Contents

A1. Factual information

A1.18 Additional information

A1.18.1 Flight over the Segnespass in 2013

Three photographs taken from HB-HOP were available from a flight over the Segnespass on 6 July 2013. Figure 1 shows a flight past the Martinsloch. On board HB-HOP for this flight was the same crew as on the accident flight in HB-HOT on 4 August 2018.

Figure 1: The second of three photographs taken from HB-HOP on 6 July 2013 during a flight past the Martinsloch (red circle).

By photogrammetrically analysing these three images, the geographical position with the corresponding flight altitude was recorded as a data point (P) and the respective pitch attitude (PA) and bank attitude (BA) of the aircraft relative to a horizontal reference line were determined. The straight segments of the red line between the points represent the reconstructed flight path. The blue extension of the flight path was drawn starting from point P 3 based on the bank attitude at this position and assuming a constant flight altitude (see figures 2 and 3).

There are striking parallels between the flight past the Martinsloch on 6 July 2013 and the accident flight (see figure 4).

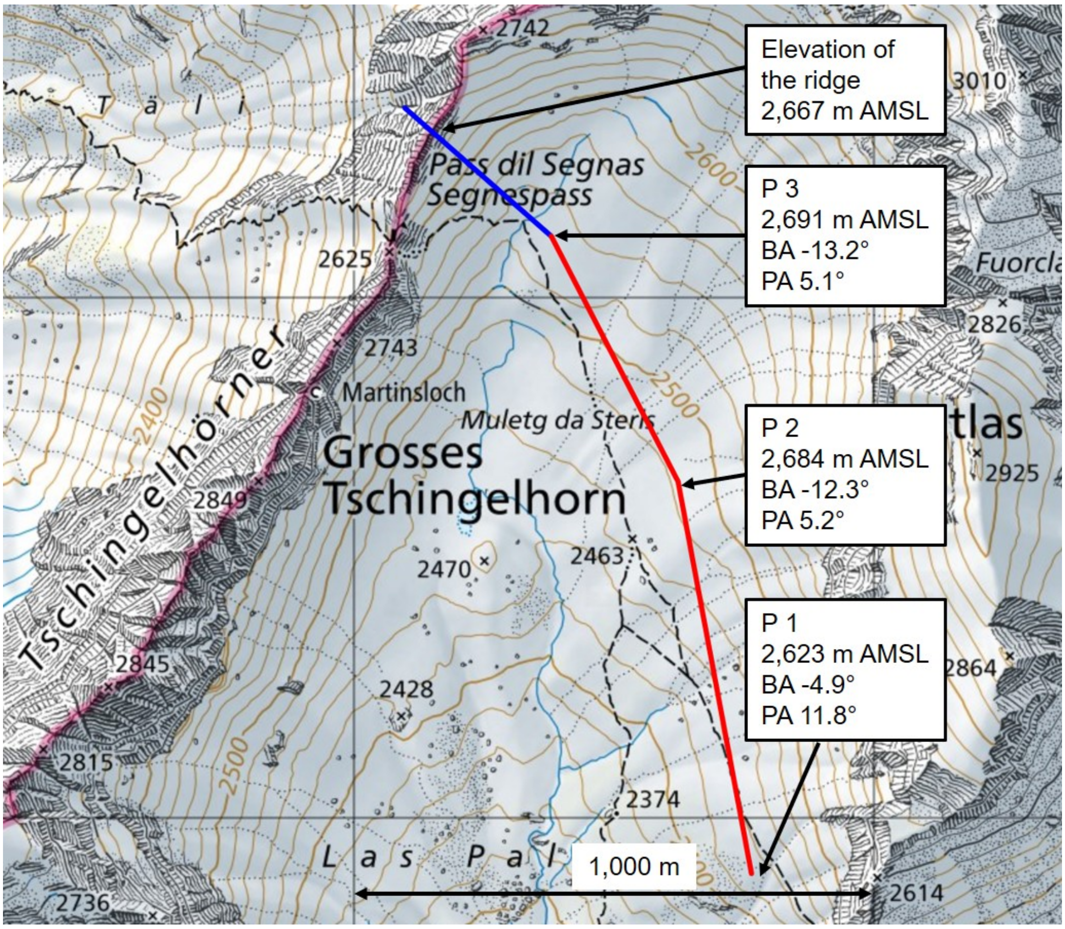

Figure 2: The flight path (red) and extension of the flight path (blue) reconstructed from data points P 1 to P 3 for the flight on 6 July 2013. Assuming the altitude of P 3 was to be maintained, the difference in height between the extension of the flight path (blue) and the elevation of the ridge is 24 m. Source of base map: Swiss Federal Office of Topography.

