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Swiss Transportation Safety Investigation Board STSB

Final Report No. 2383

by the Swiss Transportation Safety Investigation Board

concerning the accident involving the
aircraft PA-28RT-201, G-BVDH,

on 25 August 2019

Simplon Pass, within the municipality of
Simplon (in the canton of Valais), Switzer-
land

General information on this report

This report contains the Swiss Transportation Safety Investigation Board's (STSB) conclusions on the circumstances and causes of the accident which is the subject of the investigation.

In accordance with Art 3.1 of the 12th edition, applicable from 5 November 2020, of Annex 13 to the Convention on International Civil Aviation of 7 December 1944 and Article 24 of the Federal Air Navigation Act on 21 December 1944 (status as of 1 May 2022), the sole purpose of the investigation of an aircraft accident or serious incident is to prevent accidents or serious incidents. The legal assessment of accident/incident causes and circumstances is expressly no concern of the investigation. It is, therefore, not the purpose of this investigation to determine blame or clarify questions of liability.

If this report is used for purposes other than accident prevention, due consideration shall be given to this circumstance.

The French version of this report constitutes the original and is therefore binding.

All information, unless otherwise indicated, relates to the time of the accident.

In this report, the masculine form is used for all natural persons irrespective of their sex, for reasons of protection of personality.

All times in this report, unless otherwise indicated, are stated in Local Time (LT), valid for the territory of Switzerland, which corresponded to Central European Time (CET) at the time of the accident. The relation between LT, CET and Coordinated Universal Time (UTC) is:

LT = CET = UTC + 2 hour.

Synopsis

Aircraft	PA-28RT-201	G-BVDH		
Operator	Private			
Owner	Private			
Pilot	British citizen, born 1968			
Licence	Private Pilot Licence Aeroplane (PPL(A) in accordance with European Union Aviation Safety Agency (EASA) and issued by the United Kingdom Civil Aviation Authority (UK CAA)			
Flying experience	total	361 h	during the last 90 days	15:10 h
	on type	183 h	during the last 90 days	15:10 h
Location	Simplon Pass			
Coordinates	121 443 / 646 490 (<i>Swiss Grid</i> 1903) N 46° 14' 34" / E 008° 02' 29" (WGS ¹ 84)	altitude	7364 ft AMSL ²	
Date and time	25 August 2019, 10:25			
Type of operation	Private			
Flight rules	Visual Flight Rules (VFR)			
Point of departure	Aerodrome Lausanne - La Blécherette, Switzerland (LSGL)			
Destination	Aerodrome Perugia, Italy (LIRZ)			
Flight phase	Cruise			
Type of accident	Loss of control in flight			
Injuries to persons				
Injuries	Crew	Passengers	Total of occupants	Third persons
Fatal	1	2	3	0
Serious	0	0	0	0
Minor	0	0	0	0
None	0	0	0	Not applicable
Total	1	2	3	0
Damage to aircraft	Destroyed			
Other damage	Light ground contamination by fuel and post-impact fire			

¹ WGS: World Geodetic System

² AMSL: Above mean sea level

1 Factual information

1.1 Background and history of the flight

1.1.1 General

The description of the background and the history of the flight is based on the flight plan submitted, the radar data and the data provided by Flightradar24³ and a collection of testimony of ground witnesses in the proximity of the accident site. Pictures taken by one of the passengers during the flight and shared with relatives on a social media were also used.

1.1.2 Background

The pilot had the intention to fly to Perugia, Italy, from North Weald airfield (EGSX), England, with a stop in Troyes, France and an overnight stay in Lausanne - La Blécherette, Switzerland, with two passengers on board his Piper PA-28RT-201 registered as G-BVDH.

On 13 August 2019, he performed a first flight planning for the entire journey to Perugia on his electronic tablet using the VFR flight planning and navigation software SkyDemon⁴. In the morning of 24 August 2019, the pilot took off with his two passengers from North Weald Airfield. After arriving in Lausanne - La Blécherette, where all three people spent the night in a hotel, the pilot filed his ICAO flight plan with Skydemon (see Figure 2). The pilot did not enter any altitude in item 15 of the ICAO flight plan but mentioned that the flight would be conducted under VFR (Visual Flight Rules).

The next day, approximately 2 hours prior to departure to Perugia, he amended the lateral planned route on his electronic tablet with additional waypoints to better fit the route to the natural path of the valley when crossing the Swiss Alps (see Figure 1).

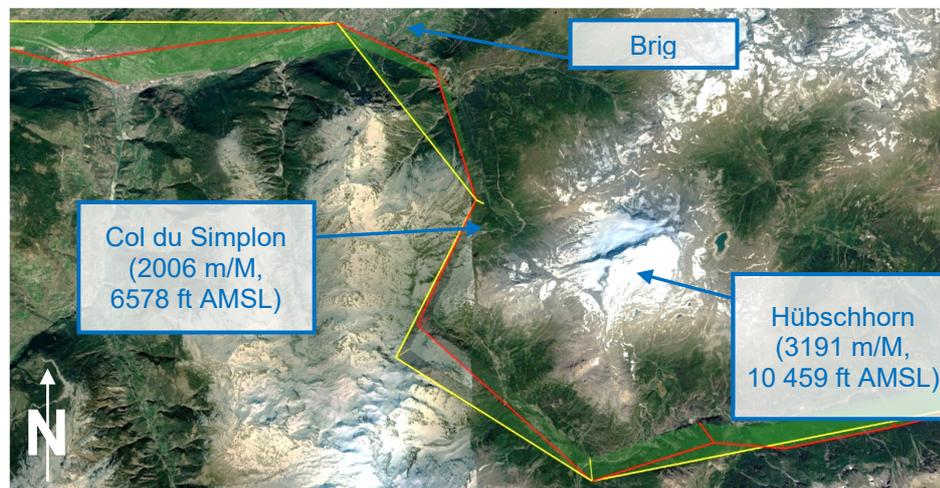


Figure 1: Planned routes across the Swiss Alps in the region of the Simplon Pass in Google Earth with altitudes in m/M and ft AMSL⁵. In yellow, the route planned on 13 August 2019 and, in red, waypoints as defined in the morning of 25 August 2019.

³ Flightradar24: Global flight tracking service providing real-time information of aircraft around the world.

⁴ Skydemon: VFR flight planning and in-flight navigation software.

