an emergency response at 15:09.

At 15:12, Reykjavik Tower changed the status to alert phase and at 15:17 to distress phase. Two pilots in a nearby aircraft were asked to fly to the MIÐSVÆÐI area and look for TF-IFC.

At 15:31, a helicopter from the ICG took off from Reykjavik Airport for search and rescue.

At 15:38 the ICG found the accident site where the aircraft had crashed within the training area MIÐSVÆÐI in a nose down attitude. Both pilots were fatally injured.

No radio distress call was received from the aircraft.

1.2. Injuries to persons

Two persons on board, both were fatally injured.

1.3. Damage to aircraft

The aircraft was destroyed.

1.4. Other damages

None.

[4] International satellite based search and rescue system

1.5. Personnel information

Instructor	
Age:	25 years old
License:	IS/CPL/A Valid
Medical certificate:	Valid
Ratings:	SEP, MEP (land), IR(A), FI
Experience:	Total all types: 382 hours Total on type: 95.5 hours (72.6 + 22.9)[5] Last 90 days: 90.4 hours Last 24 hours: 0.55 hours
Previous rest period:	Unknown

The Instructor received his CPL/A license on 27th of May 2015. His first flight as a flight instructor was on the 6th of June 2015. The Instructor had accumulated a total of 116.5 hours as a flight instructor prior to the accident.

Student	
Age:	35 years old
License:	IS/CPL/A Valid
Medical certificate:	Valid
Ratings:	DHC8, IR, SEP (land), FI
Experience:	Total all types: 4.880 hours Total on type: 0 hours Last 90 days total 119 Last 90 days SEP: 8.7 hours Last 24 hours: 0.55 hours
Previous rest period:	Unknown

The Student got his CPL/A license on the third of September 2003 and started to work as a flight instructor at the flight school. The Student had accumulated a total of 400 hours on SEP and 102 hours on MEP prior to his recruitment as a pilot on F50 and DHC8. In 2015, the Student renewed his instructor license on SEP/ME and accumulated an additional 16.8 hours as a flight instructor from June to October 2015. This was performed in a Cessna 172.

[5] 72.6 hours on TF-IFL (older aircraft), 22.9 hours on TF-IFA /B/C/D (new model with digital instruments)

1.6. Aircraft information

The aircraft was a two seat, single engine and low wing aircraft, within EASA Certification of CS-VLA[6].

Aircraft general information	
Manufacturer:	Tecnam
Type	Tecnam P2002JF
Build serial number	269
Year of manufacture	2015
Total airframe hours	16
Power plants	Single engine, 100hp, Rotax 912S2 Two blade propeller
Certificate of Registration:	TF-IFC
Date of issue	30.10.2015
Issuing Authority	Icelandic Transport Authority, ICETRA
Certificate of Airworthiness	Issued by ICETRA on 30.10. 2015

The aircraft was manufactured in 2015, the same year as the accident, and shipped from Italy to Iceland in a container. In Iceland, the aircraft was reassembled by the operator's maintenance provider, before it went into service at the flight school. The aircraft was test flown 12 days prior to the accident and had accumulated a total of 16 hours when the accident occurred.

[6] CS-VLA is for aircraft up to 750 kg. Maximum Take Off Weight (MTOW).

1.7. Weight and Balance

According to the Weight and Balance sheet that was prepared for the flight, the aircraft was within the mass and balance envelope's limits.

	SAMPLE AIRCRAFT	YOUR AIRCRAFT
Empty Weight Moment	581 kgm	676.4 kgm
Empty Weight	337 kg	400 kg
Pilot And Passenger	160 kg	150 kg
Fuel	50 ltr. * 0,72 = 36 kg	60 ltr. * 0,72 = 43 kg
Baggage	15 kg	/ kg
Take-off Weight	548 kg	593 kg

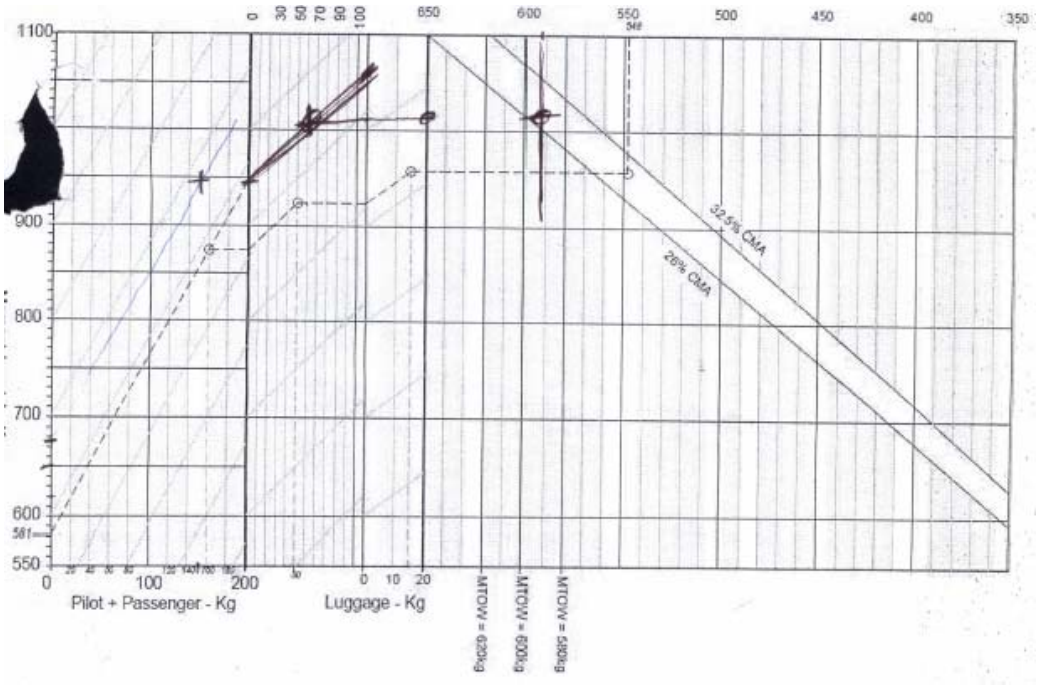


Figure 2: Weight & Balance calculations for the accident flight

1.8. Meteorological information

On the day of the accident, the first snow of that winter started to fall in the vicinity of the accident area. Around noon, or at the time when the pilots were preparing for the flight, there were snow showers with VMC in between.

According to information from the MET Office, there were snow showers over Reykjavik from just before 12:00 to just after 13:00.

METAR at Reykjavik Airport (BIRK):

METAR BIRK 121500Z 11008KT 9999 VCSH FEW035CB 02/M02 Q0988=
METAR BIRK 121400Z 10008KT 9999 VCSH FEW028CB SCT036 02/M01 Q0988=
METAR BIRK 121300Z 12011KT 9000 -SHSN SCT015CB BKN058 01/M00 Q0989=
METAR BIRK 121200Z 14009KT 9999 5000E -SHSN FEW016 SCT025CB BKN035
METAR BIRK 121100Z 15009KT 9999 VCSH FEW025CB SCT039 03/M01 Q0988=

METAR at Keflavik Airport (BIKF):

METAR BIKF 121500Z 20004KT 160V220 9999 VCSH FEW015CB SCT035 BKN060 02/M01 Q0987=
METAR RTD BIKF 121430Z 17007KT 9999 VCSH FEW015CB SCT032 02/M01 Q0987=
METAR BIKF 121400Z 16008KT 9999 VCSH FEW015CB SCT030 02/M01 Q0987=
METAR RTD BIKF 121331Z 19010KT 9999 VCSH FEW015CB SCT030 BKN038 02/M01 Q0988 RESHRA=
METAR BIKF 121300Z 20012KT 170V230 9999 VCSH FEW010CB BKN036 02/M01 Q0988=
METAR BIKF 121230Z 18009KT 9999 VCSH FEW010CB 02/M00 Q0988=
METAR BIKF 121200Z 19012KT 9999 VCSH FEW010CB SCT034 02/00 Q0988 R20/39//50=
METAR RTD BIKF 121130Z 20010KT 9999 VCSH FEW010CB SCT030 02/01 Q0988

As listed in the METAR for BIRK, the temperature and dew point were 02/-01 at 14:00 and 02/-02 at 15:00.

1.9. Aids to navigation

The aircraft's flight was tracked by ATC radar. The radar plot indicated that the aircraft was flown for three touch and go's at Reykjavik Airport (BIRK) and then the aircraft proceeded to the MIÐSVÆÐI training area. Figure 3 shows the radar plot of the flight at the airport, to and at the training area.

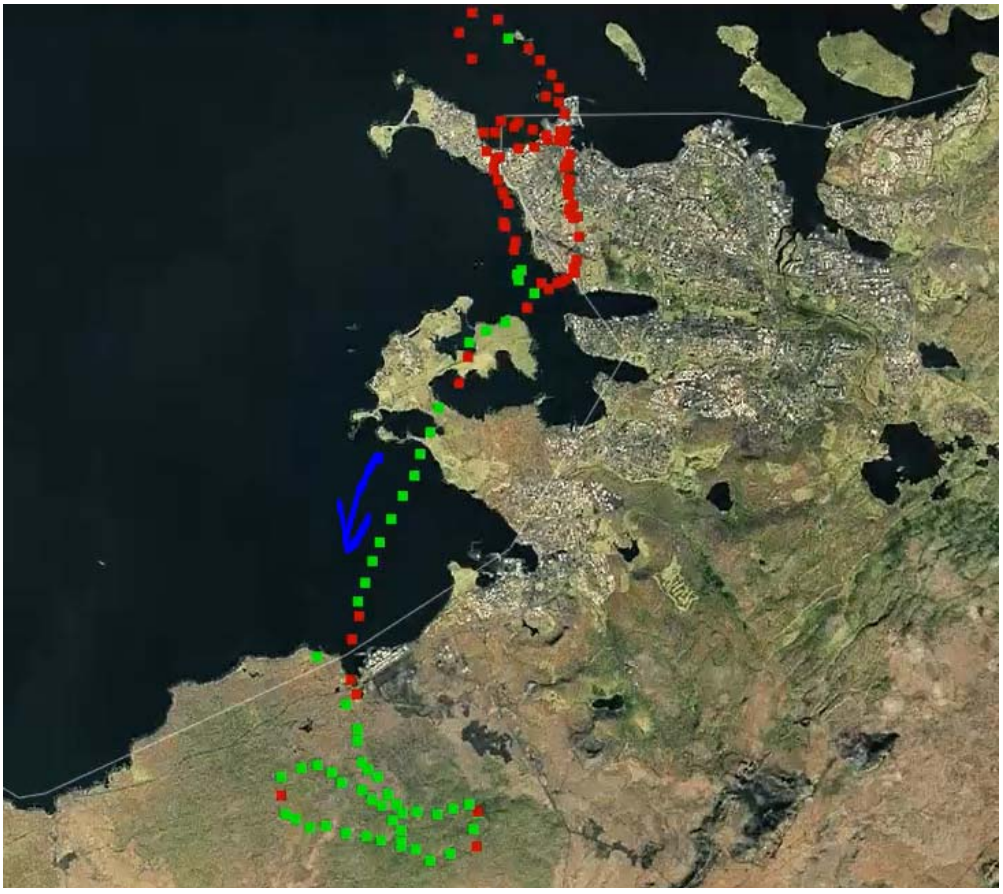


Figure 3: Radar plot of the aircraft - Red dots are primary readout and green are secondary

The figure above (Figure 3) is a plot from radar recordings (Mode C) of the aircraft. The figure below (Figure 4) is the last part of the recordings, i.e. after the aircraft entered the training area at MIÐSVÆÐI.

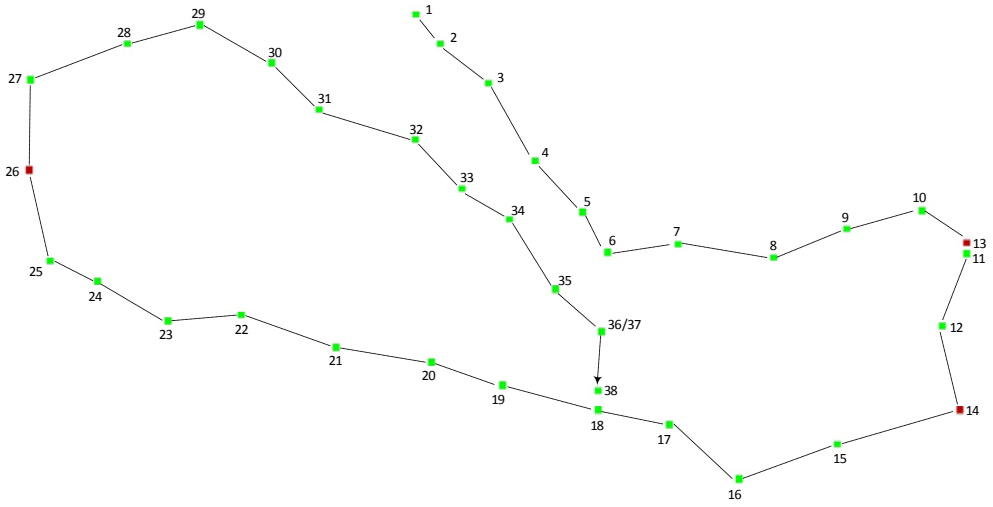


Figure 4: Radar plot from when the aircraft had entered the training area at MIÐSVÆÐI

The following chart demonstrates the altitude during the last ten minutes of the flight, corrected for local QNH (988 hPa).

