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SAFETY INVESTIGATION REPORT

Accident to the DIAMOND - DA42 - NG registered F-HIMY on 16 June 2022 at Courchevel

Time	Around 11:15[1]
Operator	Private
Type of flight	Instruction
Persons on board	Pilot and instructor
Consequences and damage	Aeroplane destroyed
This is a courtesy translation by the BEA of the Final Report on the Safety Investigation. As accurate as the translation may be, the original text in French is the work of reference.	

Runway overrun, collision with a bank, in mountain flight, in instruction

1 HISTORY OF THE FLIGHT

Note: The following information is principally based on statements, data downloaded from the engine computers (ECU) installed onboard the aeroplane and the recordings from the webcam and videosurveillance camera installed on the mountain airfield.

The pilot, accompanied by an instructor, took off from Lyon-Bron airport (Rhône) at around 10:30 bound for Courchevel mountain airfield in order to renew his access approval. While carrying out the reconnaissance overhead the mountain airfield, the pilot and instructor checked the windsock: the wind was from the north. The pilot flew away from the airfield and carried out two 360° holding patterns because of the traffic in the circuit before joining the right-hand base leg for runway 22. The pilot and instructor indicated having set the flaps to the landing position on final approach. The instructor explained that he felt a strong downdraft and took the controls. He retracted the flaps by one detent and progressively pushed the power levers to full deflection. He then completely reduced the power before wheel touchdown. The aeroplane touched down at around 170 m from the runway threshold. The instructor was unable to stop the aeroplane which continued its run into a bank at the end of the runway.

2 ADDITIONAL INFORMATION

2.1 Mountain airfield information

Courchevel mountain airfield is a restricted-use aerodrome. It has one runway oriented 22/04 measuring 536 m long; the threshold of runway 22 is situated at 6,371 ft. The profile of the runway is shown below:

[1] Except where otherwise indicated, the times in this report are in local time.

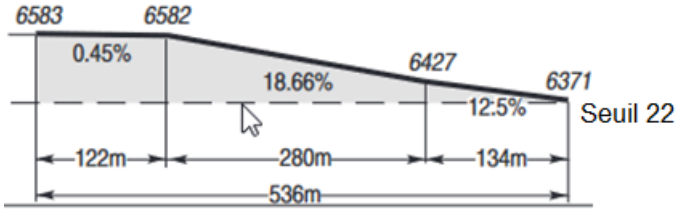
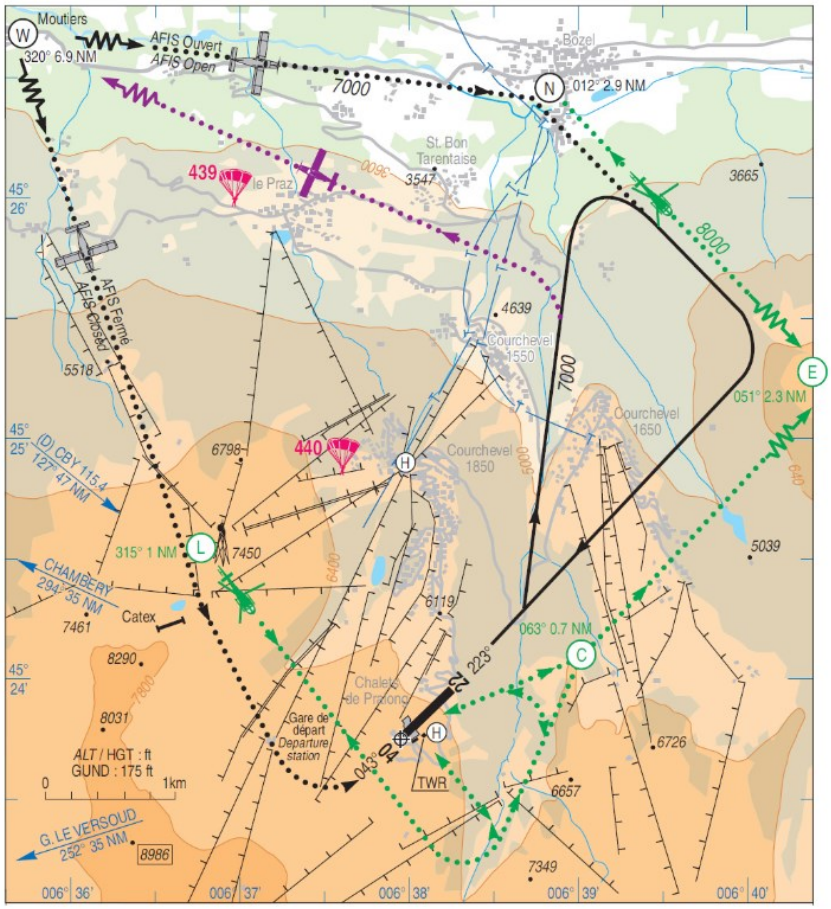