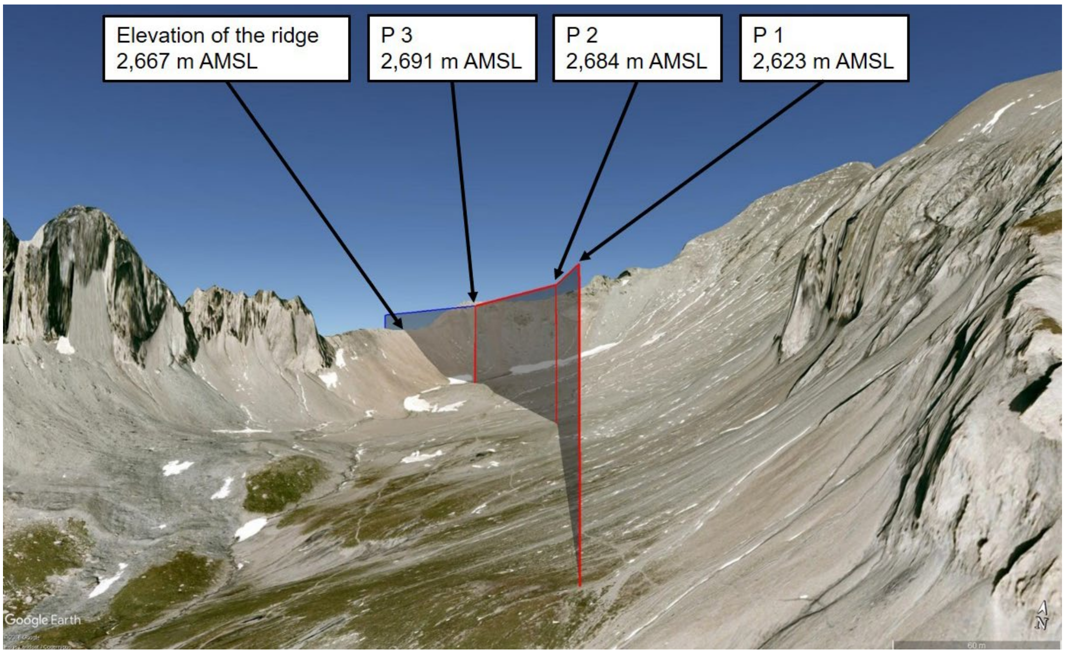

Figure 3: Flight path (red) of 6 July 2013 reconstructed from data points P 1 to P 3 and extension of the flight path (blue) shown in the direction of the flight. Shown on Google Earth.