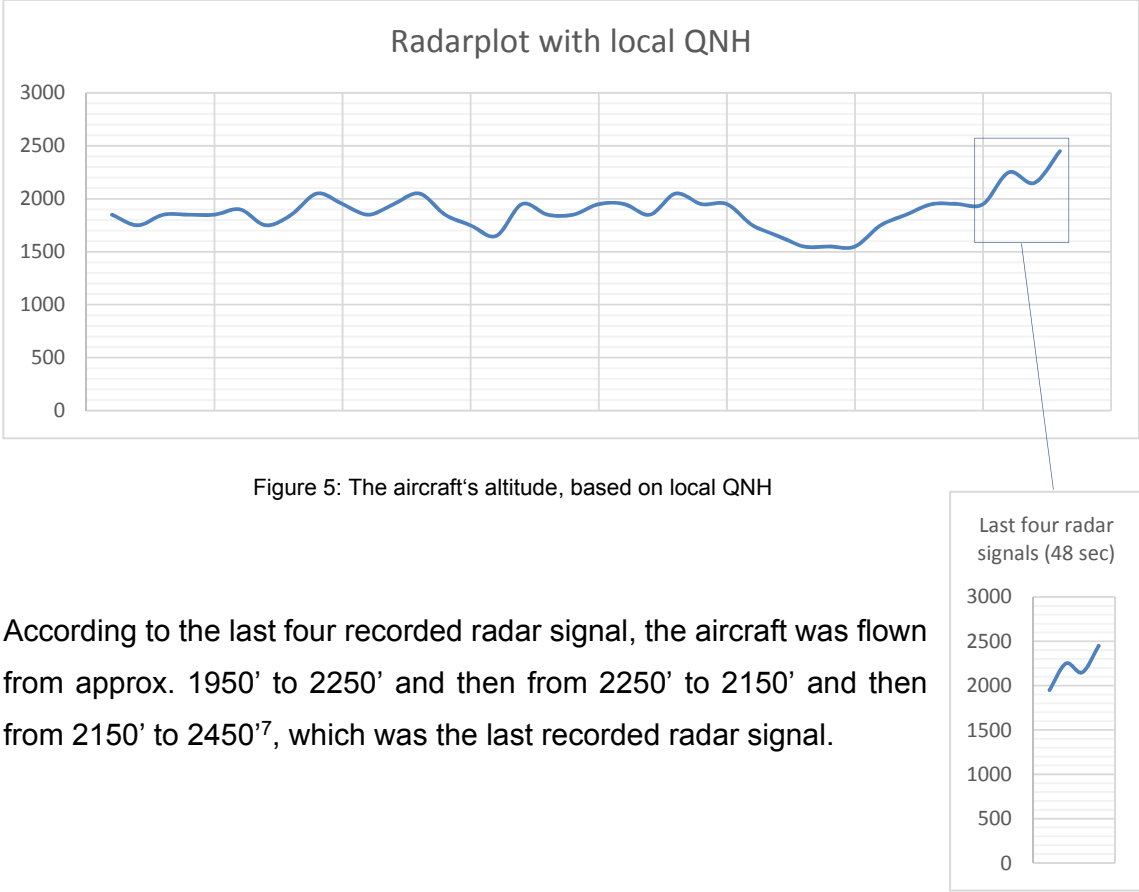


Figure 5: The aircraft's altitude, based on local QNH

According to the last four recorded radar signal, the aircraft was flown from approx. 1950' to 2250' and then from 2250' to 2150' and then from 2150' to 2450'[7], which was the last recorded radar signal.

1.10. Communications

The radio communications between the pilots of TF-IFC and the ATCO[8] at BIRK were as expected and no distress call was received from the aircraft before the accident.

1.11. Aerodrome Information

The aircraft took off from Reykjavik Airport (BIRK), performed three touch and go's on RWY 19 and then headed to the MIÐSVÆÐI training area, located south of the

7 Accuracy of the radar plot information is +/- 50 feet.

8 Air Traffic Control Officer

airport. The accident site was within this training area, approximately 7.6 NM south of Reykjavik Airport and approximately 15.6 NM east of Keflavik Airport.

1.12. Flight Recorders

The aircraft was equipped with a Garmin G500. This equipment does not record any flight data, nor the aircraft's track. The Instructor's and the Student's personal telephones were analyzed but they did not contain any tracking data.

1.13. Wreckage and Impact Information

The aircraft collided with the ground in a nose down attitude and the wreckage was twisted indicating that the aircraft was most likely spinning to the left when the collision occurred.

All main parts were connected to the aircraft at the accident site except the canopy. The canopy was located approximately 8 meters in front of the wreckage.

The aircraft's wreckage was found approximately 260 meters, horizontally from the last recorded radar plot.

1.14. Medical and pathological information

The autopsies of the Instructor and the Student did not reveal any findings that could have contributed to the accident.

1.15. Fire

N/A.

1.16. Survival aspects

Due to the fact that this was a high-energy impact, the possibility of survival was considered negligible.

1.17. Test and research

The aircraft was built in Italy in 2015, transported in a container to Iceland and reassembled in a hangar at Reykjavik airport. The manufacturer's reassembly procedure consists of the following:

- Aircraft preparation
- Wings installation
- Rigging wings
- Stabilizer installation
- Control surface installation checking
- Control checklist

During the investigation, no anomalies were found to the reassembly of the aircraft.

Trim actuator

The trim actuator was found in mid position and the flap actuator indicated that the flap position was 0 (clean configuration).

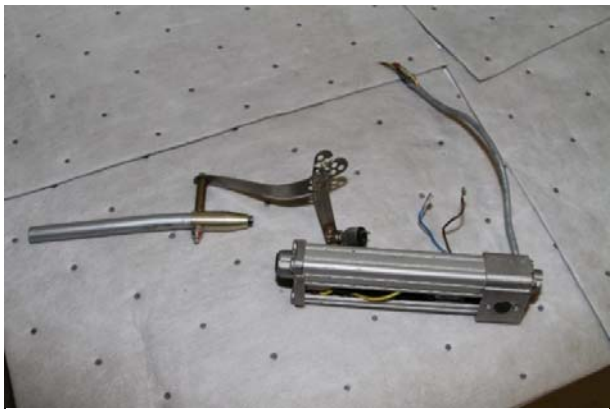


Figure 6: The flap actuator

Fuel selector valve

The fuel selector valve was found in the left position and the throttle lever was found to be in the full forward position. The position of the throttle lever is most likely a result of the impact, see page 15, Carburettors.

Due to heavy impact, it was not possible to test the engine. The engine was disassembled for investigation.

Magnetic plug

A visual inspection was made of the magnetic plug. There was no abnormal accumulation of chips on the magnetic plug.

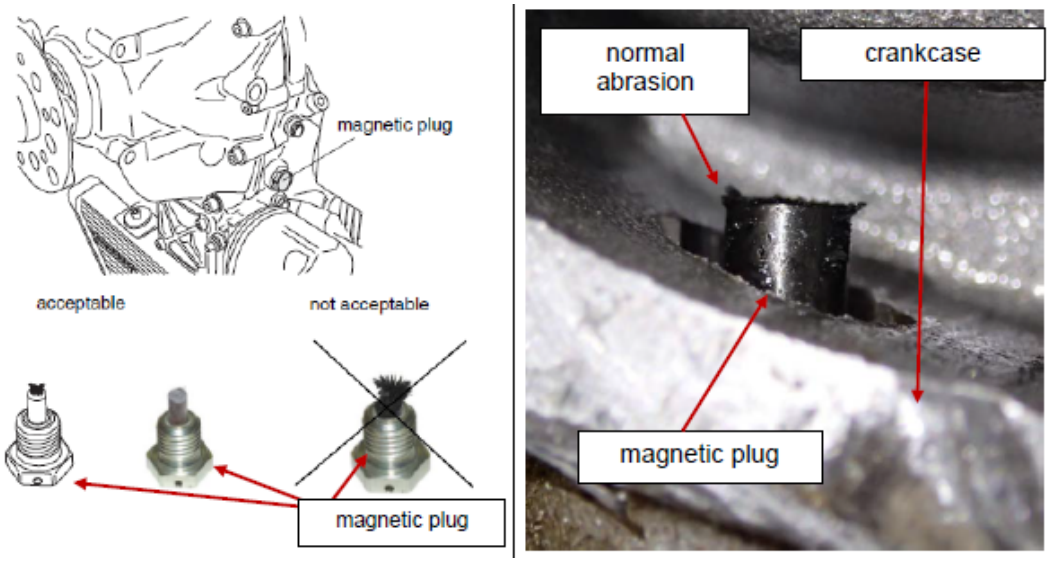


Figure 7: Magnetic plug inspection

Crankcase

A high level of damage was visible on the crankcase as a result of the crash.

There were cut indentations on the front side of the crankcase. These are signs that there was a slight material loss (like milling) in the direction of engine rotation.
These marks indicate that the crankshaft was slowly turning at the time of the impact.

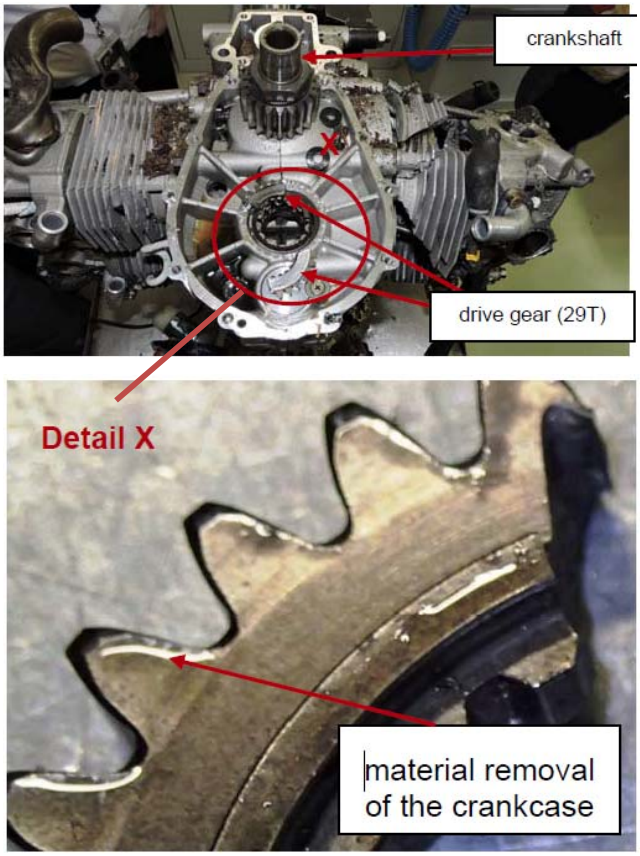


Figure 8: Crankcase inspection

The investigation of the engine revealed that free movement existed in all connecting rods of the crankshaft before impact. There were no indications or damage visible on the connecting rods that would indicate a seizure. In addition, the main bearings and the support bearings of the crankshaft and crankcase were free of defects and there was no indication of malfunction.

Carburettors

The carburettor (S/N 15.1619) was found severely damaged, as a result of the crash. The jet needle position was found bent and indicated that the power was at idle power at impact (idle position).

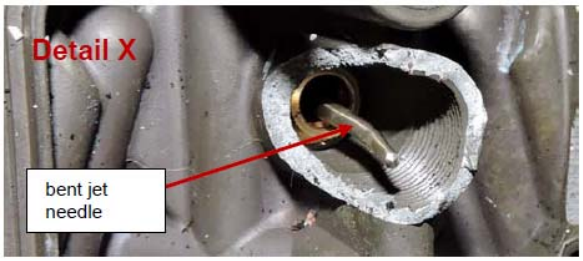


Figure 9: Carburettor inspection

No technical abnormalities were found on the carburettor.

The Bowden throttle control cable was bent approximately 90° in the area of the adjustment screw as a result of the crash (see Figure 9). This was also an indication that the engine power was at idle at the time of impact, regardless of the throttle lever position found at the accident site.

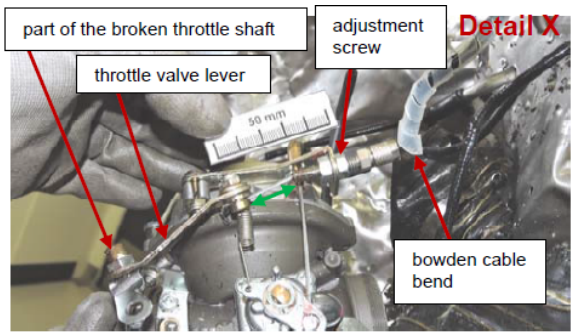


Figure 10: Throttle control cable

Based on the detected carburettor - Bowden cable bent the throttle position and also the jet needle position, it can be assumed that the engine was operating at idle at the time of the impact.

It was not possible to clearly establish at what RPM the engine was operating at ground impact.

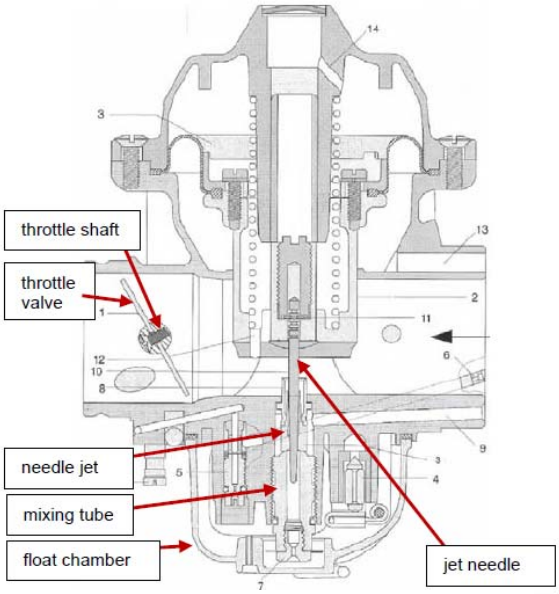


Figure 11: Carburettor

The investigation revealed no evidence of any malfunction of the engine. Furthermore, the teardown inspection of the relevant mechanical engine parts showed no damages or unusual wear, which could explain an engine failure or a loss of power.

1.18. Organizational and management information

The aircraft was operated by a flight school. For many past years, prior to the accident, the flight school had been operating aircraft within the GA category of ELA1[9] with MTOW from 750kg to 1200kg, such as Cessna 152 and 172. Therefore, the operator did set up a special Tecnam familiarisation program for the instructors.