Figure 1: lengthwise profile of runway 04/22 at Courchevel taken from VAC

The AFIS was closed at the time of the accident. The VAC chart indicates that when the AFIS is closed, pilots should route from the west, fly abeam point L to set altimeter reference and then overhead the aerodrome, before flying away to join the right-hand base leg for runway 22 at 7,000 ft. This route allows pilots to carry out a visual reconnaissance of the airfield (wind, condition of runway, obstacles, etc.) before landing.



Source : SIA

Figure 2: excerpt from Courchevel mountain airfield VAC

2.2 Site and wreckage information

Braking marks started in the last meters of the slope at 18.66% and continued to the wreckage. Their direction and spacing showed that the aeroplane had slipped on turning left and continued its run until it struck the bank. It spun around before coming to rest at the bottom of the bank. The flaps were retracted at the time of the collision with the bank.

No anomaly which could have contributed to the accident was identified on the aeroplane.

Figure 3: photo of braking marks (on left) and of aeroplane (on right) (source: BEA)

2.3 Meteorological information

The meteorological conditions estimated by the French met office, Météo-France were:

- unstable air mass at the surface, with the onset of thermal lifts in the late morning, which may explain the moderate gusts;
- light turbulence;
- few clouds to cloudy with some cumulus from 8,000 ft;
- temperature 18°C.

The data from the Courchevel mountain airfield weather station indicated at 11:15, a northerly wind of an average value of 10 kt with gusts reaching 17 kt.

When flying overhead the runway, the instructor estimated the wind as coming from 020° and of around 10 kt, corresponding to a right tailwind during the landing on runway 22. This estimation was confirmed by an instructor pilot who had landed two minutes earlier. Furthermore, using the mountain airfield webcam images which showed the windsock situated on top of a platform, it was estimated that the wind was from 020° of 10 to 15 kt.

The pilot and instructor indicated that they felt strong gusts on final as well as on the ground after the accident.

2.4 Aircraft information

The DA42-NG is a low-wing, twin-engine aeroplane with a retractable landing gear able to carry four people.

Based on the weight and balance sheet completed by the pilot before the flight, the weight and balance were within the limits defined by the manufacturer. The weight at landing was 1,775 kg, for a maximum allowable weight of 1,900 kg.

The aeroplane flight manual indicates a landing speed at the maximum weight of 84 kt with the flaps in the landing position and 86 kt with the flaps retracted or in the approach position.

Given:

- a QNH of 1030[2], i.e. a pressure altitude of around 6,000 ft at the mountain airfield;
- an outside air temperature of 18°C;
- wind from 020° of 10 kt, i.e. a tailwind component of 9 kt;

the estimated landing run distances on a flat runway, for a weight of 1,805 kg, based on the flight manual, are the following:

Landing run distance		
	Temperature 18°C, pressure altitude 6,000 ft, no wind	With wind from 020° of 10 kt (i.e. a tailwind component of 9 kt)[3]
Landing flaps	440 m	572 m
Approach or retracted flaps	610 m	793 m

Table 1: estimated landing run distances based on flight manual

On a runway with an upward slope, the landing run distance is less. The French Mountain Pilots Association (AFPM) gives, for information purposes, the reduction coefficients to be applied to the landing run distance according to the value of the slope. For a slope of 20%, this coefficient is 0.5, i.e. a run distance divided by two.