⁵ AMSL: Above Mean Sea Level

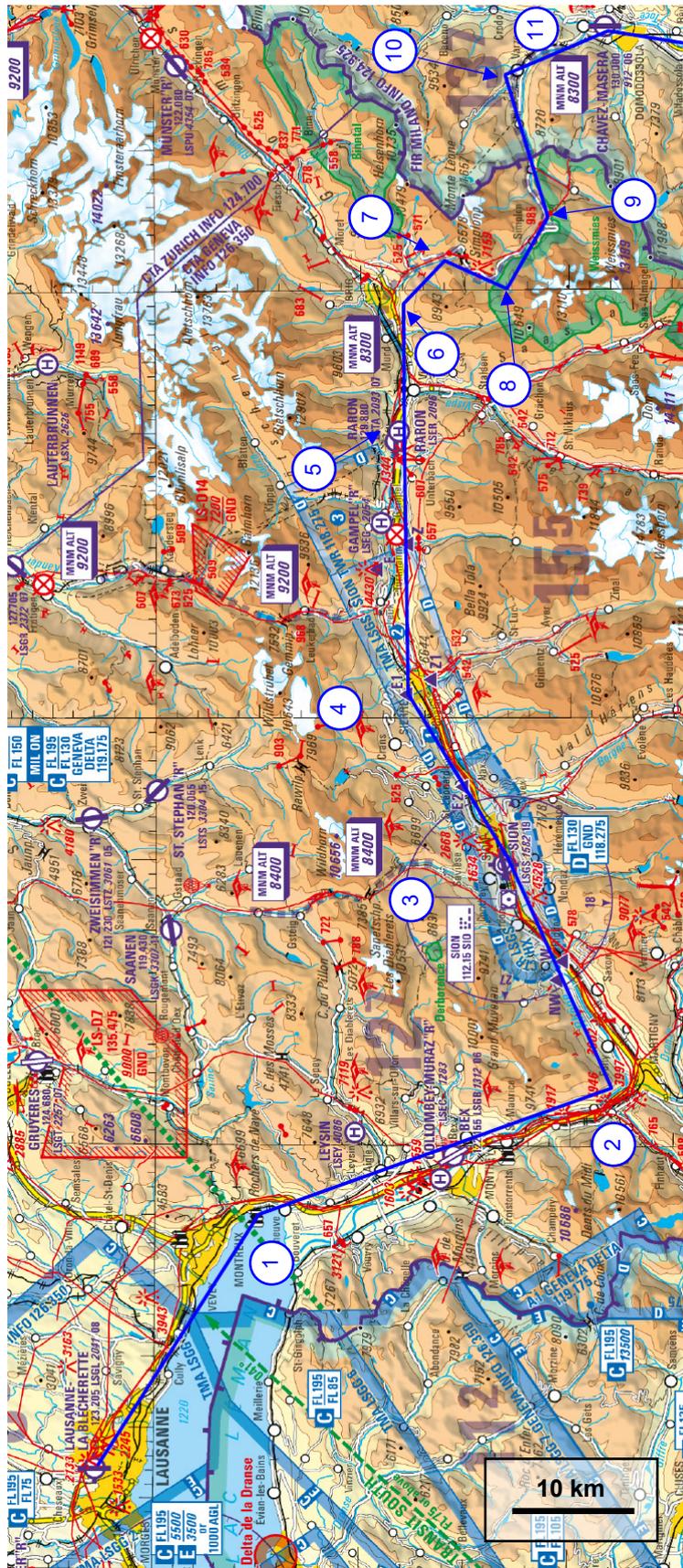


Figure 2: Extract of the planned route (waypoints 1-11) from the departure aerodrome, Lausanne – La Blécherette, to the intermediate navigation waypoint, the aerodrome of Chavez – Masera according the submitted ICAO flight plan and Illustrated on the ICAO 1:500 000 map of Switzerland. Source of map: Federal Office of Topography Swisstopo.

1.1.3 History of flight

On 25 August 2019, the single-engine piston, four seated Piper PA-28RT-201 took-off at 09:43 from Lausanne with three people on board. The pilot was seated on the front left-hand seat and two passengers were seated at the rear (see Figure 3).



Figure 3: Take-off of aircraft G-BVDH from the aerodrome of Lausanne at 09:43 on the day of the accident, with the pilot and two passengers on board. The paint scheme of the aircraft with the bottom of the fuselage in blue is clearly visible.

After take-off, the pilot joined the beginning of the Rhone Valley near Montreux, (see waypoint N°1 of Figure 2) at an altitude of 4100 ft AMSL. When approaching Martigny (see waypoint N°2) he maintained a shallow climb of about 100 ft/min with an indicated airspeed of 120 kt and navigated according to the planned route pre-programmed on his tablet (see Figure 4).



Figure 4: Picture taken from the right-rear passenger while approaching Martigny at the waypoint N°2 with a heading of 170° and an altitude of 4700 ft QNH⁶. The electronic tablet is fixed on the control wheel and is used by the pilot as a primary source of navigation. (1) depicts the current position of the aircraft, (2) is the location of the waypoint N°2, (3) represents the next active segment of the pre-programmed route to waypoint N°3 (see Figure 2). No clouds are visible in the Western Alps.

After having passed Martigny, the pilot contacted Sion Tower reporting an altitude of 5300 ft and requested to cross the Sion Airport control zone (CTR). He was

⁶ QNH: atmospheric pressure reduced to sea level, calculated with the values of the International Civil Aviation Organization (ICAO) standard atmosphere

cleared to do so and instructed to contact Sion Tower again when leaving the control zone. When he left the control zone, the air traffic controller told the pilot that he could leave the frequency and gave him the radio frequency of the local flight information service, Geneva information. No radio contact was established between the aircraft G-BVDH and Geneva information.

At 10:23 in the vicinity of Brig, with an altitude of 6100 ft AMSL and a ground-speed of 120 kt, the pilot turned right towards the Simplon Pass (6578 ft AMSL) with the intention to climb further into the valley.

At 10:25 witnesses near the Simplon Pass observed the G-BVDH flying at low height with a high pitch-up attitude and, subsequently, impacting the north-west face of the Hübschhorn (see figure 5 and 6).

All three occupants were fatally injured.

1.2 Description of the accident site

1.2.1 Information about the accident site

The accident site was located in a scree, approximately 1.5 km south-east of the Simplon Pass (2006 m or 6578 ft AMSL) on the steep north-west facing slope of the Hübschhorn (peak at 3190 m/M or 10 459 ft AMSL).

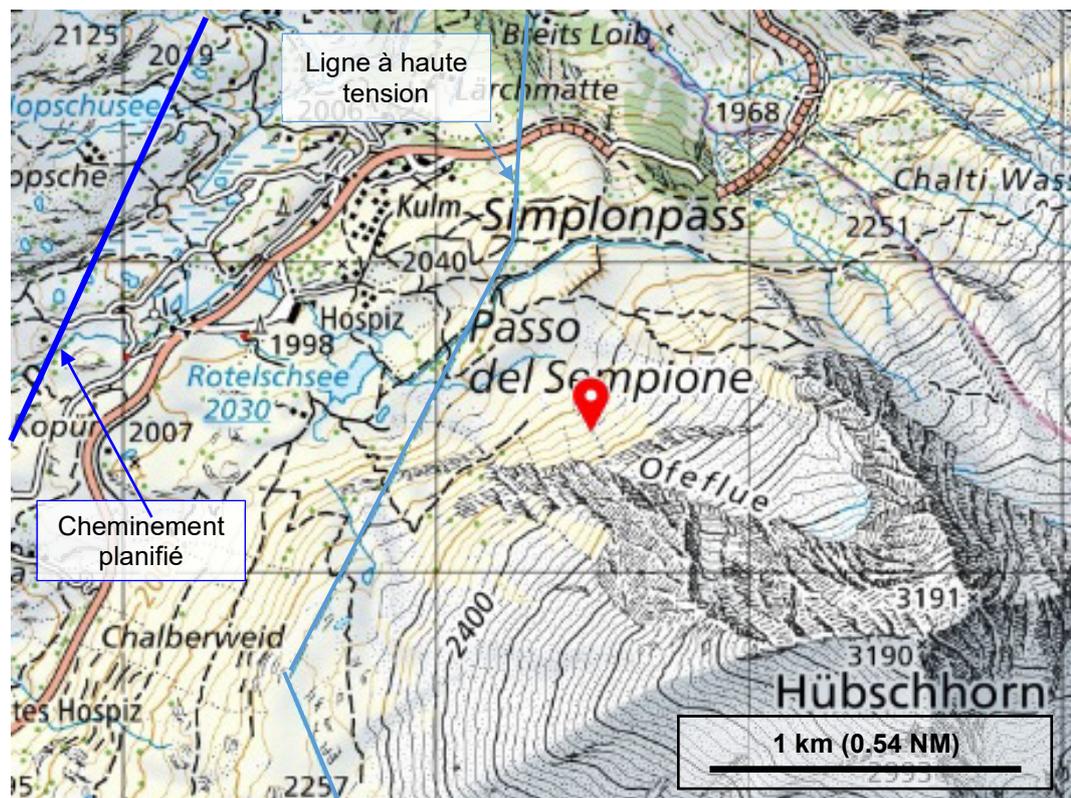


Figure 5: Location of the accident site at 2246 m (7364 ft AMSL) on the north-west facing slope of the Hübschhorn with terrain altitude indication in metres. Base map source: Federal Office of Topography Swisstopo.