In the year 2014, the flight school started to operate one Tecnam P2002JF aircraft of CS-VLA category (Very Light Aircraft). Aircraft within this category have a maximum take-off weight of up to 750kg. This aircraft was registered as TF-FTL, manufactured in 2010, and was certified with MTOW of 600 kg.

In the year 2015, the operator ordered four new aircraft within this category, namely Tecnam P2002JF. The following four aircraft were manufactured in 2015, registered as TF-IFA, TF-IFB, TF-IFC and TF-IFD. These aircraft were certified with MTOW of 620kg.

[9] European Light Aircraft

1.18.1.1. The flight school rules for minimum altitude

According to the flight schools manuals, the minimum altitude to initiate exercises such as slow flight, stalls, spin avoidance, lazy eights and chandelle, is 3.000 feet AGL[10].

During the investigation, the Icelandic Transportation Safety Board recommended to the flight school not to perform any training that might lead to a spin, on this type of aircraft. Following the accident, the flight school published the following safety bulletin:

> Note: Due to recommendations from RNSA of limiting the chances of entering spin with the Tecnams until the Investigation of the 2015 accident is complete we have been using added safety margins to flights in the Tecnams.
>
> | | |
> |---|---|
> | Slow Flight: | Fly this at higher speed than continuous stall horn and remember the purpose is not to fly as slow as possible, but accurate on speed. |
> | Stalls: | Recovery shall happen at approach to stall only, No Full stalls allowed for added safety. (Power On Stall, Max 2000RPM) |
> | Approach and Landing: | Not lower speed than 60kts. |

1.19. Additional information

In March 2019, approximately 330 Tecnam P2002 aircraft had been produced. The ITSB[11] was unable to collect information on the number of accidents involving this type of aircraft from the manufacturer or EASA.

Therefore, occurrences data from the Aviation Safety Network (ASN) was analysed. According to the ASN data (in March 2019), 62 occurrences were recorded on Tecnam P2002. Of these 62 occurrences, 18 were fatal accidents, of which 7 were on Tecnam P2002JF and 11 were on Tecnam P2002 Sierra (see Appendix 3-4).

[10] Above Ground Level

[11] Icelandic Transportation Safety Board [RNSA in Icelandic]

Three of the P2002JF fatal accidents occurred within a five-month period between November 2015 and April 2016. The first one occurred in Iceland on November 12th 2015. The second accident occurred in Hungary on March 25th 2016 and the third occurred in Poland on the 1st of April 2016. All these three accidents showed similar evidences at the accident site and all three accidents were fatal with two on board. In case of the accident in Iceland and in Poland, the purpose of the flight was training.

The State of manufacturer's air accident investigation authority, ANSV[12], has appointed an accredited representative to all of those investigations and supported them with information from the manufacturer. This is in accordance with ICAO Annex 13 as well as EU regulation 996/2010.

[12] Agenzia Nazionale per la Sicurezza del Volo

2. ANALYSIS

2.1. General

The purpose of the flight was to familiarize the Student with the new aircraft type (Tecnam P2002JF). The flight school's familiarization process included touch and goes as well as some exercises at a training area.

The pilots planned a 30 minutes flight for touch and goes only at Reykjavik Airport, likely because there were snow showers in Reykjavik and the surrounding area that day.

After 25 minutes of flight and after completing the touch and go's, they headed for the training area. The accident occurred approximately 3 minutes after the flight plan had expired. The ITSB believes that the aircraft was flown to the training area for turns, slow flight and stall training.

2.2. Flight operation

2.2.1. Crew qualification

Both pilots were certified as instructors. There was a large difference in experience between them.

The Instructor was working as a full-time employee as a flight instructor at the flight school, while the Student worked as a commercial pilot on DHC8 for a domestic flight operator and as a part-time employee at the flight school.

The Instructor, who was familiarizing the Student with the Tecnam P2002JF, had a total of 382 hours (271.3 as pilot in command), while the Student had a total of 4.880 hours (361.5 hours as pilot in command).

The 382 hours that the Instructor had accumulated were as follows:

Type	**MTOW**	**Hours**
Aircraft within ELA1	MTOW above 750 kg	286.5
TF-FTL [13] Tecnam P2002JF (Analog instruments)	MTOW 600 kg	72.6
TF-IFA, TF-IFB, **TF-IFC**[14] and TF-IFD (Digital instruments)	MTOW 620kg	22.9
	Total	382

The Student renewed his instructor license in the year of the accident (2015).

He was relatively newly hired at the flight school (five months prior to the accident) and had taught one student from the time he started. That year he had instructed for 16 hours, none of them on aircraft within VLA category.

The Student's last four training flights prior to the accident were dated 15.10.2015, 25.09.2015, 17.09.2015 and 02.09.2015. Those flights were on aircraft TF-GUZ and TF-FTZ, which are both Cessna 172 aircraft. The lessons for these flights included touch and go's, crosswind take-offs and landings, 60° turns, stalls, stalls in turns and slips.

[13] This aircraft is now registered as TF-IFE

[14] The Instructor had 2.6 hours experience on the accident aircraft

2.2.2. Operational procedures

Other lightweight aircraft operated by flight schools in Iceland are e.g. Cessna 150, 152, Piper PA-38 and Diamond DA20. These aircraft all have MTOW around 750-800 kg, which is approximately 130 - 180 kg higher than the Tecnam P2002JF.

Due to the fact that the flight school had a new type/class of aircraft (lighter aircraft), they had a procedure in place when an instructor was going to provide training on the new Tecnam aircraft. All instructors were obligated to get familiar with the aircraft and the process was to commit a 30-60 minutes flight of the following:

- Touch and go's (2-3)
- Turns
- Slow flight
- Power off stall
- Power on stall
- Loss of power

The accident occurred during this type of familiarization flight. According to the information from ATC at BIRK, the flight was planned for 30 minutes of touch and go's at the airport only. The flight was however extended (without extending the flight plan), most probably to complete the topics listed above.

2.2.3. Weather

On the accident day at 11:00, a weather balloon was released from Keflavik airport that measured the freezing point at 1.630 feet and -6°C at 4.000 feet. The balloon also recorded wind at 12 knots from the south with max 20 knots at 4.000 feet.

A report from the MET Office for VFR conditions was published the same day at 11:30 where it was stated that the cloud base in the south of Iceland would be broken at 1.500 to 2.000 feet. Widely there would be embedded CB's[15] with limited visibility in showers and snow showers, improving as the day progressed. The picture above was taken at BIRK at 15:04 on the day of the accident towards the MIÐSVÆÐI training area.

Figure 12: Picture taken towards training area MIÐSVÆÐI

Based on the METAR for BIRK and BIKF at the time of the accident, it is likely that the temperature at the accident site was 2°C.

The METAR for BIRK and BIKF indicate snow showers in the vicinity of the airports, in the afternoon, with breaking up of the clouds in between. At the time of the accident, the METAR for BIRK states few clouds in the region and no precipitation.

[15] EMB Cumulonimbus Clouds

Figure 13 shows the reflectivity detected by the weather radar at Miðnesheiði, in the vicinity of BIKF. The radar detects particles of size large enough to precipitate. The weather radar did not detect precipitation in the accident area around the accident time. However, the image clearly shows snow showers in the vicinity indicating convective conditions.

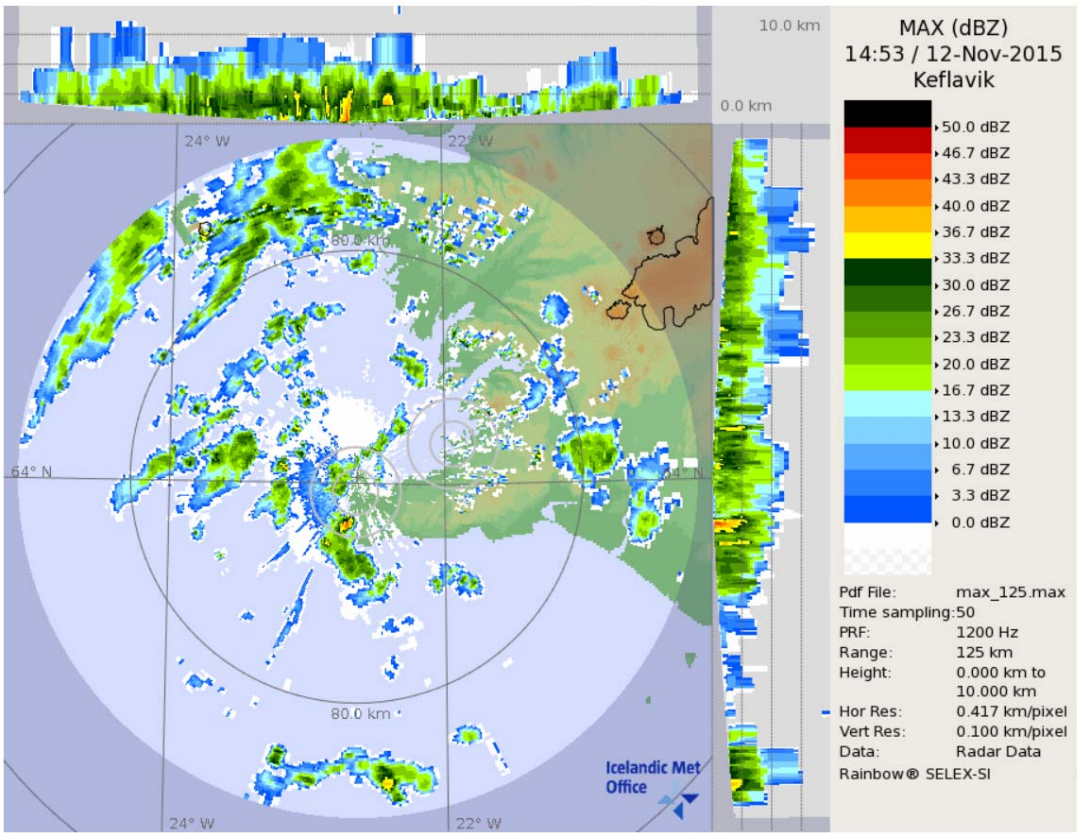


Figure 13: Precipitation in the accident area around the accident time

The satellite image in Figure 14 shows no clouds in the region at 15:15, about 32 minutes after the accident.

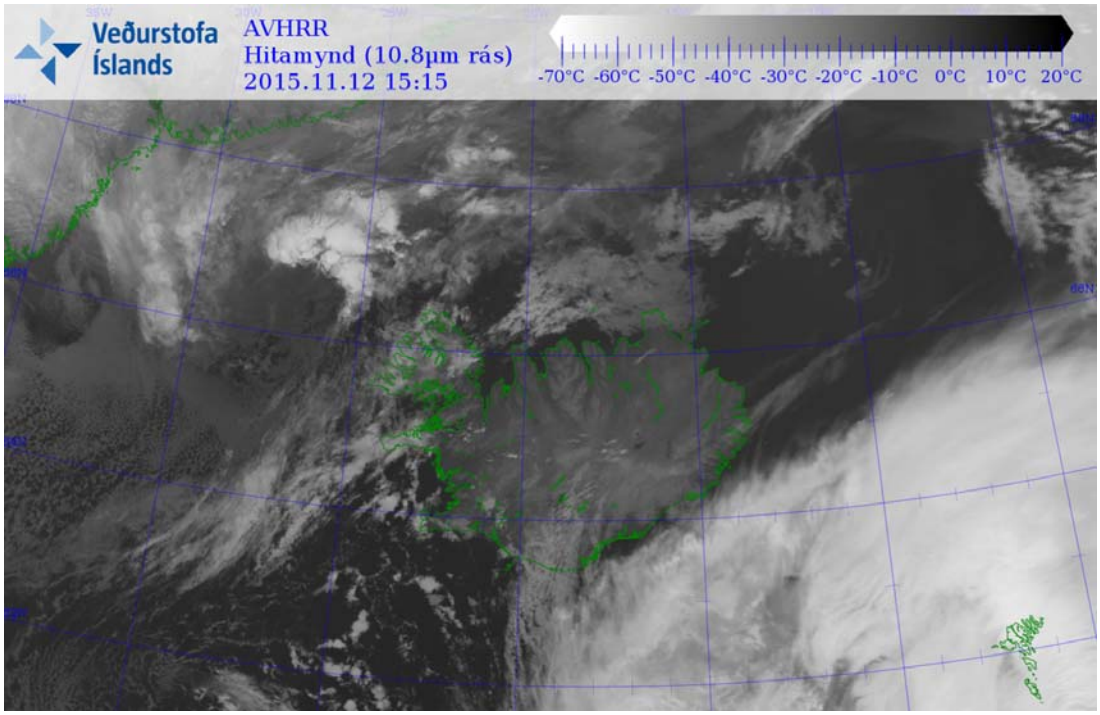


Figure 14: Clouds in the area around the time of the accident

As can be seen in Figure 15, the sun was shining and low in the sky around the time of the accident. The last plotted heading of the aircraft was towards the sun (see Figure 15 and Figure 16), possibly interfering with the pilots' instrument reading.