2.5 Analysis of ECU data and webcam and surveillance camera video recordings

The aeroplane was equipped with two ECUs recording the engine parameters.

[2] Corresponding to the QNH estimated by the pilot when setting the altimeter reference.

[3] The flight manual recommends adding 10% to the landing distance per tailwind value of 3 kt, in the case here 30%.

2.5.1 Final approach

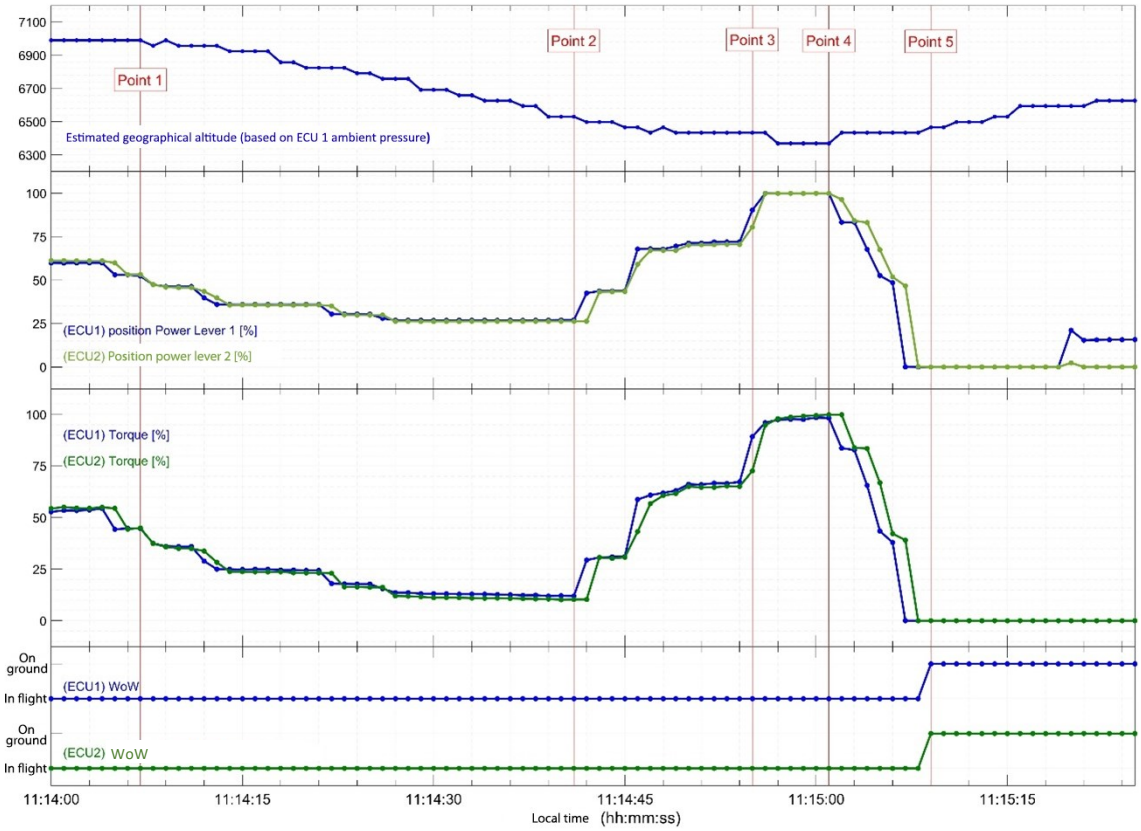


Figure 4: evolution of parameters recorded by ECUs

- At 11:14:07 (see *Figure **4***, Point 1), at an estimated altitude of 7,000 ft, the aeroplane was on the final approach and the pilot started the descent. In the following 20 s, the pilot continued to reduce power (position of power levers moved from 48% to 27%).
- Between 11:14:12 and 11:14:45, the aeroplane's average vertical speed was stable, estimated at -920 ft/min.
- From 11:14:40 (Point 2), the engine power increased.
- The aeroplane's altitude stabilized at around 6,400 ft from 11:14:45.
- From 11:14:55 (Point 3) to 11:15:01 (Point 4), the power levers were fully forward.
- From 11:15:01 (Point 4) to 11:15:07, the engine power was completely reduced.
- At 11:15:08 (Point 5), the aeroplane touched down on the runway at an estimated altitude of 6,470 ft.