1.2.2 Description of the wreckage

The single engine aircraft impacted with the terrain in an almost flat attitude, proceeding to slide downwards approximately 10 metres before reaching its final position. A post-impact fire occurred.

The following observations were made on the wreckage:

- The aircraft was laying flat on the ground.
- The post-impact fire destroyed the cabin and cockpit area; the engine compartment was severely damaged.
- The position of the elevator trim or a failure of the flight controls could not be identified.
- The T-tail assembly was still complete but uncoupled from the fuselage.
- Less damage was found on the right-wing tip in comparison with the left wing.
- The aircraft undercarriage was retracted.
- The flaps selector was in the retracted position.
- All documents on board including the aircraft logbook and AFM were destroyed by the post-impact fire.
- The propeller deformation induced by the impact demonstrate that the engine was delivering power.
- No Emergency Locator Transmitter was installed.
- The fire brigade had to decontaminate the ground for a light fuel spill.



Figure 6: View of the location of the impact with the ground (1) and the final position (2) of the aircraft G-BVDH, laying in a scree on the north-west face of the Hübsschhorn.

1.3 Aircraft information

Registration	G-BVDH
Aircraft type	PA-28RT-201 (« Arrow IV »)
Design	Light, four-seat single engine metallic aircraft, with a low wing, a T-tail empennage and retractable undercarriage.
Manufacturer	Piper Aircraft Ltd
Year of manufacture	1979
Engine	Design: four-cylinder, fuel-injected direct-drive, horizontally opposed, air-cooled piston engine Manufacturer: Lycoming Engines, USA Type: IO-360-C1C6 Power: 149 kW (200 HP) ⁷ at 2700 RPM ⁷
Propeller	Variable pitch, two-blade propeller Manufacturer: McCauley Type: B2D34C213
Emergency Locator Transmitter (ELT)	Not installed
Flight time	Aircraft : 4391: 24 h TSN ⁸ Engine : 124 h TSO ⁹
Mass and center of gravity	The values of the mass and center of gravity were within the prescribed limits of the aircraft flight manual – (AFM)
Fuel quantity	The fuel at departure was sufficient for the planned flight, with a reserve of 45 minutes at arrival
Maintenance	The last 50 h maintenance task was performed on 8 November 2018 at 4351:18 h TSN The last annual inspection was carried out on 23 March 2019 at 4373:06 h TSN
Technical restrictions	NIL

The aircraft's climb performance allowed it to cross the Simplon Pass.

1.4 Information concerning the pilot

1.4.1 Flight experience

The pilot obtained his PPL(A) license in January 2012 on board a Piper PA28 with a total flight time of 70 hours. A few days after passing his PPL(A) exam he started training to fly in Instrument Meteorological Conditions (IMC). Until August of the same year, he had accumulated more than 27 hours of flight time under Instrument

⁷ RPM: revolution per minute

⁸ TSN: time since new

⁹ TSO: time since overhaul

Flight Rules (IFR) and then decided to stop this training temporarily and continue to fly regularly in England with PA28 aircraft.

Between December 2014 and February 2015, he undertook training dealing with the qualification requirements for Retractable Undercarriage (RU) and Variable Pitch propeller (VP) to extend his privileges for the Piper G-BVDH. At the end of this training, he had accumulated a total of 6:42 hours on the G-BVDH and his total experience was over 179 hours. Since then, he only flew on this aircraft.

At the beginning of 2016 he resumed his instrument flight training with the aim of obtaining an Instrument Rating Restricted (IR(R)) which he then completed with a practical flight test (skill test) in September 2016 after an additional 10:36 hours of flight time performed under IFR conditions.

On 14 April 2017 he flew across the English Channel for the first time bound to Le Touquet-Côte d'Opale Airport (LFAT) in France. He returned to North Weald Airfield on 6 May 2017.

Between May 2017 and March 2018, the G-BVDH engine was overhauled, and the pilot did not fly.

His first flight after this interruption was conducted with an instructor on board.

Between June 15 and July 1, 2018, he undertook a trip from North Weald to Marina di Campo Airport (LIRJ) on the Isle of Elba, Italy. On the return flight he made an overnight stop in Lugano (LSZA), Switzerland. On 1 July he left Lugano and reached Reims airport (LFQA) in France, crossing for the first time the Simplon Pass from south to north. This flight was also the only crossing of the Alps until the accident flight. From Reims he continued his journey to North Weald.

On 24 September 2018, he renewed his IR(R) instrument rating by a practical flight test (proficiency check).

As of August 4, 2019, he had accumulated a total of 365 hours of flight time with over 61 hours flown under IFR.

No mention or certificate was found concerning a practical training dedicated to mountain flying.

1.4.2 Medical and pathological information

An autopsy was performed on the pilot's body. The cause of death was attributed to severe blunt trauma injuries.

Postmortem toxicological studies on specimens obtained from the pilot were performed. The tests were negative for alcohol and other substance.

The accident was not survivable.

1.5 Meteorological information

1.5.1 General weather conditions

The weather in Switzerland was influenced by a flat barometric ridge between an anticyclone centered over the Baltic Sea and an anticyclone centered over the Atlantic Ocean.

1.5.2 Weather at the time and place of the accident

The following information on the weather at the time and location of the accident is based on a spatial and chronological interpolation of the observations of various weather stations.

Weather/clouds	Sunny, no clouds
Visibility	70 km or more
Wind	020 degrees, 8 kt at 6560 ft AMSL
Temperature/dewpoint	15 °C / 11 °C
Atmospheric pressure (QNH)	1021 hPa (pressure reduced to sea level, calculated with the values of the ICAO ¹⁰ standard atmosphere)
Hazards	None

1.5.3 Astronomical information

Position of the sun	Azimuth 118°	Elevation 38°
Light conditions	Day	

1.5.4 GAFOR (General Aviation Forecast)

The content of a GAFOR message transmits forecasted weather conditions (visibility/ceiling) information for the main visual flight routes and is issued four times a day during the summer. The GAFOR comprises the route identification and the visibility forecast in kilometres and the ceiling forecast (cloud coverage of 5/8 and above). The detailed description of the GAFOR in French, German, English and Italian can be found in the “VFR Manual” for Switzerland.

According to the initial flight plan, the pilot planned a flight from Lausanne to Montreux, then flying along the Rhone valley to Brig and finally flying over the Simplon Pass before reaching Perugia. In reference to the GAFOR, the flight plan follows the VFR route N°40, which includes the segments N°41, 42, 43 and 44 indicated in Figure 7 and 8.