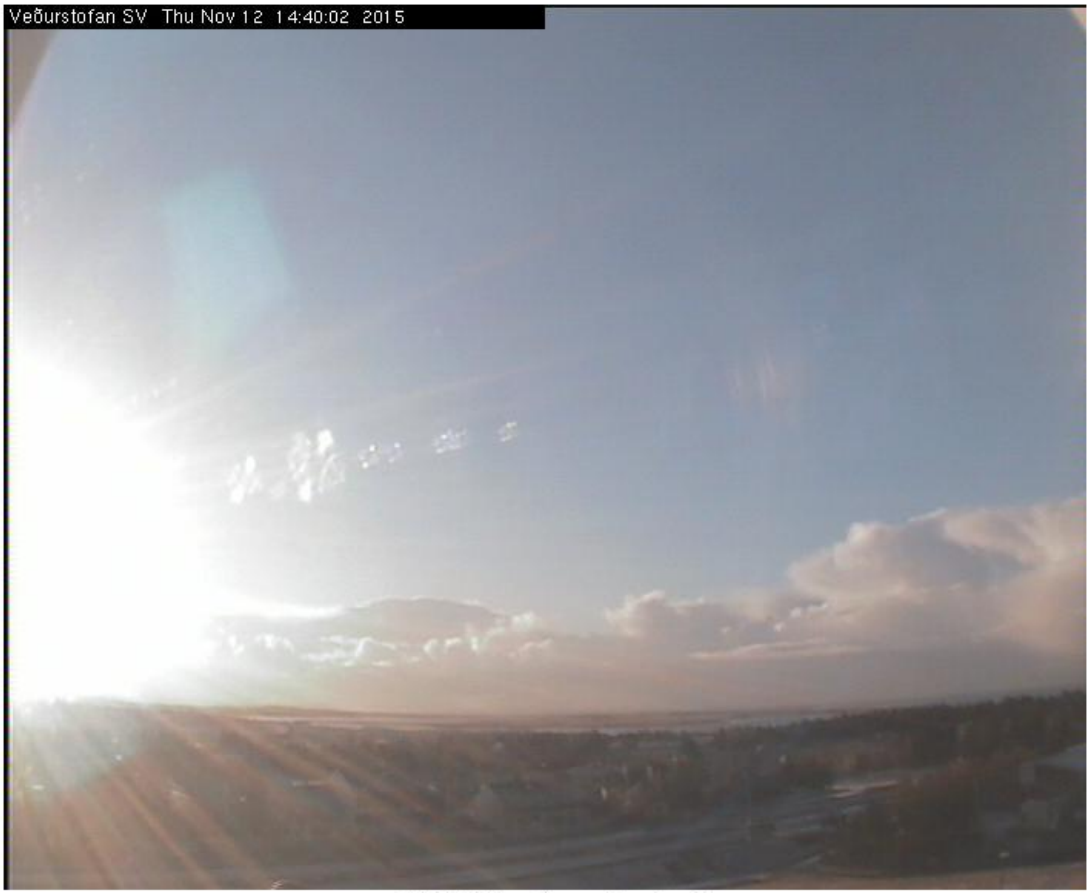


Figure 15: View from the MET Office towards the accident area around the time of the accident

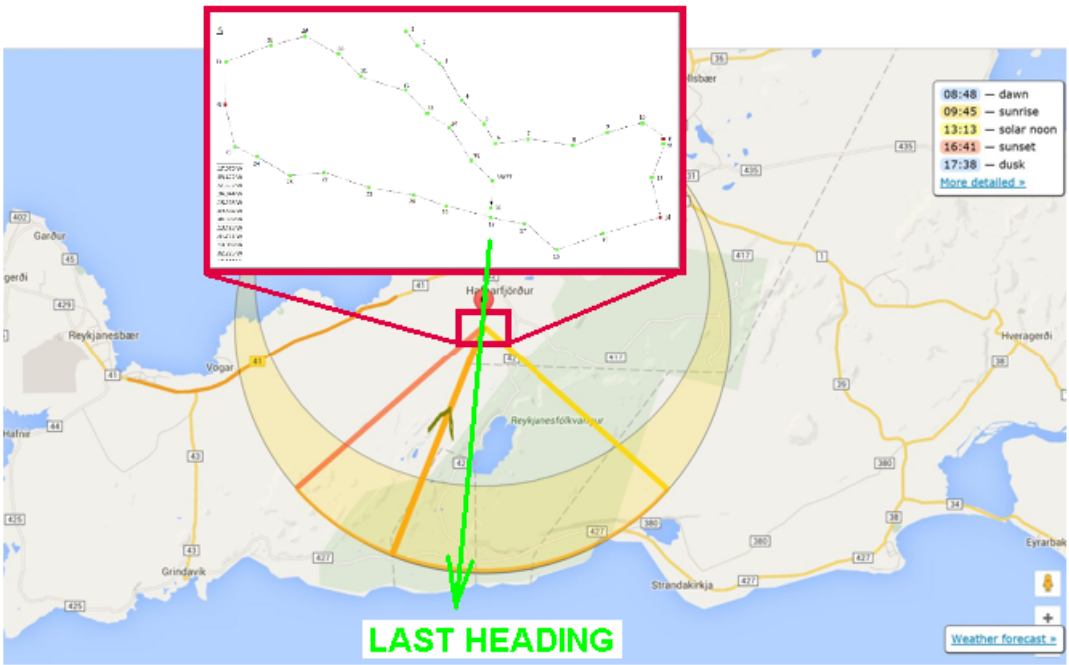


Figure 16: Last known heading towards the sun

2.2.4. Air traffic control

Air Traffic Control received an abbreviated flight plan for TF-IFC. The flight plan was for 30 minutes of touch and go's at the airport with an endurance of three hours.

- At 14:10 the aircraft took off from Reykjavik airport
- According to the plan, the ETA[16] was 14:40
- At 15:06, the ATCO in BIRK Tower declared an Uncertainty status 25 minutes after the flight plan expired
- At 15:12 The ATCO upgraded the Uncertainty phase to Alert phase
- At 15:17 Distress phase was activated

2.2.5. Communication

The communication between the ATCO in BIRK Tower and the aircraft prior to entering the training area was normal. There was no distress call received from the aircraft.

2.2.6. Accident area

The accident occurred at a training area named MIÐSVÆÐI. This area is midway between BIRK and BIKF. The training area is defined from the ground up to 2500 feet MSL.

[16] Estimated time of Arrival

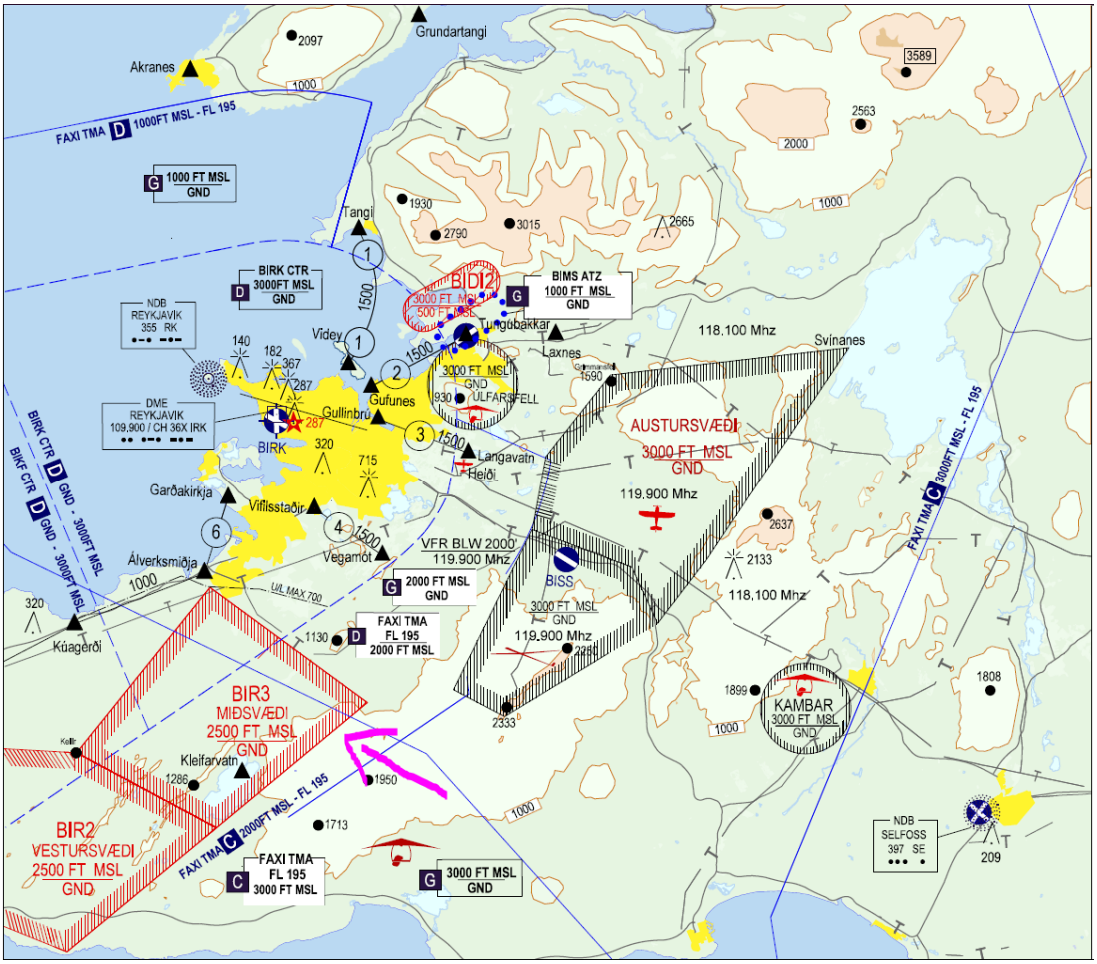


Figure 17: Reykjavik VFR – Routes (arrow points to MIÐSVÆÐI)

The elevation at the accident site, where the training was performed, varies between approximately 200-330 feet. The elevation at the area where the aircraft was found is approximately 250 feet.

The last recorded radar signal, showed the aircraft at approx. 2450’ ASL or 2200’ AGL.

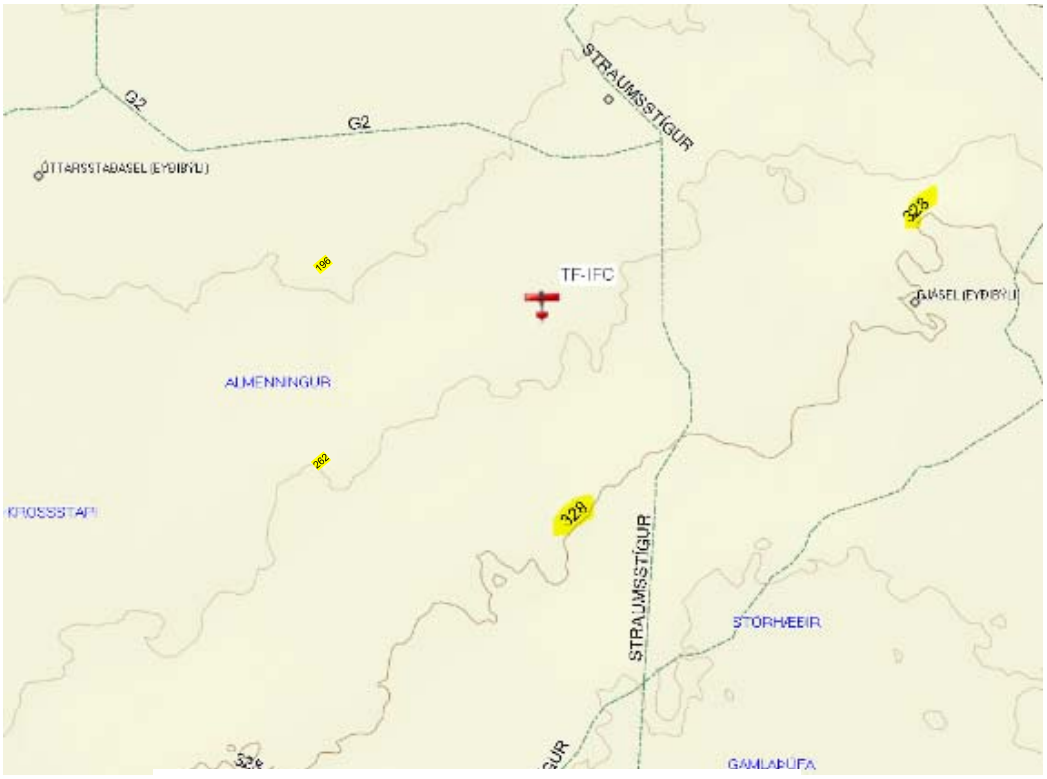


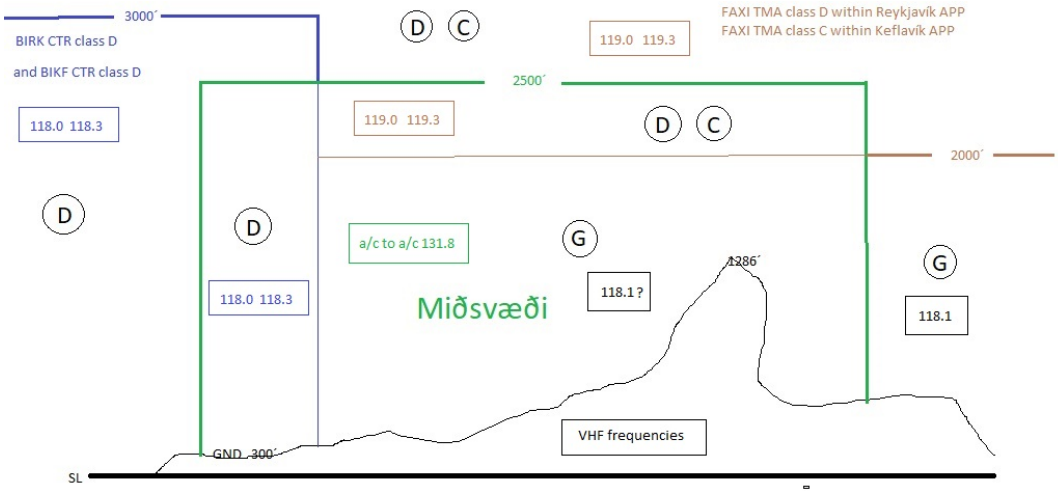
Figure 18: Map of the area around the accident site

Within the area MIÐSVÆÐI, there are hills, knolls and mountains that vary in heights from 600 – 1300 feet.

The most level part of the training area is a lava field with an elevation varying from 150 – 600 feet. This means that the training area provides maximum 2350 feet AGL (only 1200 feet in the mountainous part).