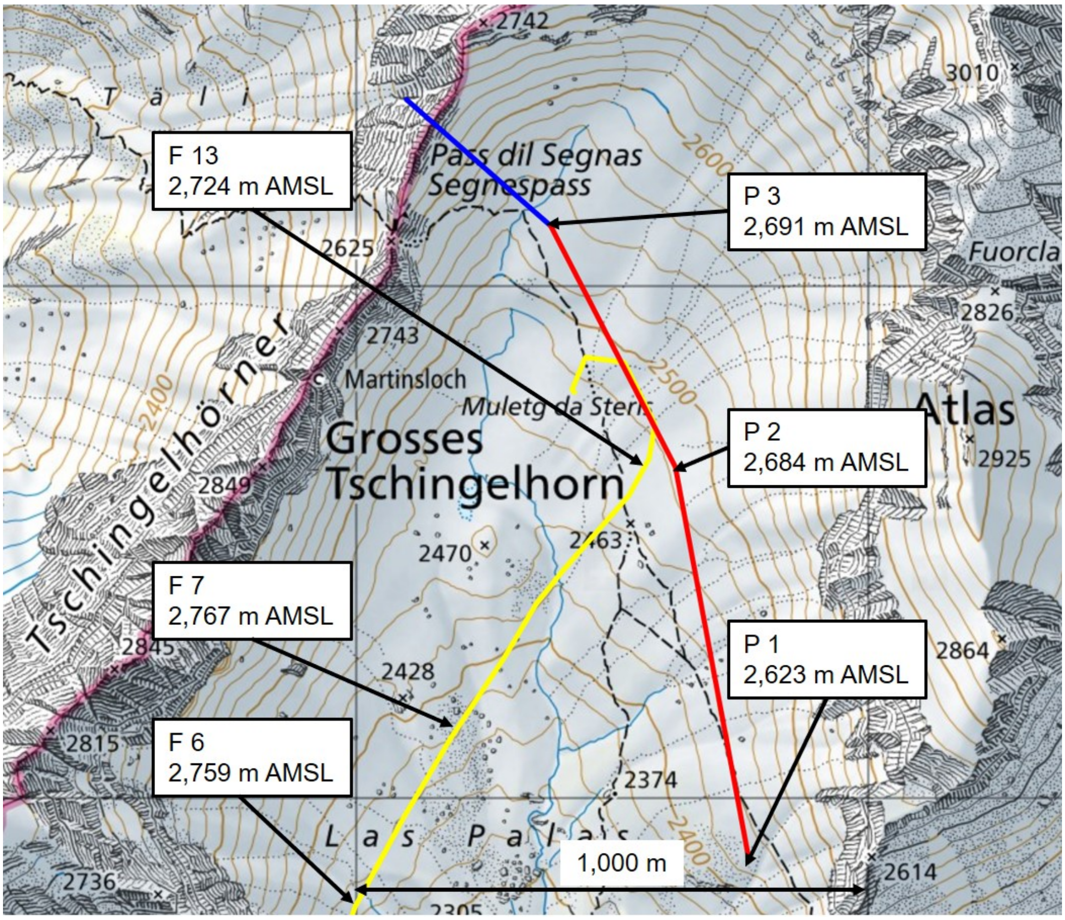

Figure 4: Comparison between the reconstructed flight paths of 6 July 2013 (red) and the accident flight of 4 August 2018 (yellow). On 6 July 2013, the section of terrain in front of the Segnespass was entered along the western flank of the mountain called Atlas, approximately 150 m lower than during the accident flight. Source of the base map: Swiss Federal Office of Topography.

A1.18.2 Comparison of photogrammetric and radar data with GPS data

At noon of 4 August 2018, the day of the accident involving HB-HOT, HB-HOP flew west of the Segnespass towards the Kistenpass, where it was photographed from the ground (see red circle in figure 5). This flight was carried out by another flight crew approximately three hours before the accident flight. It was possible to determine five data points by photogrammetrically analysing the images. Using GPS data of the flight path, the data points could be validated at an accuracy of 2 to 16 m (laterally) and 6 to 13 m (vertically).

As only radar data were available for the analysis of numerous flights before 4 August 2018, the GPS and radar flight paths of the HB-HOP flight on 4 August 2018 were compared at certain positions by way of example, and deviations in positions and flight altitudes were examined.

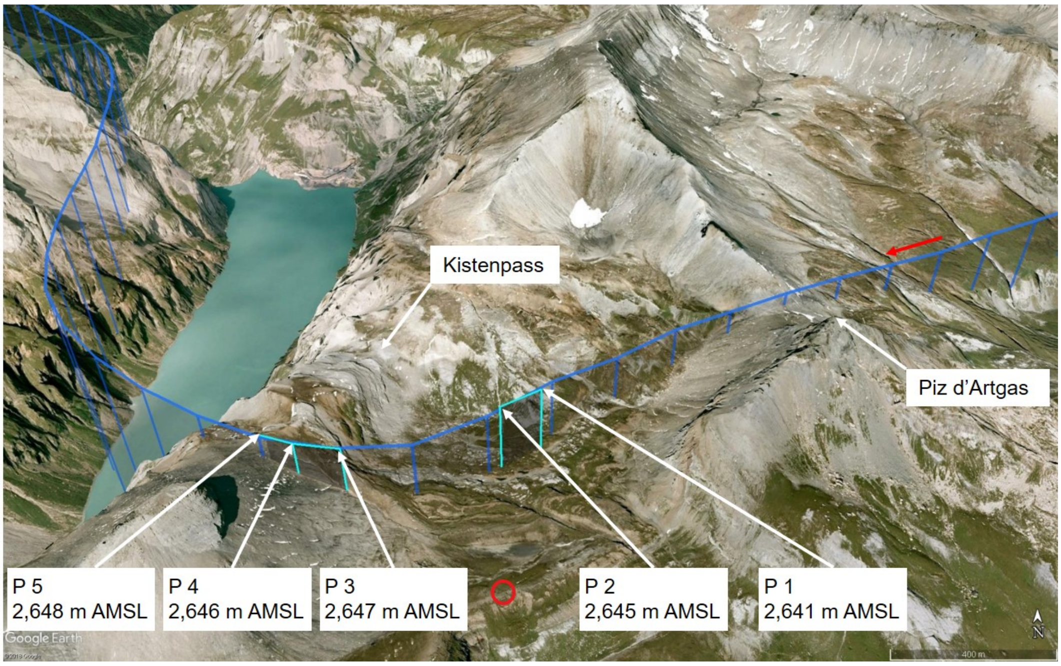

Figure 5: Flight path of HB-HOP on 4 August 2018, flight path segments reconstructed from GPS data (blue) and from data points P 1 to P 5 (light blue), including an arrow pointing in the direction of flight (red arrow) and the photographer's location (red circle). Shown on Google Earth.

The radar data originate from a multi-radar tracker (MRT), which compiles the data of several radar systems from different locations. The flight altitudes relating to the radar positions are transmitted as pressure altitudes based on the ICAO standard atmosphere; they have been corrected for the following examinations based on the actual pressure conditions (see section A1.19.5).

Due to topography, the flight path positions ascertained from radar data vary in accuracy, particularly for flights in mountainous areas, and can deviate considerably from the actual positions. Several positions in a row may be missing, resulting in gaps in a radar flight path. If the radar signal is lost, the MRT extrapolates data points (see figure 6, A and C). These isolated extrapolations and errors were taken into account during further flight path review. The radar data are usually sufficiently accurate to assess the flight path (see figure 6, B). In addition, the flight path between two radar data points located apart can also be estimated using topography. The area marked in red, bordered by the turquoise lines highlighting a zone at the same altitude as the flight path up to 800 m[1] either side of the GPS recording, is required for further comparisons in section A1.18.3. Detailed information on the methodology for the assessment of radar data is given in section A1.19.3.