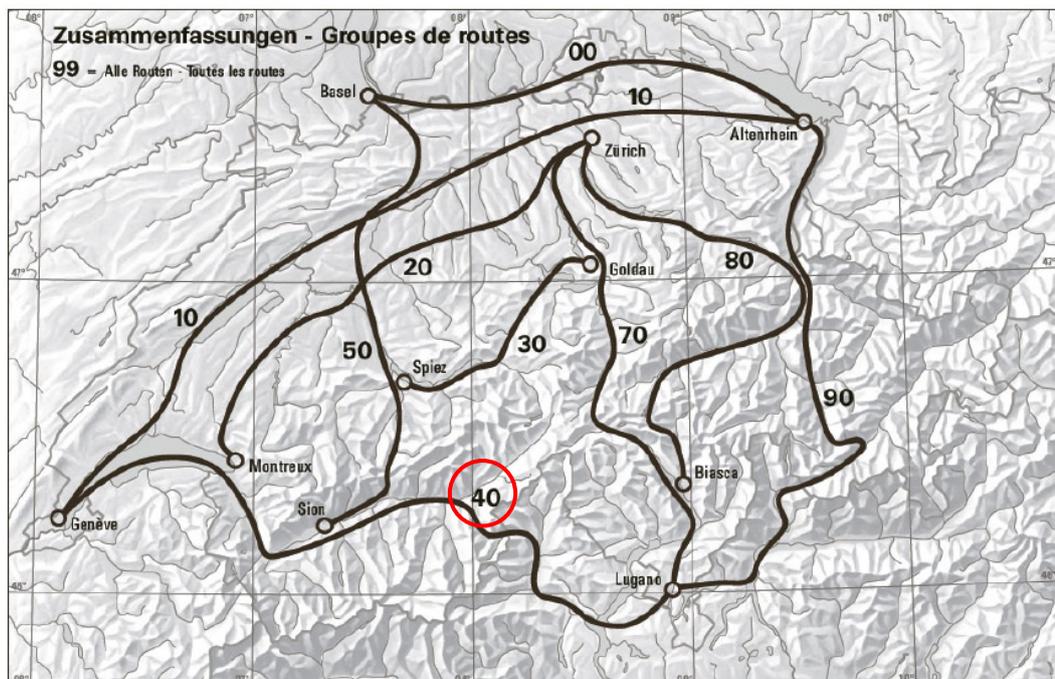


Figure 7: Network of the visual flight routes of Switzerland as published in the « VFR Manual ». The planned journey followed segments of route N°40.

¹⁰ ICAO: International Civil Aviation Organization

Between 08:00 and 14:00 the weather forecast for these VFR routes was showing a visibility greater than 8 km and a ceiling of 2000 ft or greater (see Figure 8). On route segment N°44, the highest obstacle is at 6800 ft AMSL as shown in the segment N°44 box (below). The minimum recommended altitude for a segment is obtained by adding 1500 ft (500 m) to the altitude of the highest obstacle, i.e. 8300 ft for route segment N°44. The recommended minimum altitude of 8300 ft is also shown on the ICAO 1:500 000 map in Figure 10.

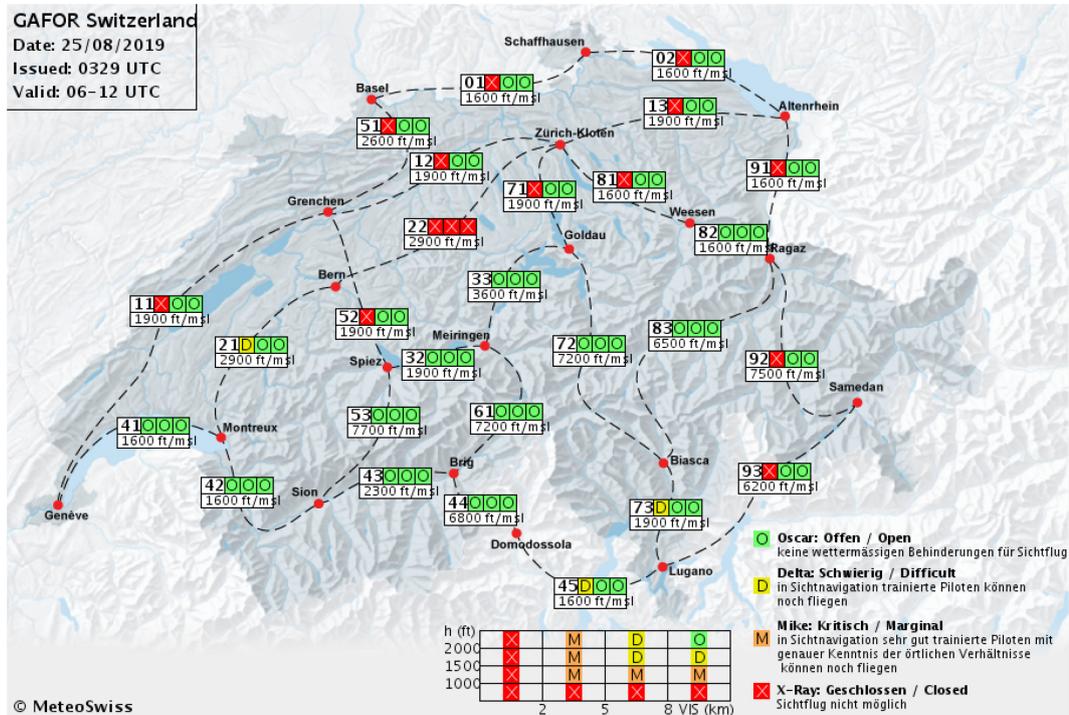


Figure 8: GAFOR issued on 25 August 2019, valid for the duration of the foreseen flight period. The VFR route N°40 is open (O).

1.6 Flight recordings

Due to the destruction of all electrical equipment on board of the aircraft by the fire and the nature of the local topography, the only available flight data were collected from Flightradar24.

As shown below and in Figure 1, the pilot last amended his route 2 hours prior to departure from Lausanne - La Blécherette by adding waypoints in the vicinity of the Simplon Pass. Both routes in SkyDemon were planned by the pilot at an altitude of 15 900 ft. The altitude at which the aircraft was recorded by Flightradar24, as well as the planned altitudes, are depicted in the Google Earth picture below. The last recorded altitude of the aircraft in the vicinity of Brig was approximately 6100 ft AMSL. An average ground speed of 120 kt and a rate of climb of about 100 ft/min were recorded during the shallow climb from Montreux to Brig.