The upper limit of 2500 feet of the training area is due to the approach of commercial aviation traffic to the nearby Keflavik International Airport (BIKF).

There are three different airspace classes[17] at MIÐSVÆÐI, Class C, D and G depending on the location from time to time.



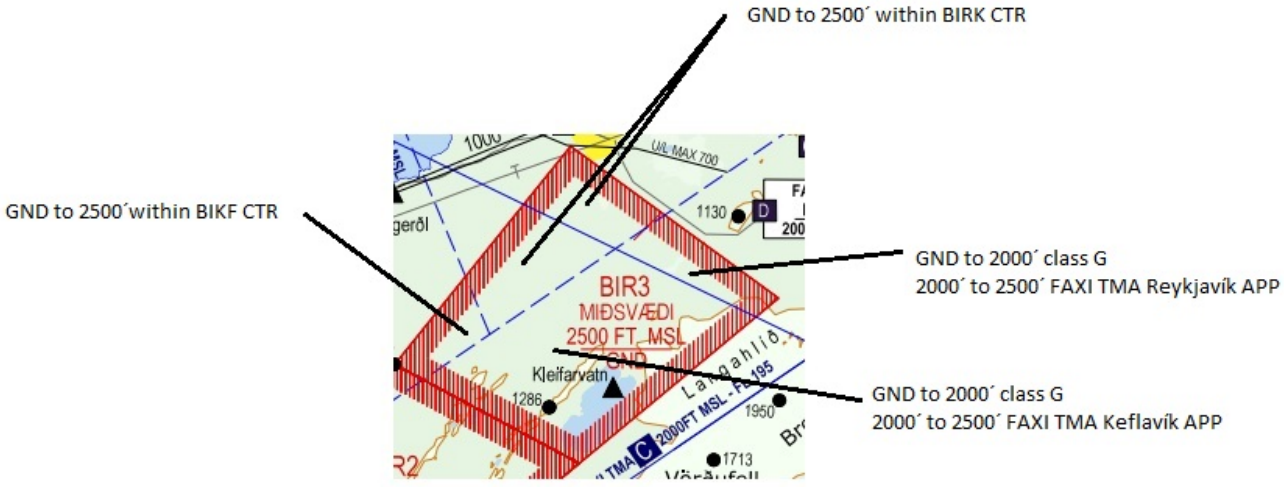


Figure 19: MIÐSVÆÐI

The investigation revealed that the area is more complicated than other training areas and in case of higher altitude needed (above 2500' MSL) the pilots need to contact either one of two approach control units, i.e. BIRK Approach and BIKF Approach. Due to this, some instructors use other training areas for higher altitude

[17] See classification of airspaces in appendix 8.

such as AUSTURSVÆÐI. The investigation also revealed that MIÐSVÆÐI is closed in case of RWY 01 is in use at BIRK.

2.2.7. Aerodrome

N/A.

2.3. Aircraft

Aircraft TF-IFC is a Tecnam P2002JF, similar to the manufacturer's type, Tecnam P2002 Sierra. The P2002JF is within the CS-VLA (Very Light Aircraft) certification and is certified within GA operation, but the Tecnam P2002 Sierra is not.

P2002 JF

CS-VLA

P2002 Sierra MkII AUL

ADVANCED ULTRA LIGHT, ULM, ULM

Figure 20: Tecnam P2002JF and P2002 Sierra

Tecnam P2002JF was initially designed with MTOW of 580 kg.

Later the MTOW was increased to 600 kg and then to 620 kg. According to the manufacturer, no changes were made to the design of the aircraft prior to the increase of the MTOW.

Report No.	Title	EASA approval No.
MOD2002/029	MTOW increment from 580Kg to 600Kg	10029126
MOD2002/041	Garmin G500 Installation	10033399
MOD2002/050	VFR night configuration for Digital version	10033950
MOD2002/084	VFR night configuration for Analogic version	10034907
MOD2002/087	MTOW increment up to 620Kg	10041442
MOD2002/127	Variable pitch propeller installation	10045205
MOD2002/0141	Rudder and Throttle additional controls	10048554

Very Light aircraft are certified by EASA for General Aviation but ultralight aircraft are not.

The EASA approval for the Tecnam PJ2002JF was prepared by the Italian Civil Aviation Authority (ENAC) on behalf of EASA. This was during the first year after the establishment of EASA, when it relied heavily on the European CAA's due to its own infrastructure still being ramped up. The final report for the approval is dated 28 May 2004.

Prior to the initial approval of the aircraft in 2004, a number of tests were made. Flight tests such as spinning [18] and stall tests were performed in February 2004 with varying W&B configurations. All test were made with weights at and below 580 kg.

[18] Normal category airplanes must be able to recover from a one turn spin or a 3 second spin, whichever takes longer, in not more than one additional turn

The certification process of EASA is divided as follows:

- Phase 0 - First Familiarization with the applicant/team establishment
- Phase 1 - Technical Familiarization TC basis
- Phase 2 - Agreement Certification Program
- Phase 3 - Compliance Demonstration
- Phase 4 - Final Report and issue of TC

Within Phase 2, a Certification Basis is laid down with certification specifications[19]. During the initial certification of Tecnam P2002JF, all the above phases were complied with.

As listed earlier the MTOW for the aircraft was increased from 580 kg to 600 kg and then from 600 kg to 620 kg. This equals approximately 7% increase in MTOW. According to EASA, an increase in MTOW is seen as a major change to the aircraft. According to report n° 2002/260, Compliance Check List for MOD2002/87 2nd Edition; December 09th, 2011; Revision 0, the aircraft was tested for the change of weight.

According to the manufacturer, flight tests regarding spin recovery are considered not affected by weight increment since the C.G. excursion is the same of the type certificate. This is confirmed by EASA.

[19] CS airworthiness code 21.A.16 effective at date of application

2.3.1. Stalls and Spins

According to the Aircraft Flight Manual[20], the aircraft is certified in the normal category in accordance with EASA CS-VLA regulation. The aircraft is certified for non-aerobatic operations, which include any manoeuver pertaining to "normal" flight, stall (except whip stall), lazy eights, Chandelles and turns of which the bank angle does not exceed 60°.

Intentional spins are not approved within normal category and a special warning note is in the AFM[21].

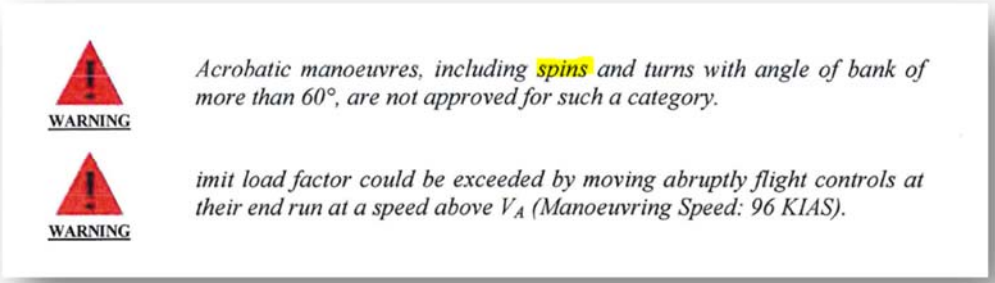
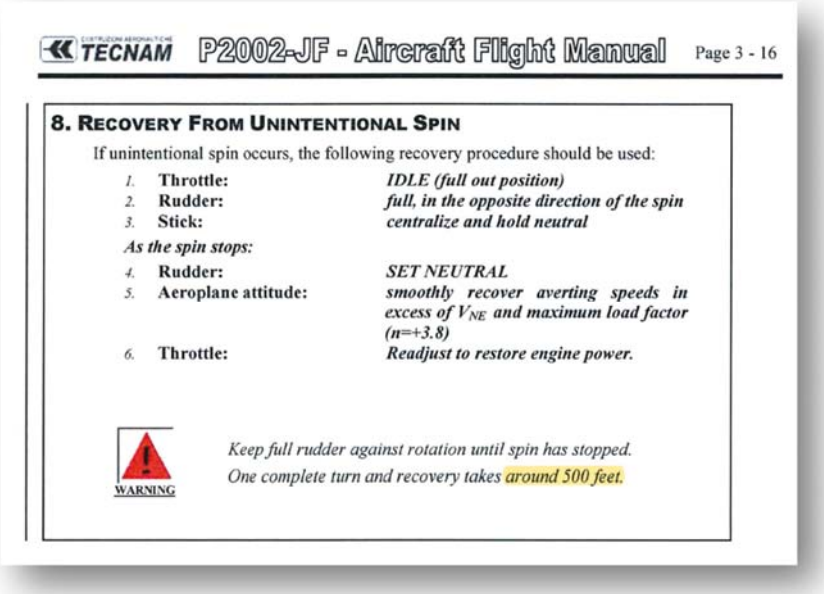


Figure 21: Warning note in AFM regarding intentional spin

In case of an unintentional spin, the Aircraft Flight Manual states that one complete turn takes around 500 feet. The picture below describes the procedure for recovery. This is based on a test for Tecnam P2002JF with TOW of 577 kg.

[20] Doc. No. 2002/028 3rd Edition - Rev. 4 2015, July 27'h

[21] Aircraft Flight Manual



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8. RECOVERY FROM UNINTENTIONAL SPIN

If unintentional spin occurs, the following recovery procedure should be used:

1.	**Throttle:**	*IDLE (full out position)*
2.	**Rudder:**	*full, in the opposite direction of the spin*
3.	**Stick:**	*centralize and hold neutral*
	As the spin stops:	
4.	**Rudder:**	*SET NEUTRAL*
5.	**Aeroplane attitude:**	*smoothly recover averting speeds in excess of V_{NE} and maximum load factor (n=+3.8)*
6.	**Throttle:**	*Readjust to restore engine power.*

WARNING

Keep full rudder against rotation until spin has stopped.
One complete turn and recovery takes around 500 feet.

Figure 22: Instructions in AFM regarding recovery in case of unintentional spin

2.3.2. Aircraft maintenance

There were no maintenance records for the aircraft other than those for the reassembly of the aircraft, as the aircraft had only been flown for 16 hours when the accident occurred. The aircraft was due for its first maintenance visit at 25 hours.

The investigation revealed no anomalies related to the assembly of the aircraft.

2.3.3. Weight and Balance

By looking at the Weight and Balance sheet that the pilot filled out, the 676.4 kgm of empty Weight moment is used. Total of 400 kg empty Weight, 150 kg of pilot and passenger Weight, and 60 liters of fuel (which equals to 43 kg of fuel). The Weight and Balance sheet was made manually before the flight and indicated that the aircraft loading was within limits. By filling out the Weight and Balance sheet with a computer, it may be seen that the center of gravity is at the forward limit of the flight envelope (see Figure 23 and Figure 24).

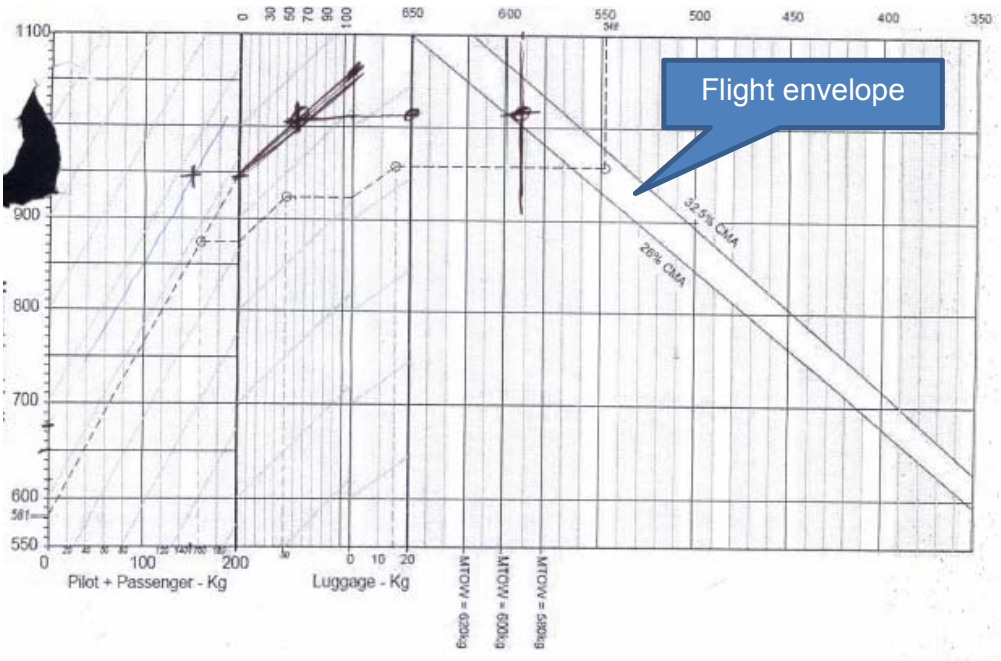


Figure 23: The Weight and Balance sheet – Hand drawn

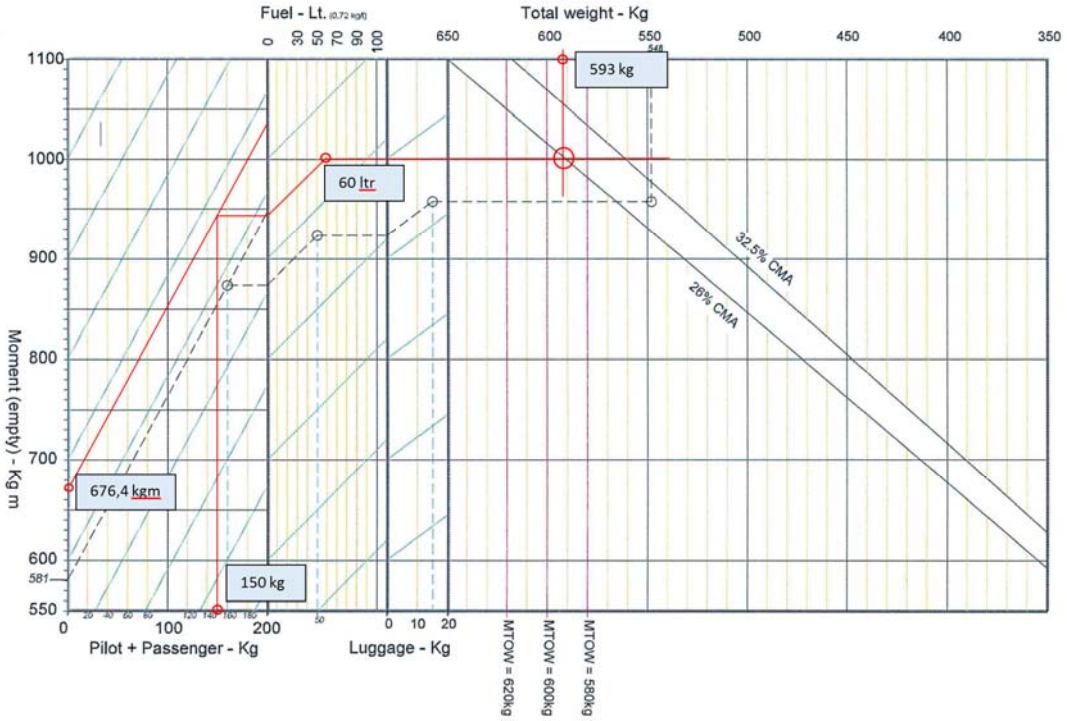


Figure 24: The Weight and Balance sheet – Computer drawn

Due to how narrowly the manufacturer´s W&B envelope is presented on the W&B sheet, it is easy to make errors while preparing the sheet. This makes locating accurately the center of gravity difficult and allows cumulative errors to occur.