[1] The 800 m mentioned here represents the space required to perform a 180-degree turn as per the information provided in the aircraft flight manual (AFM).

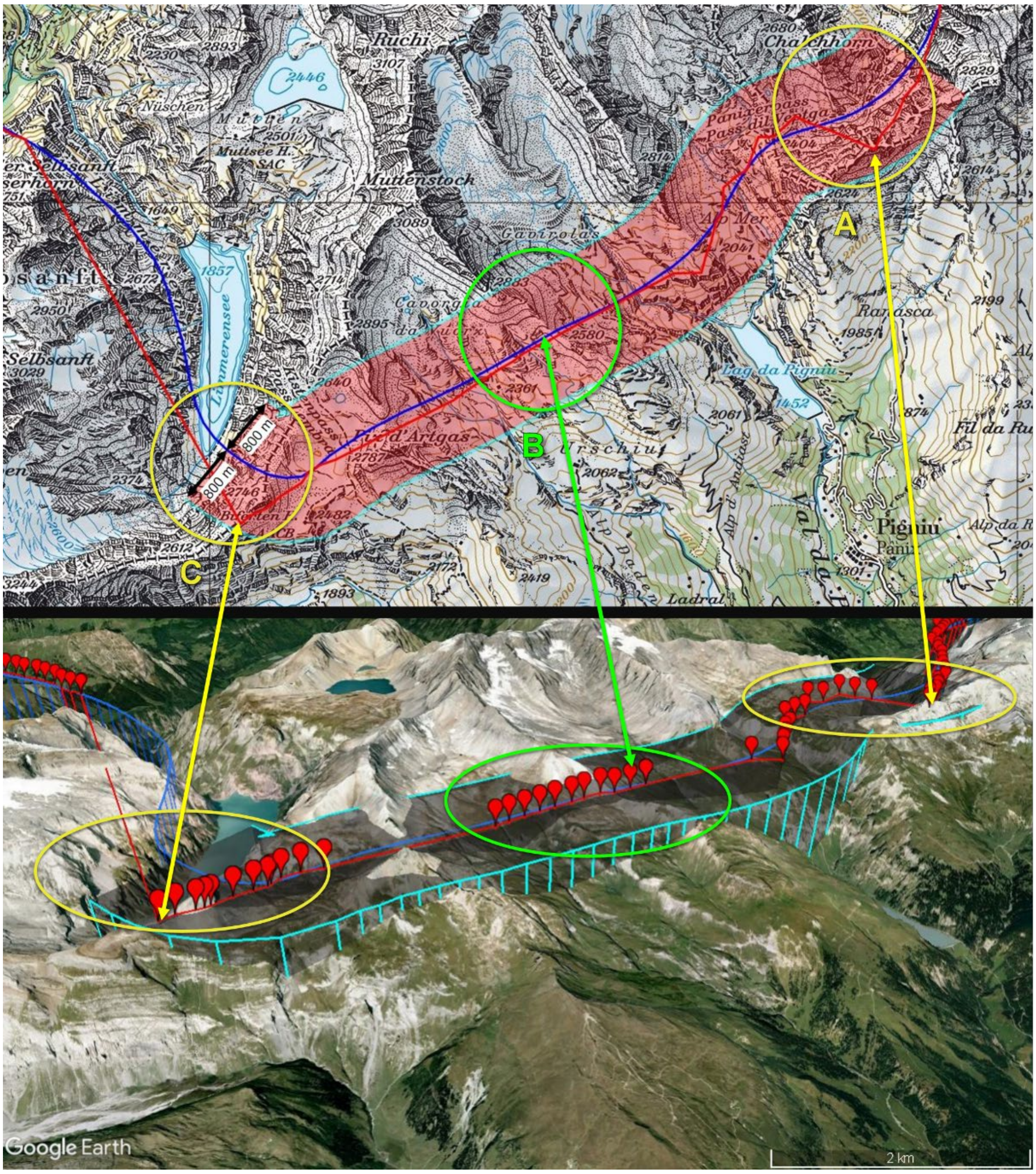

Figure 6: Above – flight path of HB-HOP on 4 August 2018, ascertained from GPS data (blue) and radar data (red). Source of the base map: Swiss Federal Office of Topography. Below – shown on Google Earth.

Deviations between the corrected radar flight altitudes and the flight altitudes from the GPS data are within ± 30 m. This approximately equates to the transponder altitude increments as recorded by the MRT.

A1.18.3 Review of flight paths

Based on the GPS data of HB-HOP's flight path on 4 August 2018 (see section A1.18.2), the flight crews' handling of mountain flying principles was analysed using two example positions. At position A, the flight path led into a rising V-shaped valley and, at position B, it ran vertically towards a ridge, which was flown over at a low level.