The analysis of the video recording from the surveillance camera installed at the edge of the aerodrome revealed part of the final approach (see *Figure **5***).

Figure 5: photomontage of end of flight

2.5.2 Wheel touchdown and landing run

Based on the analysis of the video, the aeroplane's ground speed during the landing run, after wheel touchdown, was calculated (see Figure 6).

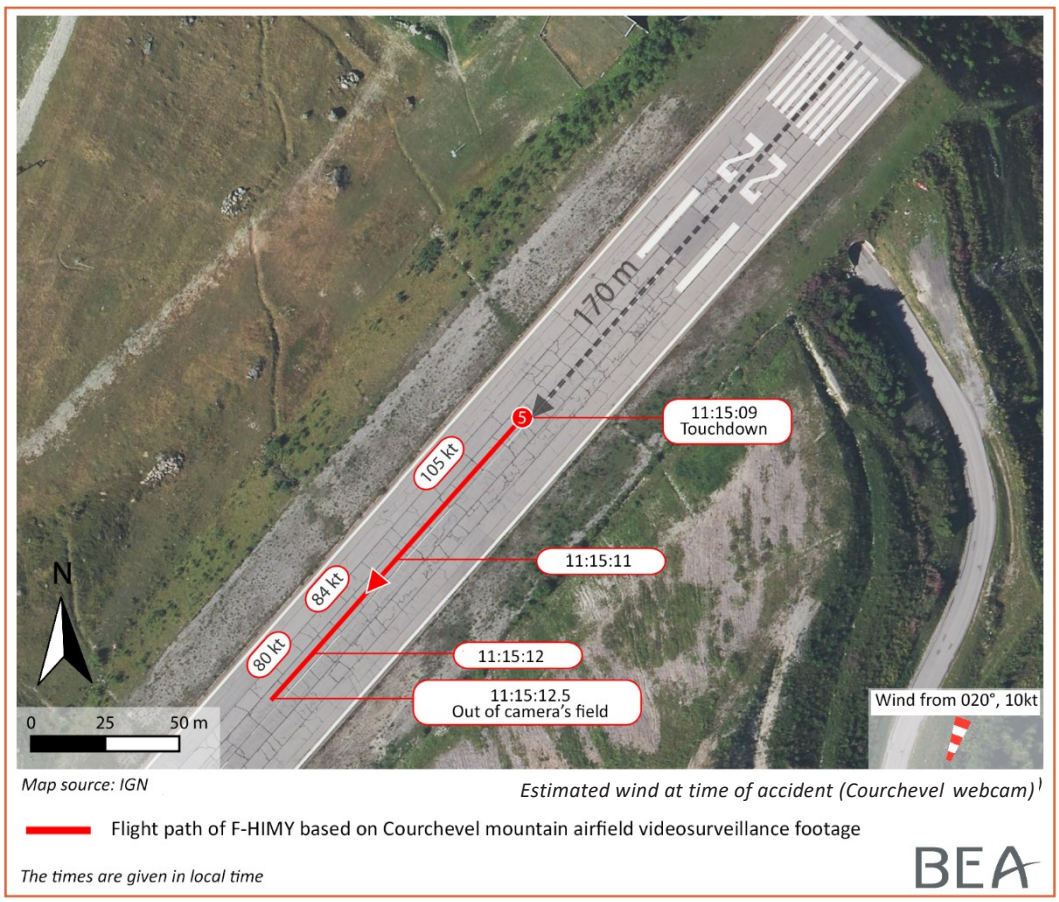


Figure 6: evolution of average ground speed during deceleration phase

The wheels touched down at an estimated distance of 170 m from the runway threshold, on the slope at 18.66%. The remaining runway distance at this point was approximately 360 m.

The average ground speed in the first two seconds after wheel touchdown is estimated at 105 kt[4]. Taking a tailwind component of 9 kt, this speed corresponds to an average airspeed for the aeroplane of 96 kt, i.e. an indicated airspeed of 85 kt in the altitude and temperature conditions at the time of the accident[5].