When analysing the Weight and Balance sheet that was filled out prior to the flight, some discrepancies were found regarding the weight of the Instructor and the Student, as well as regarding the calculation for possible fuel quantity and the weighing report from the manufacturer.

	SAMPLE AIRCRAFT	YOUR AIRCRAFT
Empty Weight Moment	581 kgm	676.4 kgm
Empty Weight	337 kg	400 kg
Pilot And Passenger	160 kg	150 kg
Fuel	50 ltr. * 0,72 = 36 kg	60 ltr. * 0,72 = 43 kg
Baggage	15 kg	/ kg
Take-off Weight	548 kg	593 kg

Figure 25: Weight calculations

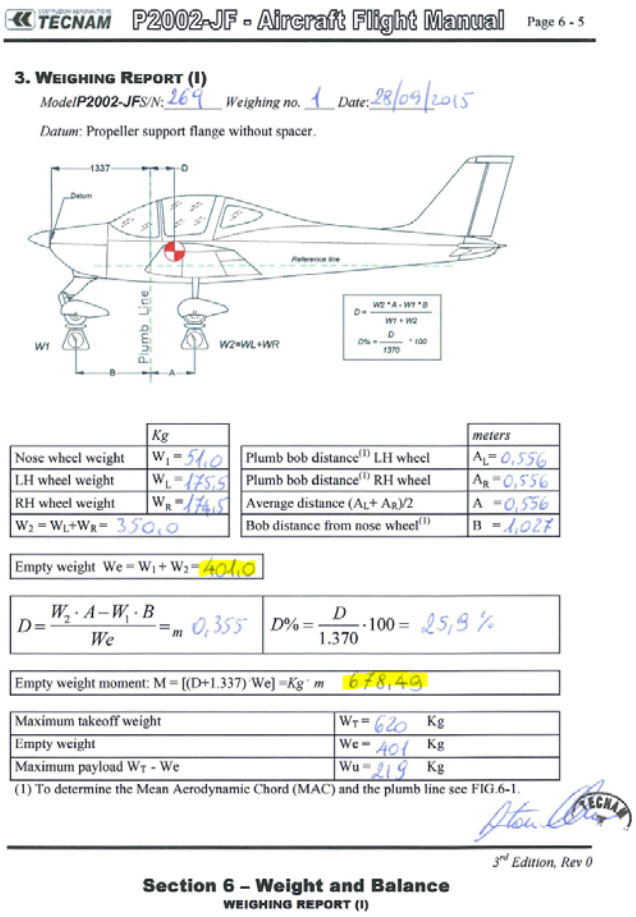
It is also noted that a correction was made for the amount of fuel from 65 L to 60 L (see Figure 25).

2.3.3.1. Discrepancies in empty weight and empty weight moment

By looking at the weighing report from the manufacturer it is apparent that both the empty weight as well as the empty weight moment are different from those used by the Instructor when filling out the Weight and balance sheet.

The empty weight moment used was 676.4 but on the weighing report, it is stated that the moment was 678.49.

There is also a discrepancy regarding the empty weight, where the manufacturer states 401 kg while the Instructor used 400 kg.



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3. WEIGHING REPORT (I)

Model P2002-JF S/N: 269 Weighing no. 1 Date: 28/09/2015

Datum: Propeller support flange without spacer.

	Kg		meters
Nose wheel weight	W_1 = 51,0	Plumb bob distance(1) LH wheel	A_L = 0,556
LH wheel weight	W_L = 175,5	Plumb bob distance(1) RH wheel	A_R = 0,556
RH wheel weight	W_R = 174,5	Average distance (A_L+ A_R)/2	A = 0,556
$W_2 = W_L+W_R$ = 350,0		Bob distance from nose wheel(1)	B = 1,027

Empty weight We = $W_1 + W_2$ = 401,0

$D = \frac{W_2 \cdot A - W_1 \cdot B}{We} =_m$ 0,355 $D\% = \frac{D}{1.370} \cdot 100 =$ 25,9 %

Empty weight moment: M = [(D+1.337)·We] = *Kg · m* 678,49

Maximum takeoff weight	W_T = 620	Kg
Empty weight	We = 401	Kg
Maximum payload W_T - We	Wu = 219	Kg

(1) To determine the Mean Aerodynamic Chord (MAC) and the plumb line see FIG.6-1.

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Section 6 – Weight and Balance
WEIGHING REPORT (I)

Figure 26: Manufacturer's Weighing Report

2.3.3.2. Discrepancies regarding the weight of the pilot and passenger

During the investigation, the combined weight of the Instructor and the Student was found to be 169 kg, 19 kg more than the weight listed on the Weight and balance sheet used while preparing for the flight.

2.3.3.3. Discrepancies regarding the fuel information

The investigation revealed that pilots of the flight school were not using a dipstick to measure fuel quantity on the Tecnam aircraft, but relied on the fuel meter and/or the information from the fuel up-lift information sheet.

Below is a table with data from the Airplane Journey and Technical Log, i.e. how the log pages were filled out for this aircraft.

Data from the Airplane Journey and Technical Log

Log P. Nr	Date	Air time	Block time	Tach	Calc Tach	Dep. fuel	F. Uplift
31706	10.11.2015	0,9	1,2	15,28	15,31	100	61,49
31706	10.11.2015	0,4	0,6	15,98	15,88	75	

Max capacity of the fuel tanks is 100 liters. According to the flight school, the average fuel consumption varies from 16 to 18 liters per hour.

Given that the aircraft was filled up on the 10th of November (dep. fuel = 100 liters), two days prior to the accident, and the aircraft engine ran (block time) for 1.8 hours after that (1.2+0.6), and given that the upper value for the average fuel consumption was 18 liters per flight hour, a conservative value for the fuel quantity at departure of the accident flight should have been 67.6 liters (49 kg).

While using the corrected information the weight and balance chart demonstrates the following:

	SAMPLE AIRCRAFT	YOUR AIRCRAFT
Empty Weight Moment	581 kgm	678,5 kgm
Empty Weight	337 kg	401 kg
Pilot and passenger	160 kg	169 kg
Fuel	50 ltr. * 0,72 = 36 kg	68 * 0,72 = 49 kg
Baggage	15 kg	0 kg
Take-off Weight	548 kg	619 kg

Figure 27: Corrected Weight calculations

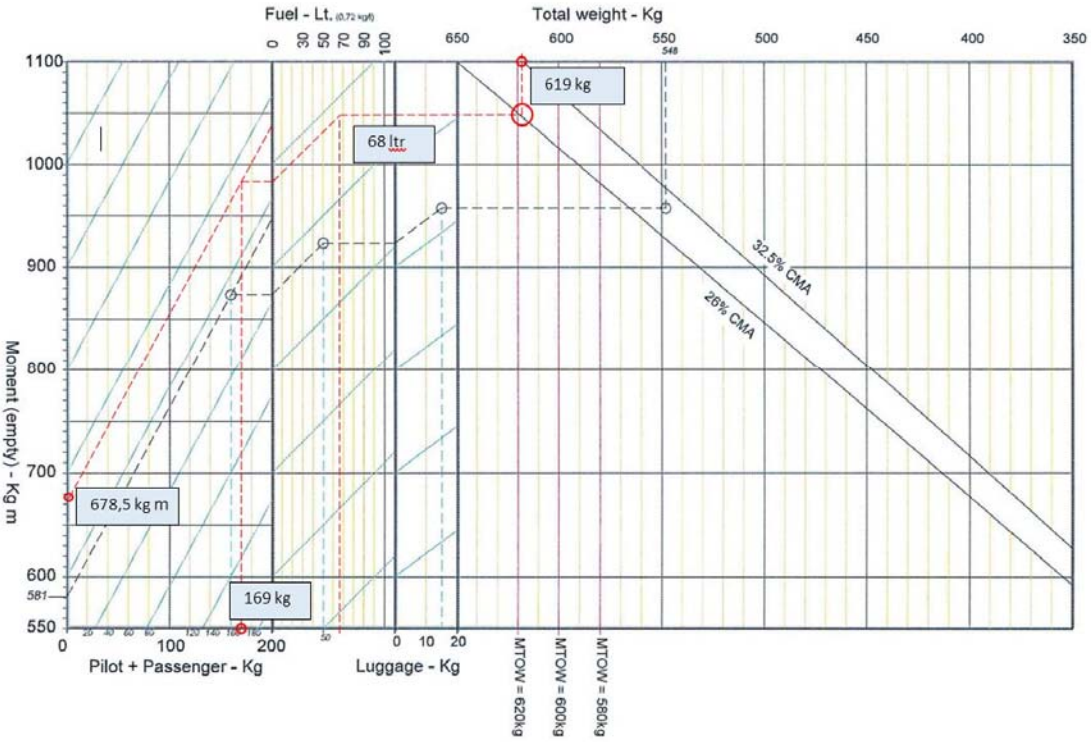


Figure 28: Corrected Weight and Balance sheet

From the calculations above, it is apparent that the aircraft was within the Weight and Balance boundaries but slightly closer to the limits than depicted on the Weight and Balance sheet prepared by the Instructor/student.

2.3.4. Aircraft instrumentation

The flight school was operating Tecnam P2002JF with two types of instrument panels, an analog and a digital panel.

The flight school had a total of five Tecnam P2002JF where the first aircraft was configured with an analog panel (see Figure 29). The other four aircraft, including TF-IFC, were equipped with digital panels (see Figure 30).

Figure 29: Tecnam P2002JF – Analog configuration

Figure 30: Tecnam P2002JF – Digital configuration

The first aircraft was delivered in 2014, a year prior to the accident and the other four were delivered in 2015, a few months prior to the accident.

The Instructor collected most of his Tecnam experience in the aircraft equipped with analog instruments, 72.6 hours, and 22.9 hours on the digital instruments.

The Instructor was in the left seat since the Student would be in the right seat while operating as an instructor.

Figure 31 demonstrates the difference between the analog and the digital panels of the Tecnam P2002JF. At the digital configuration there are also some analog instruments as a standby instruments.

ANALOG DIGITAL

Figure 31: The difference between analog and digital panels

Numerous inconsistencies were found between the airspeed limitation given in the aircraft's handbook and those marked on the airspeed indicator of the accident aircraft.

In the Aircraft Flight Manual (AFM), the white arc[22] on the airspeed indicator indicates 30-67 knots, but the standby airspeed indicator in the aircraft indicates 32-69 knots. The green arc[23] indicates 40-110 knots in the AFM, but the standby airspeed indicator in the aircraft indicates 41-114 knots. The yellow arc[24] in the AFM indicates 110-138 knots, but the standby airspeed indicator indicates 114-141 knots. The red line (maximum speed for all operations) in the AFM indicates 138 knots, but the standby airspeed indicator indicates 142 knots. See details in Figure 32 and Figure 33.

[22] White arc commonly referred to as the flap operating range - Lower limit of white arc indicates the stalling speed

[23] Green arc indicates the normal operating range of the aircraft

[24] Yellow arc indicates the caution range (usually to fly only in smooth air, and then with caution)

3. AIRSPEED INDICATOR MARKINGS

Airspeed indicator markings and their colour code are explained in the following table.

MARKING	KIAS	EXPLANATION
White arc	**30 – 67**	Positive Flap Operating Range (lower limit is V_{SO}, at specified maximum weight and upper limit is the maximum speed permissible with landing flaps extension).
Green arc	**40 – 110**	Normal Operating Range (lower limit is V_{S1} at specified maximum weight and most forward c.g. with flaps retracted and upper limit is maximum structural speed V_{NO}).
Yellow arc	**110 – 138**	Manoeuvres must be conducted with caution and only in smooth air.
Red line	**138**	Maximum speed for all operations.