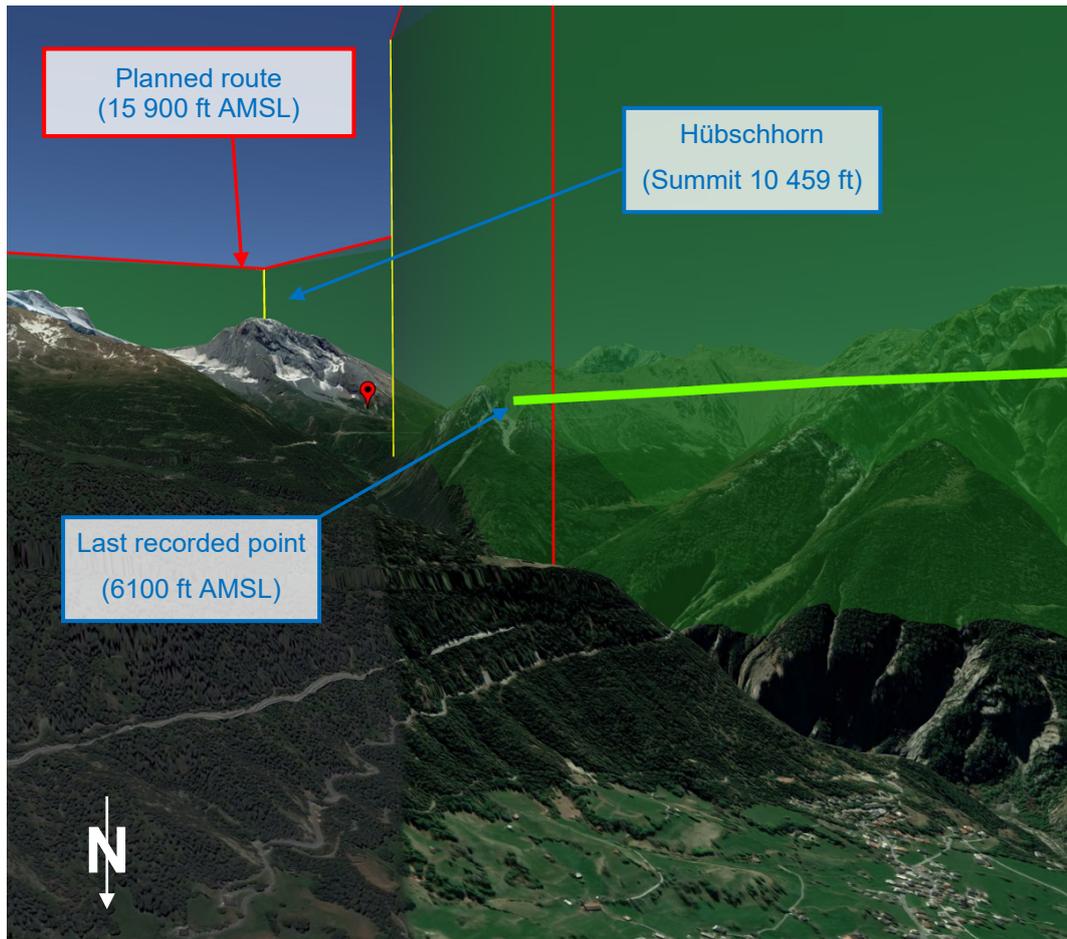


Figure 9: Google Earth view from the vicinity of Brig of the recorded flight path (green) and the planned routes (yellow, first planned route; red, last amended route 2 hours prior to departure). Both routes have been planned at an altitude of 15 900 ft AMSL. The recorded flight path indicates a last altitude of approximately 6100 ft at 10:23 when entering the Simplon valley. Due to geographical constraints the flight path has not been recorded further towards the Simplon Pass. The location of the impact at an altitude of 7364 ft is shown with a red marker below the Hübschhorn.

1.7 Fight reconstruction

Thanks to the data collected, the flight path from Brig to the accident site of the aircraft could be reconstructed during a flight 10 days after the accident. Pictures taken during this flight are shown below (see Figure 10 and Table 1).

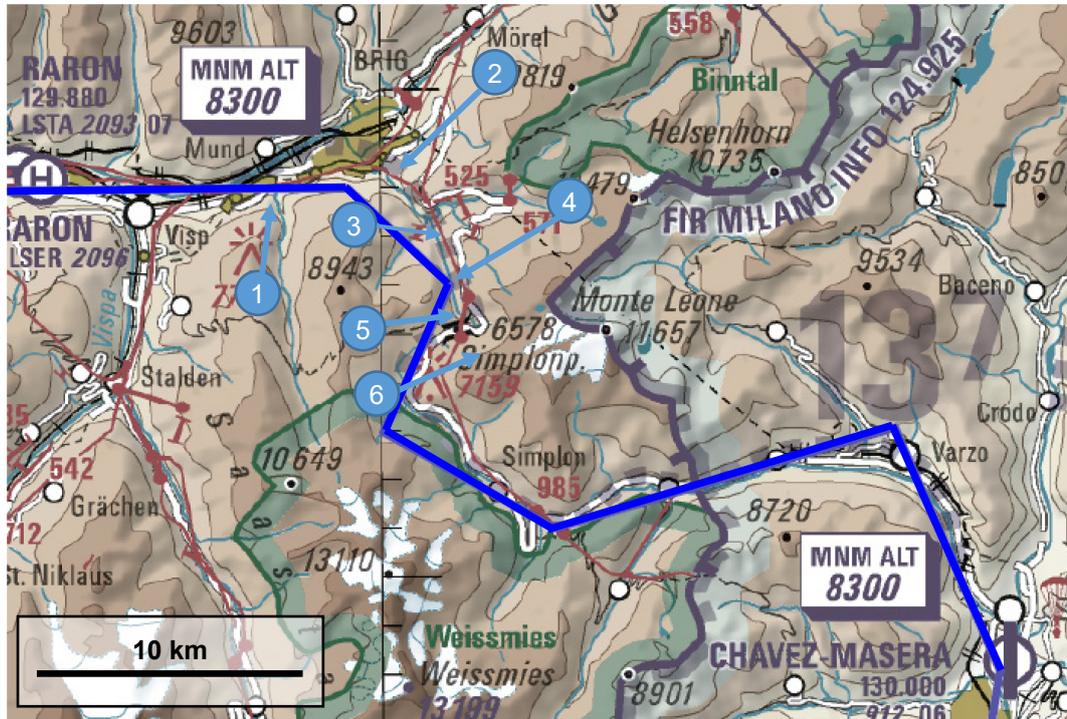
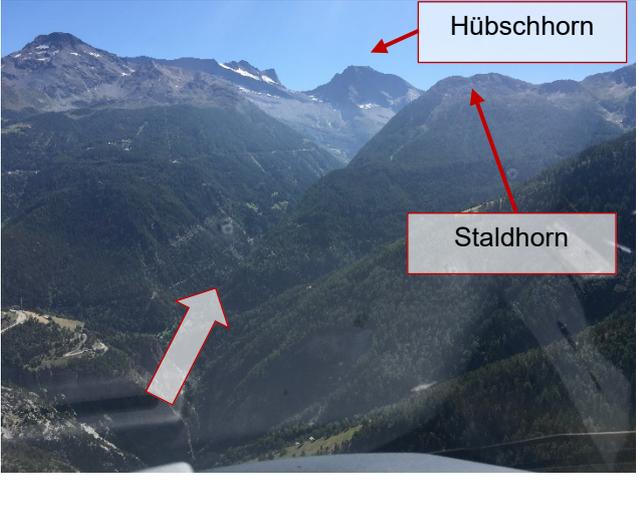


Figure 10: Last segments of reconstructed flight from Brig (Valais) to the impact location near the Simplon Pass with markers indicating the position from where the pictures were taken. The blue line represents the planned route according the filed OACI flight plan. The minimum recommended safe altitude for the route segment 44 is 8300 ft AMSL, as depicted in the violet box. Base map source: Federal Office of Topography Swisstopo.

N°	Observations	Pictures
1	<p>Altitude : 6000 ft</p> <p>Heading : 090°</p> <p>Distance to impact : 6 NM</p> <p>Observations</p> <ul style="list-style-type: none"> - Left : city of Brig - Right : start of the Simplon Valley 	
2	<p>Altitude : 6100 ft</p> <p>Heading : 170°</p> <p>Distance to impact : 5 NM</p> <p>Observations</p> <ul style="list-style-type: none"> - Entrance of Simplon Valley - Hübschhorn summit, 10 466 ft - Simplon Pass located behind Staldhorn (8072 ft) 	
3	<p>Altitude : 6500 ft</p> <p>Heading : 170°</p> <p>Distance to impact : 3.0 NM</p> <p>Observations</p> <ul style="list-style-type: none"> - Impact location, 7364 ft (red dot) - High voltage power lines (blue) 	