The analysis of the video shows that the flaps were not in the landing configuration on touchdown on the runway. The quality of the recording is such that it is not possible to determine if they are in the approach configuration or retracted. It is however certain that they were retracted from three seconds after wheel touchdown.

[4] With an accuracy of 5 kt.

[5] Given that the indicated airspeed is obtained using the airspeed increased by 1% for every 600 ft and every 5°C with respect to the international standard atmosphere (ISA).

2.6 Mountain rating and mountain airfield approval

2.6.1 Approval to use mountain airfields

The regulations[6] stipulate that in order to be approved to land on a given snow-free mountain airfield, the pilot must hold:

- the "wheel" mountain rating, or
- "wheel" access approval. The latter is issued by a Mountain flight Instructor (MI) following theoretical and practical training.

The pilot holding the access approval can only land on the given mountain airfield as pilot-in-command if s/he has carried out at least one landing as pilot-in-command in the previous six months. Failing this, the holder must carry out a training flight with an MI to renew her/his access approval.

2.6.2 Mountain rating

According to PART-FCL – FCL.815 of Regulation (EU) No 1178/2011 (known as "Aircrews"[7]), and the order of 21 June 2019[8] laying down the surfaces which require a mountain rating, the "wheel" mountain rating authorises aeroplane pilots to use snow-free mountain landing areas and mountain airfields. It is obtained after completing a theoretical course and flight training with a training organization and successfully passing a practical examination. It is valid for 24 months and is revalidated on condition that the pilot has carried out six mountain landings in this period or has successfully passed a flight proficiency check. These six landings can be carried out on any mountain landing area or mountain airfield. If the validity of the rating has expired, the pilot must successfully carry out a proficiency check to renew it.

The mountain rating is independent of the aeroplane type and class.

2.6.3 Mountain instructor

According to the Aircrews regulation[9], to be an MI, the pilot must hold an instructor rating - FI, CRI or TRI - with privileges for single-pilot aeroplanes, have followed a specific training course and hold a mountain rating.

Concerning the mountain specificity, the revalidation conditions are the same as those for the mountain rating described in paragraph 2.6.2.

The MI is authorised to certify the theoretical and practical training with a view to issuing or renewing a mountain airfield approval.

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[6] The order of 21 June 2019 setting out the conditions authorising access to mountain airfields (Version in force on the day of the accident).

[7] Commission regulation of 3 November 2011 laying down technical requirements and administrative procedures related to civil aviation aircrew (Version in force on the day of the accident).

[8] *Ibid.*

[9] PART-FCL – FCL.905MI.MI, 915MI.MI, 930.MI.MI.

2.7 Pilot and instructor information

2.7.1 Pilot information

The 60-year-old pilot held a valid aeroplane private pilot licence obtained in 2005 with a multi-engine piston rating obtained in 2006. He had logged approximately 2,700 flight hours, including approximately 1,700 h on the DA42 of which around 30 h in the previous three months. He had totalled 82 landings at Courchevel since 2012, including 80 landings on the DA42, the last landing being in July 2020. He did not have a mountain rating. He principally flew on F-HIMY which belonged to his family.

The purpose of the flight was to renew his access approvals for Courchevel and Megève mountain airfields.

2.7.2 Instructor information

The 75-year-old instructor held an aeroplane private pilot licence obtained in 1968 with “wheel” and “ski” mountain ratings obtained in 1971, the “wheel” and “ski” mountain instructor ratings obtained in 1971, FI, TRI, CRI, and instrument - multi-engine ratings along with various twin-engine ratings. All were valid on the day of the accident.

He had logged approximately 26,000 flight hours, around 1,000 h on the DA42 including 13 h in 2022.

His mountain flight experience in the previous two years consisted of:

- In 2021, several mountain flights including a total of around 60 landings, mainly on mountain airfields on the Piper PA-12, Jodel D140 and Jodel DR1050. One landing only at Courchevel in October.
- In 2022, on 21 May, he flew on the DR1050 which included nine landings on mountain airfields.