Figure 32: Airspeed indicator markings in Aircraft Flight Manual

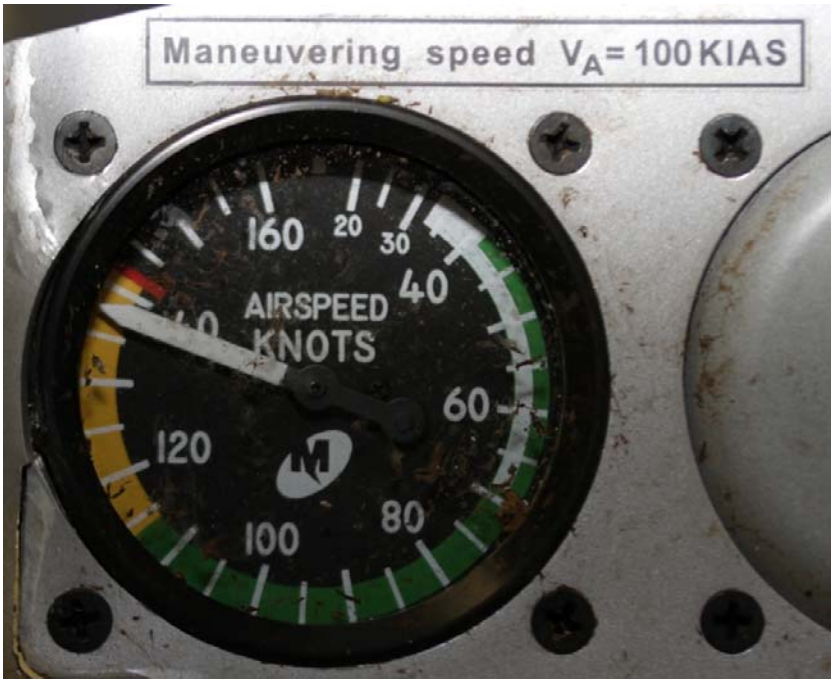


Figure 33: Airspeed indicator markings on instrument

The reason for this difference is that the table in the AFM is given for the Tecnam P2002JF variant with a MTOW of 580 kg.

The accident airplane was equipped with Garmin 500 instruments including GPS. Garmin 500 does not record any track data. This non-recording function, although such functions are normally present in handheld units from the manufacturer, hindered the ITSB in collecting relevant flight data from the Garmin 500 unit of the accident aircraft. In supplement, A07 of the AFM, a table of Airspeed Indicator Markings for the Garmin G500 is as follow:

AIRSPEED INDICATOR MARKINGS

Airspeed indicator markings and their colour code are explained in the following table.

Garmin G500 Airspeed Indicator displays airspeed on a rolling number gauge using a moving tape: a color-coded (white, green, yellow, and red/white "barber pole") speed range strip is located on the moving tape.

NOTE *Refer to Garmin G500 Pilot's Guide (P/N 190-01102-02) – last issue – for airspeed indicator description.*

MARKING	KIAS	SIGNIFICANCE
White band	31 - 68	Positive Flap Operating Range (lower limit is V_{SO}, at maximum weight [600 kg] and upper limit is the maximum speed permissible with landing flaps extension).
Green band	41 – 112	Normal Operating Range (lower limit is VS1 at maximum weight [600 kg] and most forward c.g. with flaps retracted and upper limit is maximum structural speed V_{NO}).
Yellow band	112 - 141	Manoeuvres must be conducted with caution and only in smooth air.
Red line	141	Maximum speed for all operations.

Figure 34: Airspeed Indicator markings for Garmin G500

The table of Airspeed Indication Markings for MTOW of 620 was missing in the AFM supplement valid at the time of the accident. This has been corrected in the 3rd edition – Rev. 14, dated November 11th 2019.

2.3.5. Characteristics of the aircraft

Based on interviews with a number of instructors and students, the investigation revealed that they found the Tecnam P2002JF to be quite sensitive on the controls. One found it difficult to get used to the behavior of the turn and bank indicator since the behavior of the “ball” was different from other aircraft he was used to flying.

Prior to the accident, one student stated that his comfort zone on Tecnam P2002JF was quite small where he would like to take more time to get used to the aircraft, i.e. before he would go into a full stall. Furthermore, one claimed that it was difficult to get the aircraft into power on stall and aggressive inputs were needed in order to accomplish this.

The interviewed pilots stated that the aircraft handled the power off stall a little better than power on stall since, in power on stall; the aircraft had the tendency to suddenly flip to one wing. Instructors at the flight school described the aircraft to be a good aircraft to handle in cruise and landings.

In rough weather conditions, instructors experienced that some students had difficulty flying the Tecnam P2002JF wings level.

The investigation revealed that in most cases, it would not be possible to stay within the limit of MTOW with two persons on board and full fuel tanks.

The load sheet of the Tecnam P2002JF is narrow and quite important to follow all figures in details when evaluating if the Weight and Balance are within limits.

2.4. Human factor

Given the locations and timing of the final radar plots from the flight, the inclusion of stall training in the flight school training plan, the consistency between the time at which the loss of control occurred and the sequence of flight exercises that were to be carried out and the aircraft wreckage data (see chapter 1.9), it is likely that loss of aircraft control occurred during the execution of practice stall maneuvers.

The initial event leading to a loss of control was likely a stall exercise during which the aircraft most likely entered a spin at approximately 2200 feet above ground level. Aircraft impact damage indicates that the pilot had not been able to recover from a spin when it impacted the ground. Insufficient information was available to determine what caused the stall to develop into a spin.

The investigation was unable to determine which pilot was at the controls during the final moments of the flight.

2.4.1 Pilot readiness and overall experience

The investigation revealed that this new type of aircraft (Tecnam P2002JF) had different maneuvering characteristics than other aircraft types of the school. Some instructors of the flight school stated that they were not comfortable with the handling characteristics of the aircraft. As mentioned in chapter 2.3.5 Characteristics of the aircraft, when compared with other aircraft types within the flight school, aggressive input on the controls was needed in order to get the aircraft into power on stall.

Statements from pilots that had flown with the Instructor indicate that he was familiar with the aircraft flight characteristics and was aggressive on the controls when needed.

The Instructor was the most experienced pilot of the flight school, on this type of aircraft. His flight experience on this type of aircraft was 95.5 hrs of which only 22.9 hours were with digital instruments.

The Student was a commercial pilot on F50 and DHC8 with approximately 4.400 total hours as well as experienced in flying with digital instruments. He had flown 8.7 hours on SEP aircraft over the previous 90 days. This was his first time flying the accident aircraft.

The limited digital instruments experience of the Instructor as well as the Student's limited experience on this type of the accident aircraft might have negatively affected the reaction needed at a critical moment.

Although the investigation did not reveal anything that suggests that the difference in overall experience between the two pilots was a contributing factor to the accident, it is however possible that it may have affected the pilot dynamics during the accident sequence.

2.4.4 Fatigue or pressure

The investigation did not find any evidence that the fatigue had a role to play in the accident nor were there any indications that the crew was rushed.

2.4.5. Environmental factors

The investigation revealed that prior to the accident, it was generally considered acceptable amongst trainer pilots to conduct stall exercises within MIDSVÆÐI at the upper limits (2500 feet) of the training area. Pilots tend to refrain from getting approval from adjacent ATC units for higher altitudes as the training area is situated underneath the main approach path to the local international airport.

2.4.6 Impaired visibility

The investigation revealed that according to the last known location of the aircraft it was headed towards the sun which was low in the sky. The Instructor and Student may have suffered sun glare which could have interrupted instrument scanning.

2.5. Survivability

An ELT[25] signal was received from the accident site, which helped to locate the wreckage. Due to the fact that this was a high energy impact, the possibility of survival was considered negligible.

[25] Emergency locator transmitter

3. CONCLUSION

3.1 Findings

- The Instructor had a total of 382 flight hours, most on SEP.
- The Instructor had 6 months and 6 days (116 flight hours) of experience as an instructor.
- The Instructor had total of 95.5 hours on Tecnam P2002JF, thereof 22.9 hours on aircraft with digital instruments.
- The Instructor was the most experienced pilot of the school on this new type of aircraft.
- The Student had a total of 4.880 flight hours, most as a commercial pilot on F50/DHC-8.
- The Student had 5 months (16 flight hours) of experience as a flight instructor after he renewed his flight instructor rating.
- The Student had no prior experience on the Tecnam P2002JF.
- The Instructor and the Student were most likely doing critical maneuvering below the minimum altitude required by the flight school.
- The data entered on the weight and balance sheet was inaccurate.
- The aircraft was most likely at the forward center of gravity limit.
- At take-off, the aircraft was probably at its maximum take-off weight.
- The pilots most likely extended the flight from touch and go's only, to include other training needed to complete the familiarization, such as stalls, turns and slow flight.
- The flight plan was approximately three minutes overdue at the time of the accident.
- The on-site evidence, as well as the radar plot, indicate that the aircraft spun to the ground.
- The last plotted track of the aircraft was towards the sun.
- According to the weather data, the sky was likely mainly clear in the accident area at the time of the accident but there were snow showers in the vicinity, indicating convective conditions.

- Two similar types of Tecnam aircraft are both within the Ultralight and the Very Light Aircraft category.
- Very Light Aircraft are certified by EASA for General Aviation but Ultralight Aircraft are not.
- Analysis and flight tests published by the manufacturer, regarding spin performance for the aircraft's certification, were made with weights at or below 580 kg.
- Certification approval for the Tecnam PJ2002JF was prepared by the Italian Civil Aviation Authority (ENAC) on behalf of EASA in 2004.
- The W&B envelope is presented narrow on the manufacturers W&B sheet.
- The weight and balance chart allows cumulative errors to occur while locating the center of gravity.
- Some of the instruments and placards in the aircraft were not in accordance with the Aircraft Flight Manual.
- The Garmin 500 does not record flight track nor altitude data.
- The aircraft was assembled in accordance with manufacturer's procedures and all assembly connections were found to be correct.
- Accidents with similar evidences occurred in Poland and Hungary within five months after this accident.
- In March 2019, around 330 Tecnam P2002 aircraft had been manufactured.
- Of the 330 manufactured Tecnam P2002 airplanes in March 2019, 62 occurrences had been recorded, of which 18 were fatal.
- ELT signal was received by Cospas Sarsat, which helped to locate the wreckage.

3.2. Causes

Due to the fact that there were no witnesses, no recording tracking device on board and no survivors, there was limited information to the investigation and therefore difficult to determine the root cause of the accident, i.e. why the airplane went into spin.

The pilots most likely extended the flight from touch and go's only, to include other training needed to complete the familiarization, such as stalls, turns and slow flight. The last radar recorded altitude was 1900 - 2200 feet (AGL) which is below the flight school's minimum altitude (3000 AGL). This however was a common practice in this training area, most likely due to its complexity.

The last recorded radar plot shows that the aircraft is heading toward the sun. This may have affected the pilots' vision and is seen as a possible contributing factor to the accident.

According to the weather data, the sky was likely mainly clear in the accident area at the time of the accident. However, the ITSB could not exclude the possibility of icing or convective conditions affecting the flight at critical moment.

The ITSB believes that the most probable causes of the accident to be the power on stall characteristics of the aircraft and the insufficient altitude for critical maneuvers.

Even though considered unnecessary by EASA, to test the spin characteristics of the aircraft after increase of MTOW, the ITSB urges the manufacturer to do so.

4. SAFETY RECOMMENDATIONS

The ITSB issues the following Safety Recommendations:

15-089F026-T01

The ITSB recommends to the manufacturer of the aircraft, Tecnam, to:

> Redesign the weight and balance envelope chart for the Tecnam P2002JF load sheet, to minimize the risk of incorrect W&B calculations.

15-089F026-T02

The ITSB recommends to EASA to:

> Require a spin test for VLA aircraft that goes through a major change, such as for MTOW, even though the C.G. excursion is the same.

15-089F026-T03

The ITSB recommends to flight schools, operating this type of aircraft, to:

> Increase the minimum altitude for exercises that can lead to a spin to 5000 feet (AGL).

15-089F026-T04

The ITSB recommends to Icetra to:

> Define a flight training area within the vicinity of BIRK and BIKF, which has an upper limit of at least 5.000 feet AGL.

15-089F026-T5

The ITSB recommends to the International Civil Aviation Organization, ICAO, to:

> Elevate the relevant SARPs for navigation to utilizing GPS to require aviation GPS driven navigation equipment to automatically record flight track data. This can then be accessed by an official accident investigator with the manufacturers support.

This final report was approved by following ITSB board members:

- Geirþrúður Alfreðsdóttir Chairman
- Gestur Gunnarsson Board member
- Tómas Davíð Þorsteinsson Deputy board member
- Hörður Arilíusson Deputy board member

Reykjavík 28. November 2019

On behalf of the Icelandic Transportation Safety Board

Þorkell Ágústsson – IIC

APPENDIX 1 – FLUGSKILYRÐI YFIR ÍSLANDI

Flugskilyrði yfir Íslandi sem voru í gildi milli 12 og 17.
Útgáfutími: 12. nóvember 2015, kl. 11:30

Flugskilyrði yfir Íslandi frá kl. 12 til 17:

Háloftavindar/hiti: FL050: 18018KT en VRB/10-20KT undir kvöld, -06 FL100: 180/10-20KT, -16 FL180: 190/30-50KT, hvassast NA-til en 09020KT yfir Vestfjörðum, -33

Yfirlit: Við Breiðafjörð er 982 mb smálægð, sem þokast N, en á Grænlandshafi er önnur álíka lægð, sem hreyfist ANA.

Vindar nærri yfirborði: S-læg átt, 10-20 hnútar en gengur í NA 25 til 30 hnúta með SA-ströndinni síðdegis.

Skýjahæð/skyggni/veður: BKN í 1500 til 2000 fetum, S- og V-til. Víða EMB CB og takmarkað skyggni í skúrum eða slydduéljum en éljum til fjalla en dregur úr CB skýjum þegar líður á daginn.
SCT/BKN í 3000 til 5000 fetum á N- og A-landi og víða gott skyggni. Skúratoppar í allt að 18.000 fetum.

Sjónflugsskilyrði milli landshluta: Varasöm eða léleg S- og V-lands, en annars þokkaleg eða góð.
Frostmarkshæð: Rétt yfir yfirborði en í kringum 2000 fet við A-ströndina.
Ísing og Kvika: MOD í skúra- og éljaskýjum S- og V-til.