When assessing the options for mountain flying tactics – for example, in the event of a loss of engine power or unforeseen downdraughts – the following assumptions were made for the scenarios used based on information in the aircraft flight manual (AFM): a very small margin of 30 % on the stall speed, a 30-degree bank attitude and a turn radius of 400 m, i.e. a 180-degree turn with a diameter of 800 m (see figure 7). It should be noted that this is a theoretical consideration assuming optimal conditions. In particular, the margin on the stall speed does not represent a large enough safety margin for flying in the mountains. Furthermore, no minimum distance from the terrain was taken into account, which would of course also have to be respected in reality.

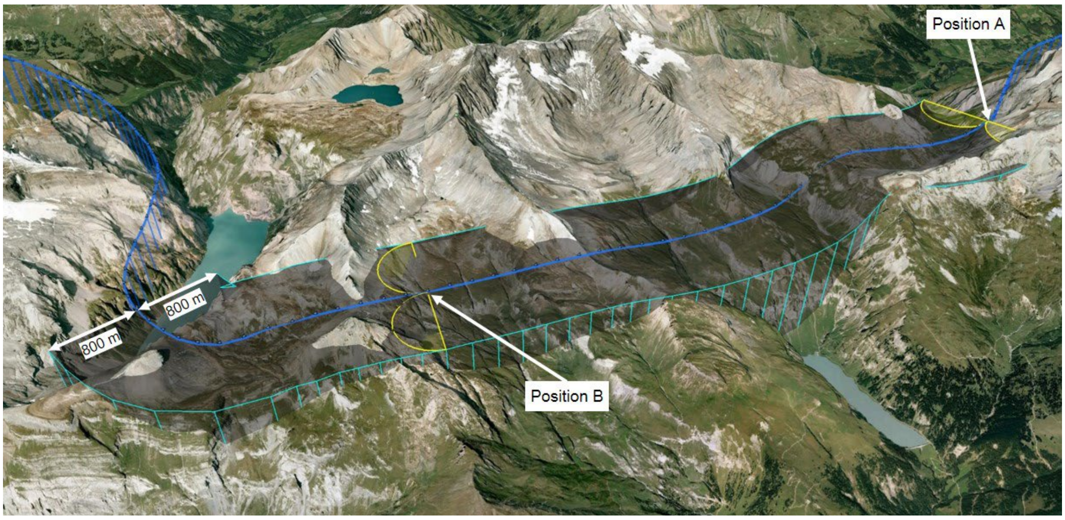

Figure 7: Flight path of HB-HOP on 4 August 2018, ascertained from GPS data (blue) and 180-degree turns (yellow) at a constant flight altitude at positions A and B. Shown on Google Earth.

Assuming a rate of descent of 2 m/s (approx. 400 ft/min), as may result from entering an area of slight downdraught or due to a loss of engine power, the potential options become even more limited.

The approach over the V-shaped valley to the Panixerpass, which was flown over at approximately 140 m above ground, was made along a slightly climbing flight path. A 180-degree turn to the right would still have been possible at position A, assuming the parameters described above, i.e. if flown at a turn radius of 400 m and a rate of descent of 2 m/s. Just before the end of the semicircle (red arrow in figure 8) the hypothetical flight path runs approximately 100 m above the terrain. Had the flight hypothetically continued (marked in yellow in figure 8), also at a rate of descent of 2 m/s, the flight path would have run over the Panixerpass at a height above ground of approximately 43 m.