He indicated that the last time he had landed at Courchevel on the DA42 was several years ago. It was not possible to determine the date.

He also indicated that around 20 years previously, he had been employed as chief pilot for three winter seasons at Courchevel on the De Havilland DHC-6 Twin-Otter and operated between Geneva (Switzerland) and Courchevel.

2.8 Statements

2.8.1 Pilot’s statement

The pilot indicated that he followed the published flight path on the VAC on approaching Courchevel, and extended the flaps by one detent at point W at an altitude of 7,500 ft. After routing to point N, there were three aeroplanes ahead of him in the circuit and he decided to carry out two 360° holding patterns. He then joined the right-hand base leg for runway 22 before turning onto the final approach, keeping the flaps in the approach position. He took the top of the bank situated before the runway threshold as his aiming point. He remembered that during the final approach, the instructor called out that he was extending the flaps to the landing position. The pilot indicated that he increased the power to maintain the speed at 85 kt. The instructor took the

controls on short final, applied a lot more power and continued the landing. During the run, the pilot observed the aeroplane's excessive speed on the 18% slope and asked the instructor to brake.

2.8.2 Instructor's statement

The instructor explained that during the final approach, the pilot extended the flaps to the landing position. On short final, he felt a very strong downdraft. As they had gone past the "no-return point", he decided to continue the approach. He indicated that he took the controls, increased power and retracted the flaps by one detent to reduce drag. According to the instructor, the flaps were then in the approach position. He completely reduced power for the landing. The aeroplane ran very quickly on the slope, he braked and turned right to gain ground. At the end of the runway he turned left. The presence of an aeroplane at the holding point meant that he could not avoid the bank. The instructor specified that he completely retracted the flaps during the landing run.

3 CONCLUSIONS

The conclusions are solely based on the information which came to the knowledge of the BEA during the investigation.

Scenario

During the final approach to Courchevel mountain airfield with a tailwind of around ten knots, the instructor felt a strong downdraft and took the controls. As the aeroplane was in the landing configuration, he set the flaps to the approach position and then gradually increased engine power for around 15 s, significantly reducing the rate of descent. The engines reached maximum speed, which the instructor maintained for five seconds before starting to reduce power completely. The aeroplane touched down a few seconds later about 170 m from the runway threshold, with an average ground speed of about 105 kt. The instructor was unable to stop the aeroplane despite heavily braking. The aeroplane ran off the end of the runway and collided with the bank just beyond.

Contributing factors

The following factors may have contributed to the runway overrun and the collision with the bank:

- A non-stabilised final approach in the last thirty seconds, with a change of flap configuration and significant variations in power and flight path profile, which, combined with the weather conditions, led to a long landing.
- The decision to land with the flaps in the approach configuration, which increased the landing distance.
- The instructor's small amount of recent experience of mountain landings in twin-engine aircraft, particularly at Courchevel.

Safety lessons

Landing in a mountainous environment

Mountain landings require a special technique, given the constraints of the runway (size, slope) and the environment (altitude, terrain, aerology) and the fact that it is generally impossible to go around. In particular, a high level of rigour and precision in piloting is required during the execution of the approach. This means that the pilot must have precise knowledge of the aeroplane's characteristics and performance, and must assess and take into account the atmospheric and

aerological conditions, to enable her/him to decide whether or not to undertake the landing, and then once s/he is committed to the approach, to concentrate all her/his attention on closely keeping to the flight parameters.

Recent mountain experience

The recent experience conditions required to revalidate an instructor's mountain rating are identical to those for a pilot's mountain rating, i.e. six mountain landings, at any mountain landing area or mountain airfield, in the previous 24 months.

This rating, which can be obtained or revalidated on a single-engine piston class aeroplane, allows the pilot or instructor to land in the mountains with an aeroplane of a different type or class for which s/he holds the rating, without further training. However, the characteristics of aeroplanes can differ significantly, particularly between a single-engine and a twin-engine aeroplane: operational performance, configuration, procedures.

Maintaining recent mountain experience, by aeroplane type/class, is therefore fundamental to maintaining the level of technical skills required for a safe landing.