APPENDIX 2 - DOCUMENT ON BOARD

Flugtakshraði (venjulegur f[illegible] speed)	VR 42 kts
Besta klifurhorn (best angle of climb)	VX 56 kts
Besti klifurhraði (best rate of climb)	VY 66 kts
Best svifhraði (best glide speed)	VG 68 kts
Mesti flapahraði TO° (flap extension speed)	VFE 99 kts
Mesti flapahraði LDG° (flap extension speed)	VFE 68 kts
Mesti flapahraði APP° (flap extension speed)	VFE 99 kts
Ofrishraði Vs1	VS1 41 kts
Ofrishraði Vso með vængbörð niðri	VS0 31 kts
Beitihraði (manoeuvring speed) 600 kg	VA 98 kts
Mesti farflugshraði VNO	110 kts
Hámarksflughraði (never exceed speed)	VNE 141 kts
Aðflugshraði	66 kts
Lokastefnuhraði (Final Approach speed)	51 kts
Farflugs klifurhraði	70 kts

98 hestöflum við 2388 rpm (hámark 5 mínútur)
Olía á að vera á bilinu 2-3 lítrar. Olían smyr, kælir, þéttir og hreinsar hreyfilinn.
Snúa prop með magnetos á OFF og master OFF
Kælivökvaforðinn sé 2/3 fullur.
Gult MOGAS 95 okt. 50 Ltr. Hvor (13,2 USG) Leða 100 Ltr. 18L/klst, 5 total flugpol.

Upwind leg (uppvinds leggur): TO° flapa. 400fet taka upp flapa og halda áfram klifri upp í 500 fet yfir vallarhæð á 66 kts (Vy).

Crosswind leg (krossvind leggur): Vinstri beygja (max 20° bank) þar til þvert á brautarstefnu. Klifrað á 66 kts.

Downwind leg (undan vindi): Vinstri beygja í 800 fet [illegible] yfir vallarhæð (max 20° bank) Klifrað áfram í 1000 fet yfir vallarhæð. Minnka afl í 1500 rpm.
Þvert af brautarenda (sebrabraut) skal:

- Afl 1100 rpm
- Halda hæð með því að halda að sér stýrum á meðan hraði lækkar
- Á 67 kts skal setja TO° flapa
- Þegar hraði nær 67 kts skal hefja lækkun á 500 fpm (fet á [illegible] u) og þá ætti vélin að halda 67 kts.

Base leg (þverleggur):
Max 30° bank þar til við fljúgum þvert á brautarstefnu. Að lokinni beygju Skal hraði vera 60 kts og lækkunarhraði 500 fpm. Afl ætti að haldast 1100 rpm.
Final approach leg (lokastefna): Beygt á lokastefnu (max 30° bank) og flugvélin stillt af við miðlínu flugbrautar. Þegar flugmaður er viss um að ná inn skal velja FULL° flapa og lokahraði 51 kts.
Ef rétt er farið að ætti ekki að þurfa að breyta afli úr 1100 rpm en þó getur þurft að minnka/auka lækkunarhraða á einhverjum tímapunkti og verður þá að breyta

APPENDIX 3 – LIST OF TECNAM P2002JF FATAL ACCIDENTS

P2002JF

7	16.7.2018	F-HOAB	2	Instructor & student		France
6	10.08.2017	UP-LA321	2	Pilot & Student		Kazakhstan
5	01.04.2016	SP-RWZ	2	Instructor & student		Poland
4	25.03.2016	HA-VOE	2	Private		Hungary
3	12.11.2015	TF-IFC	2	Instructor & Instructor		Iceland
2	15.04.2012	EC-LJV	2	Instructor & student		Spain
1	06.06.2011	I-LICC	1	Student		Italy

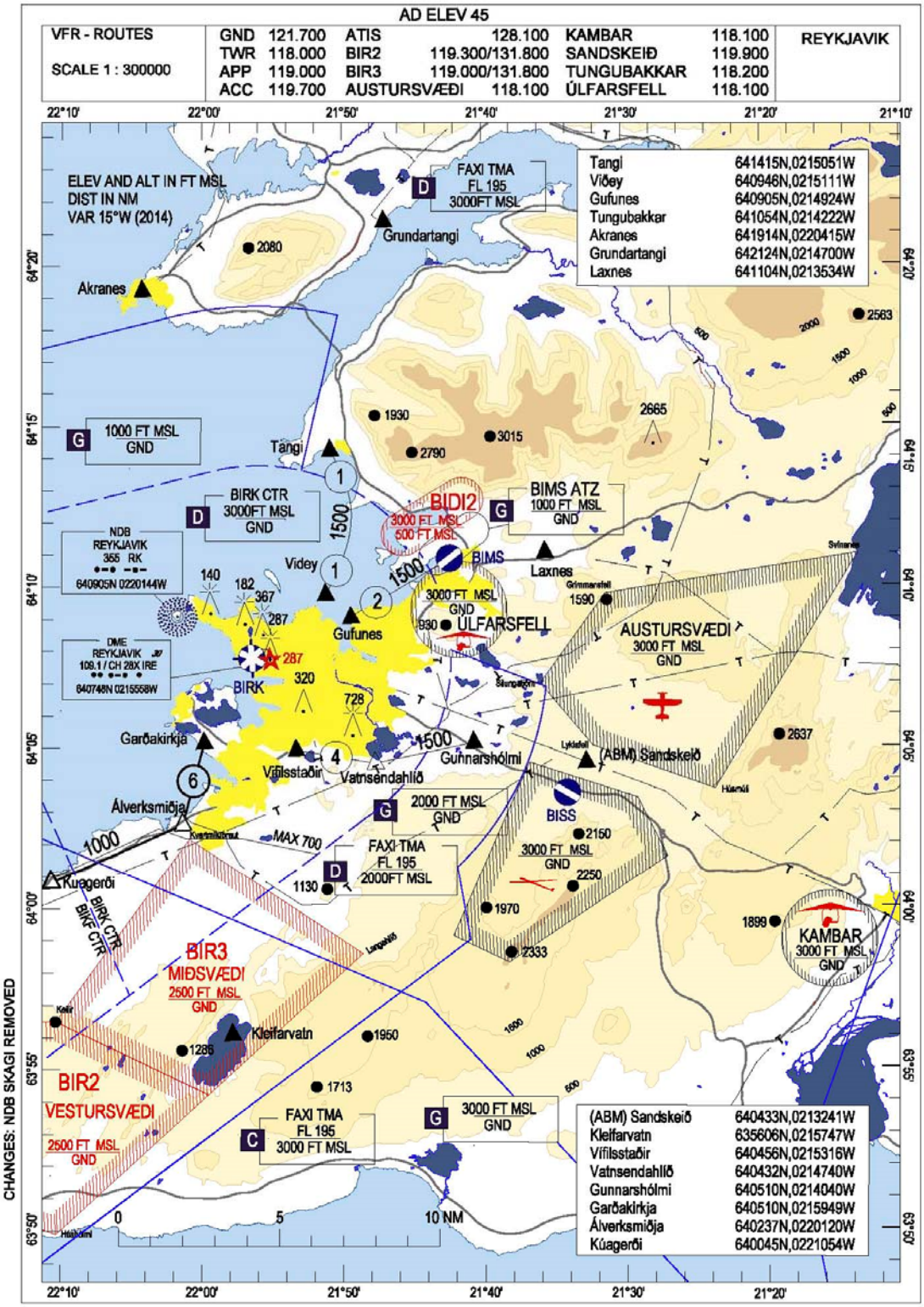
APPENDIX 4 – LIST OF TECNAM P2002SIERRA FATAL ACCIDENTS

P2002 Sierra

11	06.02.2019	EC-NAM		Instructor & student – Quality fly		Spain
10	07.10.2017	I-8662	1	Pilot		Italy
9	08.02.2017	EC-FP6	2	Private		Spain
8	15.01.2017	EC-MFH	2	Private		Spain
7	13.09.2015	PU-CMV	1	Private		Brazil
6	22.12.2013	EC-FO3	2	Private		Spain
5	03.12.2011	RA-1209G	1	Instructor & student		Russia
4	03.12.2011	RA-1333G	2	Instructor & student		Russia
3	18.07.2010		2	Private		Italy
2	23.01.2010	N145AG	2	Instructor & student		USA
1	16.08.2009	CS-UQX	1	Private		Portugal

APPENDIX 5 – VFR ROUTES AT BIRK

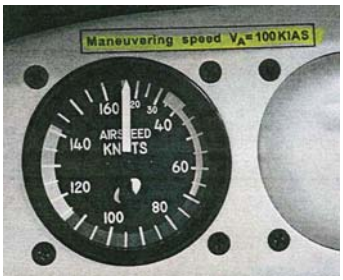
Reykjavik VFR - Routes



APPENDIX 6 – DIFFERENCES IN SPEED INFORMATION

Marking	AFM	Airspeed Indicator Standby	Airspeed Indicator Garmin G500
White arc	30-67	32-69	31-68
Green arc	40-110	41-114	41-112
Yellow arc	110-138	114-141	112-141
Red line	138	142	141

APPENDIX 7 – DIFFERENCES FROM AFM AND AIRCRAFT

Tecnam P2002-JF Flight Manual	Aircraft
MANEUVERING SPEED V_A = 96 KIAS	100 KIAS in aircraft 
THIS AIRPLANE IS CLASSIFIED AS A VERY LIGHT AIRPLANE APPROVED FOR DAY VFR ONLY, IN NON-ICING CONDITIONS. ALL AEROBATIC MANEUVERS INCLUDING INTENTIONAL SPIN ARE PROHIBITED. SEE FLIGHT MANUAL FOR OTHER LIMITATIONS.	Missing in Aircraft
FASTEN TIE-DOWN NET MAXIMUM WEIGHT *20 KG* MAX. PRESS *12.5 kg/dm²*	Tie-Down Harness in aircraft  TIE-DOWN HARNESS MAX WEIGHT 20kg [44 lbs] MAX SPEC. PRESS: 12.5 kg/dm² [256 lbs/sq ft]

APPENDIX 8 – CLASSIFICATION OF AIRSPACES

The following table is from the Icelandic Aeronautical Information Publication (AIP) ENR 1.4.1

Flokkur Class	Tegund flugs Type of flight	Veittur aðskilnaður Separation provided	Veitt þjónusta Service provided	Takmarkanirá hraða Speed limitation	Kröfur um fjarskiptabúnað Radio communication requirement	Þurfa flugheimild Subject to an ATC clearance
A	**Aðeins IFR** IFR only	**Öllum loftförum** All aircraft	**Flugstjórnarþjónusta** Air traffic control service	**Á ekki við** Not applicable	**Talstöð** Continuous two-way	**Já** Yes
B	IFR	**Öllum loftförum** All aircraft	**Flugstjórnarþjónusta** Air traffic control service	**Á ekki við** Not applicable	**Talstöð** Continuous two-way	**Já** Yes
	VFR	**Öllum loftförum** All aircraft	**Flugstjórnarþjónusta** Air traffic control service	**Á ekki við** Not applicable	**Talstöð** Continuous two-way	**Já** Yes
C	IFR	**IFR frá IFR** **IFR frá VFR** IFR from IFR IFR from VFR	**Flugstjórnarþjónusta** Air traffic control service	**250 kt IAS undir F100** 250 kt IAS below F100	**Talstöð** Continuous two-way	**Já** Yes
	VFR	**VFR frá IFR** VFR from IFR	1. **Flugstjórnarþjónusta til aðskilnaðar frá IFR** 2. **Upplýsingar um VFR- /VFR-loftför (ráðgjöf til að forðast árekstur að beiðni)** 1. Air traffic control service for separation from IFR; 2. VFR/VFR traffic information (and traffic avoidance advice on request)	**250 kt IAS undir F100** 250 kt IAS below F100	**Talstöð** Continuous two-way	**Já** Yes
D	IFR	**IFR frá IFR** IFR from IFR	**Flugstjórnarþjónusta.upplýsingar um VFR-loftför (ráðgjöf til að forðast árekstur að beiðni)** Air traffic control service including traffic information about VFR flights (and traffic avoidance advice on request)	**250 kt IAS undir F100** 250 kt IAS below F100	**Talstöð** Continuous two-way	**Já** Yes
	VFR	**Engin** Nil	**Upplýsingar um umferð milli IFR/VFR- og VFR/VFR-loftfara (ráðgjöf til að forðast árekstur að beiðni)** IFR/VFR and VFR/VFR traffic information (and traffic avoidance advice on request)	**250 kt IAS undir F100** 250 kt IAS below F100	**Talstöð** Continuous two-way	**Já** Yes
E	IFR	**IFR frá IFR** IFR from IFR	**Flugstjórnarþjónusta og upplýsingar um VFR-loftför eftir því sem við verður komið** Air traffic control service and traffic information about VFR flights as far as practical	**250 kt IAS undir F100** 250 kt IAS below F100	**Talstöð** Continuous two-way	**Já** Yes
	VFR	**Engin** Nil	**Upplýsingar um loftför eftir því sem við verður komið** Traffic information as far as practical	**250 kt IAS undir F100** 250 kt IAS below F100	**Engar** No	**Nei** No
F	IFR	**IFR frá IFR eins og við verður komið** IFR from IFR as far as practical	**Flugráðgjafaþjónusta** **Flugupplýsingaþjónusta** Air traffic advisory service; flight information service	**250 kt IAS undir F100** 250 kt IAS below F100	**Talstöð** Continuous two-way	**Nei** No
	VFR	**Engin** Nil	**Flugupplýsingaþjónusta** Flight information service	**250 kt IAS undir F100** 250 kt IAS below F100	**Engar** No	**Nei** No
G	IFR	**Engin** Nil	**Flugupplýsingaþjónusta** Flight information service	**250 kt IAS undir F100** 250 kt IAS below F100	**Talstöð** Continuous two-way	**Nei** No
	VFR	**Engin** Nil	**Flugupplýsingaþjónusta** Flight information service	**250 kt IAS undir F100** 250 kt IAS below F100	**Engar** No	**Nei** No