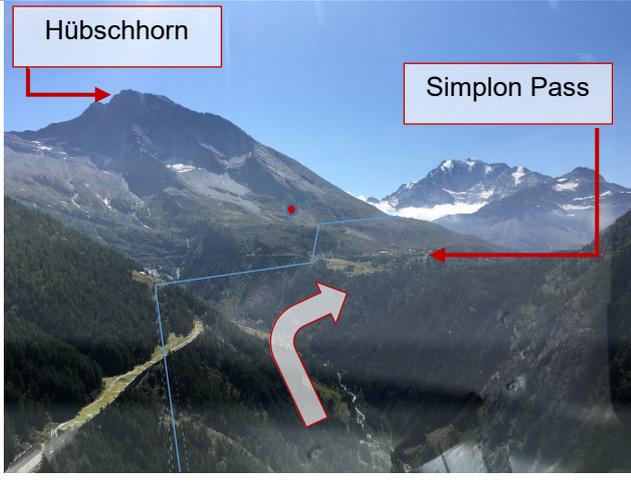
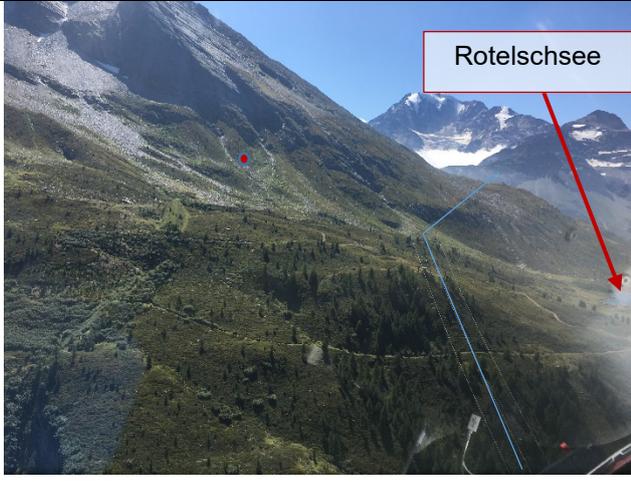
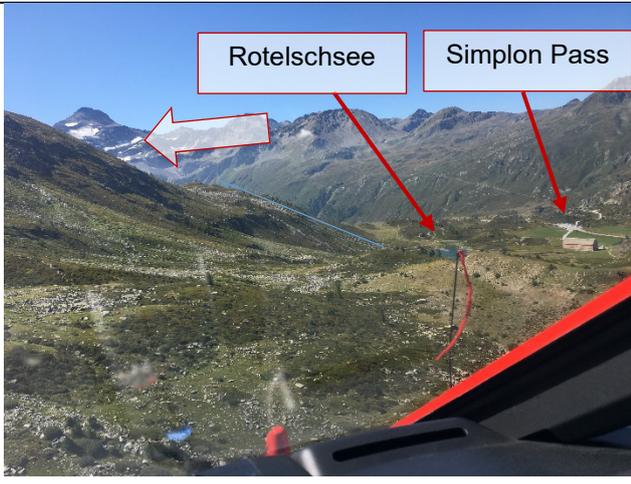
N°	Observations	Pictures
4	Altitude : 6600 ft Heading : 170° Distance to impact : 1.5 NM Observations - Simplon Pass, 6578 ft - Impact location, 7364 ft - High voltage power lines	
5	Altitude : 7100 ft Heading : 190° Distance to impact : 0.3 NM Observations - Impact location, 7364 ft - High voltage power lines - Rotelschsee, 6656 ft	
6	Altitude : 7400 ft Heading : 270° Distance to impact : 0 NM Observations - Simplon Pass, 6578 ft - Rotelschsee, 6656 ft - High voltage power lines	

Table 1: Pictures taken during the reconstruction flight. All altitudes are given in ft AMSL.

1.8 Expertise of the engine

The expertise of the engine was limited to some parts only due to severe damage resulting from the impact and the post-impact fire of the aircraft (see Figure 6). The engine accessory box was partly destroyed. All auxiliary units, the oil carter and the lower casing were destroyed.

The checking of igniters, exit ducts, cylinder injection nozzles and the oil filter did not reveal any malfunction of the engine before the accident.

1.9 Ground witnesses

Moments before the impact of the G-BVDH with the terrain, two different groups of people were hiking in the vicinity of the Simplon Pass. Their exact position at that time is shown in the figure below.

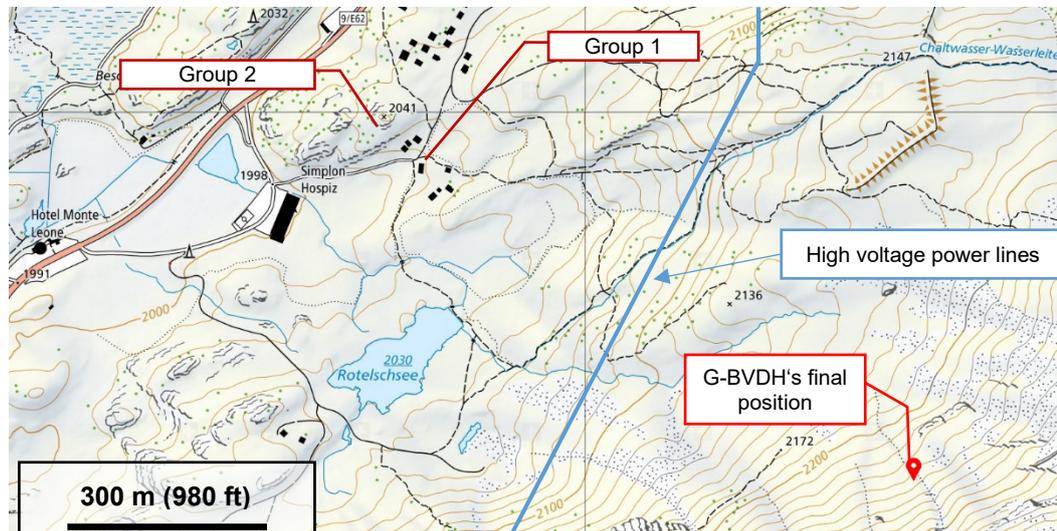


Figure 11: Position of the wreckage and the location of the two hiking groups. Source of map, Federal Office of Topography Swisstopo.

One of the hikers belonging to group 1 observed the Piper aircraft flying at low height and decided to take some pictures.

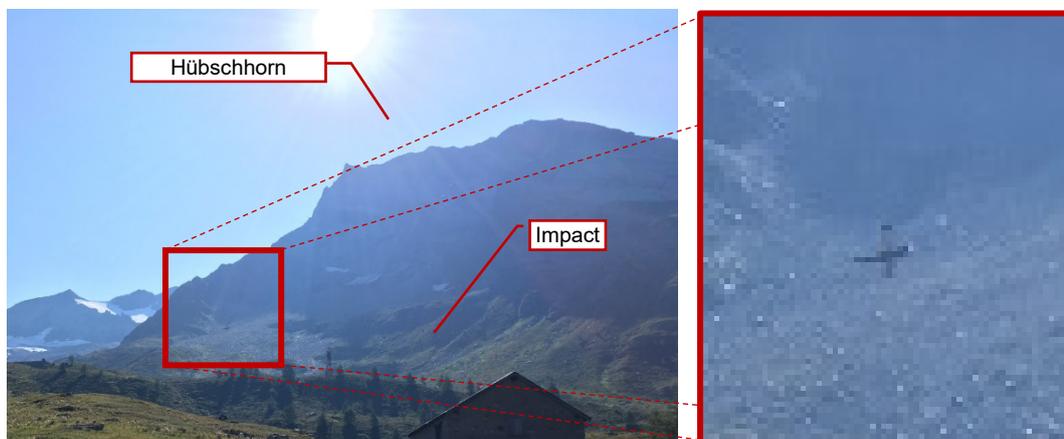


Figure 12: View from group 1 of G-BVDH a few seconds before the impact.

The photo taken by this hiker shows the aircraft in a nose-up position. From the paint scheme of the aircraft, with the lower fuselage in blue (see Figure 3), it can be determined that the aircraft is banking heavily to the left.