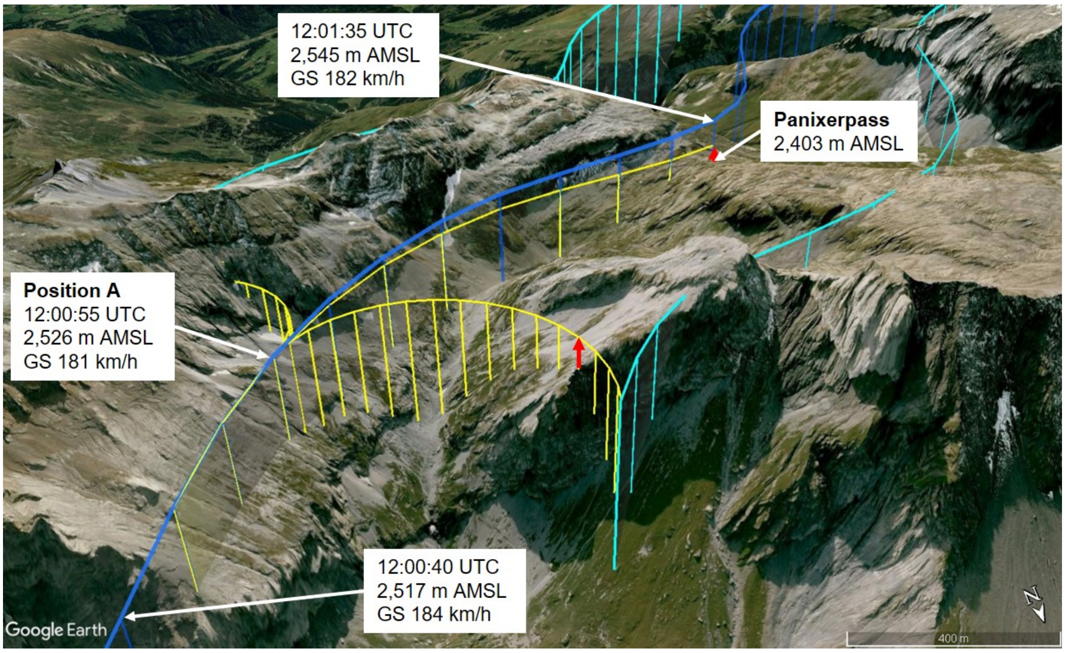

Figure 8: Flight path of HB-HOP on 4 August 2018, ascertained from GPS data (blue), including a zone 800 m either side and hypothetical flight paths at position A (yellow) assuming the sink rates described. Shown on Google Earth.

The saddle of the Piz d'Artgas mountain was flown over at 90 degrees to the saddle ridge at an altitude of less than 50 m above ground (red arrow in figure 9). A 180-degree turn was not possible from position B onwards, approximately 690 m or 17 seconds before the overflight. Had the flight hypothetically continued at a rate of descent of 2 m/s, it would have flown over the saddle of the mountain at a clearance of less than 10 m.

During the right turn south-west of the Kistenpass, the altitude when flying over the ridge at 90 degrees was approximately 60 m (orange arrow in figure 9).

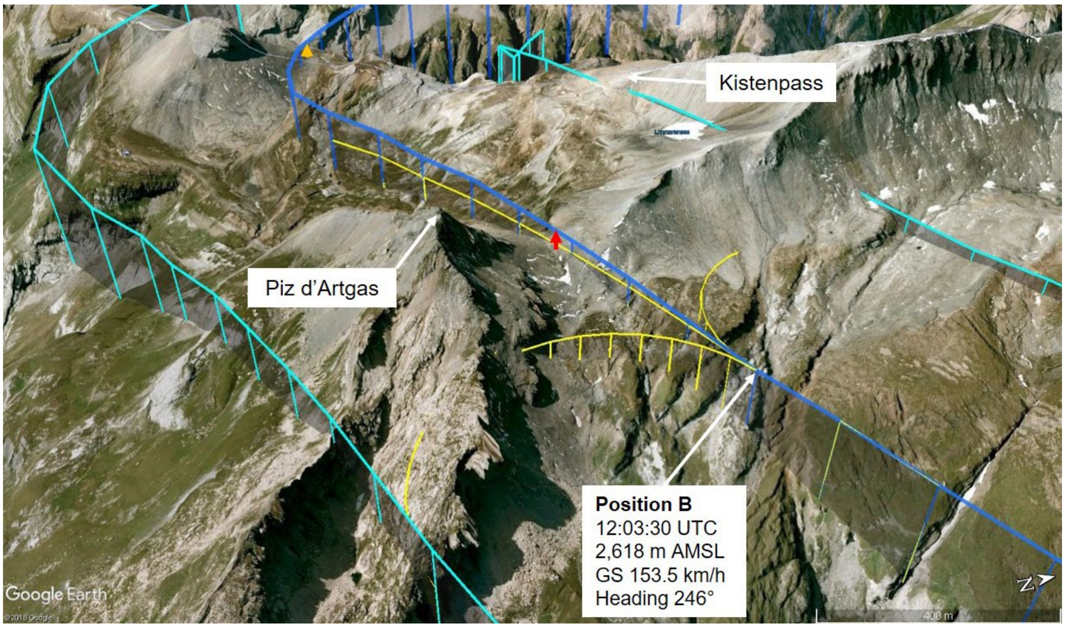

Figure 9: Flight path of HB-HOP on 4 August 2018, ascertained from GPS data (blue), including a zone 800 m either side and hypothetical flight paths at position B (yellow) assuming the sink rates described. Shown on Google Earth.

The comparison between the GPS and radar data (see section A1.18.2) shows that – in terms of quality – the above considerations at example positions A and B could have been determined in the same way using radar data only as the flight path sections inevitably had to pass through the V-shaped valley (figure 8 at position A) and over the ridge (figure 9 at position B), and as the available flight altitudes are sufficiently accurate.

A1.18.4 Analysis of flights in summer 2018

A1.18.4.1 General

Ju-Air did not have any systematic record of its flights' data. This meant that it was not possible to obtain data on previous flights from the aviation company. Radar data were used for analysis of the flights.