A hiker from group 2 took a picture a few seconds after the collision of the G-BVDH with the terrain. A post-impact fire was visible with rising grey smoke.

1.10 Flight training for PPL(A) obtention in Switzerland

The training syllabus for the PPL(A) according to EASA¹¹ does not foresee any training dedicated to mountain flying. However, this flight technique requires the acquisition of a specific know-how which, for example in Switzerland, is generally acquired in two distinct navigation sections of the PPL(A) syllabus carried out at different stages of progression and includes at least two mountain flights. These two mountain navigation flights are performed with the help of visual references and part of the training is to plan two flights that cross the Alps in different directions. These two exercises, generally, include basic mountain navigation, crossing alpine passes at recommended minimum safe altitudes, as indicated on the ICAO 1:500 000 map, calculation of the point of climb and descent and dealing with specific phenomena encountered in the alpine environment.

1.11 Description of Skydemon's terrain Alerting Features

The Skydemon application offers terrain alert functionalities in the planning mode and during flight tracking (navigation), which can be used as a navigation aid. However, it is important to note that such applications are not certified to be primary means of navigation. The basic principle of VFR is to follow the planned route visually with the official published maps of each area to be flown over, such as with the ICAO 1:500 000 map.

When a cruising altitude is set during flight planning, Skydemon displays at the bottom of the main map the planned vertical profile according to the waypoints. For example, at a selected flight altitude of 15,900 ft, the vertical profile meets no obstacles on the established path on 13 August 2019. However, if an altitude of 6500 ft is selected, similar to the one last recorded at the beginning of the Simplon Valley, the vertical profile intersects the terrain around the Simplon Pass (see Figure 14).

Another feature called "Colour High Terrain", available in both planning and navigation mode, is an easy way to view valleys and passes. When a reference elevation is set in planning mode, SkyDemon adds colour to the terrain on the main map according to that elevation as follows:

- Terrain above 500 ft below: bright red,
- Terrain between 500 - 1000 ft below: orange,
- Terrain between 999 - 1500 ft below: yellow
- Terrain below 1500 ft: shaded in light green

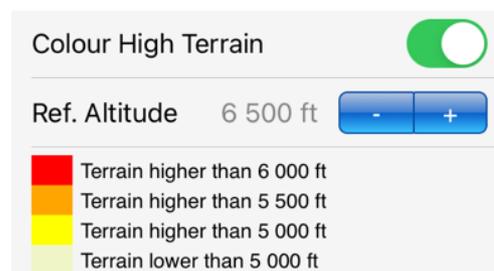


Figure 13: Explanation and visualisation of the terrain colouring according to the selected reference altitude at 6500 ft.

This feature must be selected by the user in order for it to be available. In the selection menu, an image explains the colouring of the terrain according to the

¹¹ Obtaining a PPL(A): Obtaining a PPL(A) in Switzerland is regulated by EASA for aircrew in Annex I (FCL part) of Regulation (EU) No. 1178/2011, FCL.200 to 205 and FCL. 205.A to FCL.210.A. The flight training of a PPL(A) must also meet the requirements of the Acceptable Means of Compliance (AMC), AMC1 FCL.210, in which the proposed syllabus considers a reference list with about 24 practical exercises as a sequential instruction guide. In Switzerland, the Federal Office of Civil Aviation (FOCA) has decided to add two mandatory mountain flights to the basic training for the PPL(A).

reference altitude (see Figure 14). The rendering of the "Colour high terrain" mode on the main map is shown in Figure 15.

In flight, the reference altitude of the "Colour high terrain" mode is also available and the current GPS altitude is used as reference altitude.

These features were available at the time of the accident.

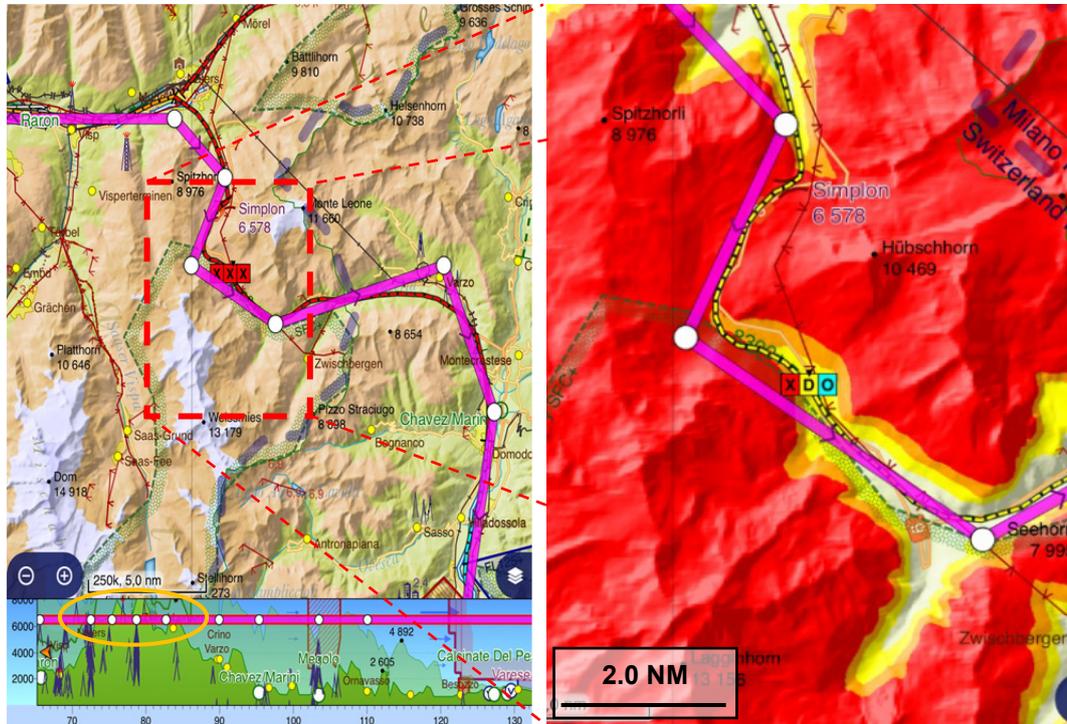


Figure 14: View of the planned flight path (magenta) on 13 August 2019 in the Skydemon application. The lower part of the image on the left shows the vertical profile of the planned flight (magenta) at 6500 ft and the terrain flown over (green). The vertical profile intersects the terrain around the Simplon Pass (orange circle). On the right, visualisation of the Simplon Pass surroundings with the "Colour high terrain" feature activated at an altitude of 6500 ft.

2 Analysis

2.1 Technical aspects

The investigation did not reveal any technical element that could have affected or caused the accident.

2.2 Human and operational aspects

To establish his navigation flight plan, the G-BVDH pilot used the Skydemon software installed on his electronic tablet. After a first version of the flight plan on 13 August 2019, the pilot modified it on 25 August 2019, 2 hours prior to the departure from Lausanne-La Blécherette Regional Airport. The change consisted in modifying the crossing of the Alps in order to better adapt the lateral trajectory to the mountainous terrain of the Simplon Valley. In Figure 1, the difference between the two planned routes is illustrated. The choice of the path and its lateral adjustment demonstrate that the lateral planning performed by the pilot was appropriate for the intended flight.

However, for some undetermined reason the pilot never planned a flight altitude, as it remained unchanged at an altitude of 15,900 ft throughout the flight. The introduction of a cruise altitude appropriate for the flight also allows visualisation of a potential collision with terrain using the Skydemon application (see Figure 14) during flight planning. The picture in Figure 3, taken in flight by the backseat passenger, shows that the "Colour high terrain" functionality was not activated, and therefore the visualisation of a risk of collision was not available in flight either.