A1.18.4.2 Procedure and analysis of flights in summer 2018

In order to assess previous Ju-Air flights with regard to flying tactics in the mountains and general flight procedures, as well as for an exemplary presentation of flight data monitoring (FDM) (see section A1.18.4.4), radar data from flights between 6 April 2018 and 4 August 2018 were processed. During this period of around four months, Ju-Air carried out 406 flights. As flights from Dübendorf to the mountains further afield were of particular interest, the radar data for a total of 216 flights (over 50 % of all flights carried out) were obtained and analysed by the STSB based on flight duration and flight programme. For each flight, the choice of flight path in the mountains was assessed by two specialists. As with positions A and B of the flight involving HB-HOP on 4 August 2018 (see section A1.18.3), the flight path options in the event of any disruptions, for example loss of engine power or downdraughts, which do not represent an abnormal phenomenon in the mountains, were examined in detail.

As Ju-Air's operating manuals did not contain any instructions for flying in the mountains, generally accepted principles regarding the choice of flight path in the mountains were used as criteria, as are also taught to trainee pilots during their basic training. A selection of these analysed flights is presented in section A1.18.6.

The first round of flight assessment served to roughly filter notable flights; the radar data of all 216 available flights were only provisionally corrected in terms of altitude in this round. These data were then used for basic analysis. Particularly notable flights were examined in detail during the second round (see section A1.18.4.3).

The flight paths were analysed in 3D using cartographic tools from the Swiss Federal Office of Topography (Swisstopo) and Google Earth. Hazardous situations on the flight path were identified and independently assessed by two specialists. These hazardous situations are referred to as hotspots in the pages that follow. Each flight was given points ranging from 1 to 5. Here, 1 point means 'unremarkable', whilst 5 denotes 'extremely notable and very high-risk'. The two independently awarded points were added to a score for each flight. This resulted in a scale of scores ranging from 2 (considered unremarkable by both specialists) to 10 (considered extremely notable and very high-risk by both specialists). The results of this analysis, including the distribution of flights according to their score, are shown in figure 10.

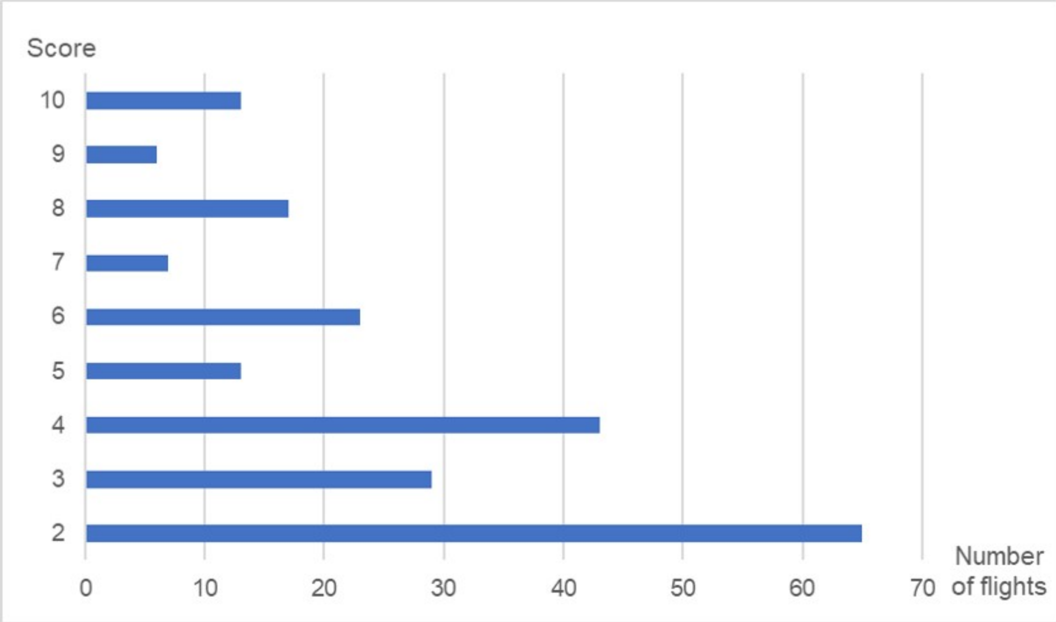

Figure 10: Evaluation of the 216 flights with a score ranging from 2 (unremarkable) to 10 (extremely notable and very high-risk).

It is striking that 79 flights (36.6 % of the 216 flights evaluated) were assessed as having medium and high scores, i.e. risk scores of 5 to 10. These deviations from the principles of safe flying in the mountains will henceforth be referred to as infractions. Flights with scores of 5 to 7 involve major infractions. Flights with a score of 8 to 10 involve massive infractions. This category comprises 36 (16.7 %) of the flights analysed.

In figure 11, infractions with a score of 5 to 10 are shown individually for each pilot. 16 out of a total 27 pilots exhibit major or massive infractions (score 5 to 10). The purpose of such analyses is to ascertain whether the infractions occurred with individual pilots or whether undesired conduct extended across the entire cohort of pilots.

The overall analysis shows that there were certainly pilots who were not listed at all as, not having caused any infractions, their flights had not been provided with scores of 5 to 10 or their flights, with few infractions only classified as minor, were barely noteworthy.