From Montreux (waypoint N°1 in Figure 2) to Brig (waypoint N°6) the lateral trajectory of the G-BVDH aircraft indicates that the pilot followed precisely his pre-programmed path on his electronic tablet. His ground speed remained stable at about 120 kt and the rate of climb was only about 100 ft/min as shown in Figure 3. These flight parameters brought him after 20 minutes of flight from Martigny to an altitude of 6100 ft AMSL at the entrance of the Simplon Valley, about 2200 ft below the minimum safe altitude recommended on the ICAO chart.

This lack of anticipation on the management of the flight altitude, generated a climb with a pronounced nose-up attitude in the Simplon valley during the last 5 NM which corresponds to a flight duration of approximately 2 min 30 sec. With the configuration of the dashboard of a PA28, this nose-up attitude consequently also increased the difficulty to see the ground on its trajectory. This lack of visibility led him to fly low over the Simplon Valley power line and prevented him from anticipating a possible turn around to adapt his flight tactics.

Once he reached the Simplon Pass, he induced a right turn to follow the natural path of the valley. At this point the critical angle of attack was exceeded and the left wing stalled. The aircraft crashed into the scree on the north-west flank of the Hübschhorn without the pilot being able to recover the aircraft due to a lack of height.

In view of the above, it appears that the flight tactics applied for the crossing of the Simplon Pass were not adequate.

In all likelihood, the pilot was absorbed by his flight path on his electronic chart and this coupled with both a lack of training and experience in mountain flying, were obstacles in realising the dangers associated with this type of flight.

3 Conclusions

3.1 Findings

3.1.1 Technical aspects

- The aircraft fulfilled the requirements for flying under VFR.
- Both values of mass and centre of gravity of the aircraft were within the limits of the aircraft flight manual (AFM) at the time of the accident.
- There is no evidence of pre-existing technical defects that could have caused or influenced the accident.
- The last 50 h check was carried out on 8 November 2018 at 4351:18 TSN.
- The annual check was performed on 23 March 2019 at 4373:06h TSN.
- The engine had about 126 hours of operation since the overhaul.
- No Emergency Locator Transmitter (ELT) was installed.

3.1.2 Pilot

- The pilot held the necessary licences for the flight.
- There is no evidence of health or fatigue-related adverse effects on pilot during the flight.
- The pilot had a good level of experience with the PA-28RT-201 aircraft.
- The pilot was lacking appropriate training in mountain flying.

3.1.3 Flight planning

- The pilot adequately prepared the lateral navigation of his route from Lausanne-La Blécherette (LSGL) to Perugia (LIRZ) using the Skydemon application installed on his electronic tablet.
- The pilot planned his route between Lausanne - La Blécherette Regional Airport and Perugia Regional Airport for the first time on 13 August 2019.
- The pilot had initially planned to follow the Rhone Valley to Brig, then cross the Alps to Italy via the Simplon Pass.
- The pilot did not plan a flight altitude in the Skydemon navigation software and kept a default altitude of 15,900 ft.
- According to the documents obtained, the pilot had limited experience in mountain flying and never received practical training for this type of flight.
- The pilot filed an ICAO flight plan for the planned route one day prior to the accident.
- The pilot did not enter any altitude in item 15 of the ICAO flight plan but mentioned that the flight would be conducted under VFR (Visual Flight Rules).
- The pilot modified his waypoints in the Skydemon software in the Simplon Pass area 2 hours before his departure from Lausanne-La Blécherette in order to better adapt his lateral trajectory to the mountainous relief of the valley.

3.1.4 History of the accident

- The single-engine, four-seat Piper PA-28RT-201, registration number G-BVDH, took off from Lausanne at 09:43 with the pilot and two passengers on board.
- The pilot followed his pre-programmed path in flight using the Skydemon application installed on his electronic tablet that was attached to the aircraft's control wheel.
- The last radar reading recorded in Flightradar24 at 10:23 in the vicinity of Brig indicated an altitude of 6100 ft AMSL, which is 2200 ft below the recommended altitude for the chosen route.
- The pilot entered the incised valley at a low altitude and in climbing flight path, with few possible changes of trajectory.
- In order to cross the Simplon Pass, the pilot had to initiate a steep climb with a nose-up attitude.
- When the pilot tried to reach the Simplon Pass by initiating a right turn, the left wing stalled, and the pilot was not able to recover the aircraft.
- Eyewitnesses in the vicinity of the Simplon Pass observed G-BVDH flying at low altitude with a nose-up attitude and a left roll before it finally collided with the terrain.
- The wreckage was located at an altitude of 7364 ft AMSL on the north-west flank of the Hübschhorn (10 459 ft AMSL).
- The occupants were fatally injured, and a post-impact fire broke out.

3.1.5 General conditions

- The weather had no influence of the accident occurrence.
- The EASA does not require specific training for mountain flying to obtain a PPL(A).

3.2 Causes

In order to achieve its objective of prevention, a safety investigation authority shall express its opinion on risks and hazards that have been identified during the investigated incident and which should be avoided in the future. In this sense, the terms and formulations used below are to be understood exclusively from the perspective of prevention. The identification of causes and contributory factors does not, therefore, in any way imply assignment of blame or the determination of administrative, civil or criminal liability.

The accident, in which the pilot lost control of the aircraft at low altitude and collided with the ground, was due to a lack of anticipation in the management of the flight climb, which caused the stall.

A lack of training and experience in mountain flying contributed to the accident.

The investigation was unable to determine why the pilot flew into the Simplon Valley at an altitude of 2200 ft below that recommended on the ICAO 1:500 000 map.

4 Safety recommendations, safety advice and measures taken since the accident

4.1 Safety recommendations

None

4.2 Safety advice

The STSB may publish safety advice in response to any safety deficit identified during the investigation. Safety advice shall be formulated if a safety recommendation in accordance with Regulation (EU) No. 996/2010 does not appear to be appropriate, is not formally possible, or if the less prescriptive form of safety advice is likely to have a greater effect. The legal basis for STSB safety advice can be found in article 56 of the OSITI:

“Art. 56 Information on accident prevention

The STSB may prepare and publish general information on accident prevention.”

4.2.1 Preparation for flying through mountain passes

4.2.1.1 Safety Deficit

During a private flight by a foreign-registered aircraft, the four-seater aircraft entered the valley leading to the Simplon Pass through Brig at an altitude of 2200 ft below the minimum safe altitude for flying through the pass. The flight continued with a low rate of climb and a nose-up attitude throughout the approach to the pass.

The pilot did not notice that the plane's speed was decreasing while he was busy navigating with his electronic tablet. The Simplon Pass was on his right when the aircraft eventually stalled.

The collision with the mountainside occurred at an altitude of 7364 ft AMSL; the pass was at an altitude of 6578 ft AMSL.

The three occupants were fatally injured, and a post-impact fire broke out.

The investigation determined that preparations were made for the flight with the aid of an electronic tablet and that the pilot followed the path of his tablet during the approach to the Simplon Pass.

4.2.1.2 Safety Advice N° 45

Target group: General aviation operators in Europe

General aviation operators in Europe should emphasise the dangers of navigating through mountain passes and adapt flight tactics according to the predefined flight plan. For mountain flights, many recommendations on safety measures such as flight tactics, flight plan and equipment can be found in the VFR manual under rules of the air and air traffic services (RAC) 4-5-2, 4-5-3.

4.3 Measures taken since the accident

None

This final report was approved by the Board of the Swiss Transportation Safety Investigation Board STSB (Art. 10 lit. h of the Ordinance on the Safety Investigation of Transportation Incidents of 17 December 2014).