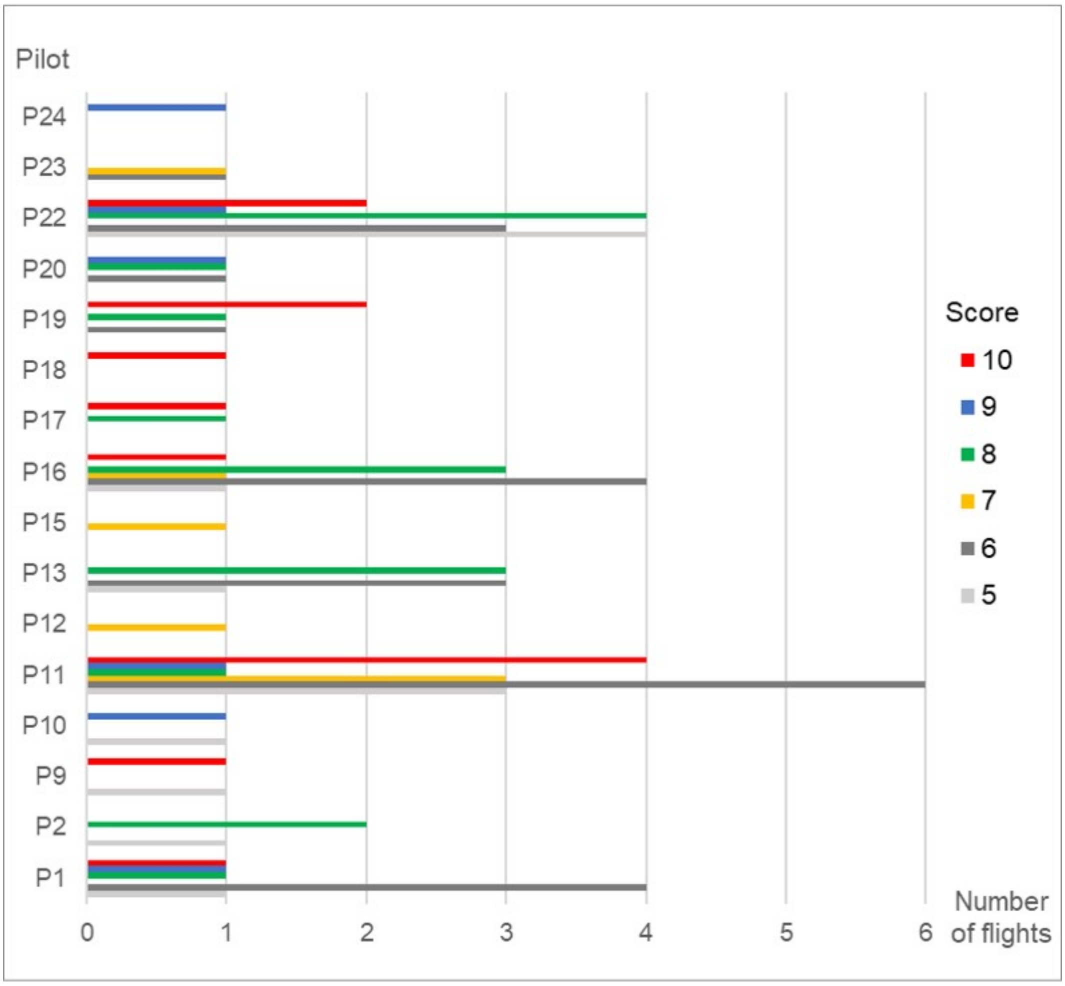

Figure 11: Analysis of the number of major and massive infractions with scores of 5 to 10 (x-axis) per pilot in command (y-axis).

Out of the 23 flights (10.6 % of the 216 flights evaluated) conducted by crews with a purely civilian background, five flights (21.7 %) exhibit infractions with a score of 5 to 10; one flight (4.3 %) had a score of 8 to 10. The flights evaluated included 193 flights that had been conducted by a crew with at least one member trained as an Air Force pilot. 74 flights of these flights (38.8 %) were given a score of 5 to 10 and 35 flights (18.1 %) a score of 8 to 10.

These figures show that in many instances, major and massive infractions involved pilots who had been trained as Air Force pilots[2] and then went on to have a career in civil aviation. This also applies to the pilots of the accident flight on 4 August 2018. Flights considered unremarkable (scores of 2 to 4) were predominantly carried out by crews with a purely civilian background.

It was also of interest as to whether and to what extent it was individual pilots or combinations of two pilots who caused the infractions with high scores. Out of the total of 216 flights evaluated, the pilots of the accident flight on 4 August 2018 performed 11 flights together acting as the cockpit crew. Four of these flights (36.4 %)

[2] Most of these pilots had completed their training with the Air Force during the Cold War. According to the Swiss Air Force, today's training programme for military pilots and the current air traffic control system of the Air Force cannot be compared to the conditions of that time and now conform with the international standards applicable today.

were provided with a score of 8 to 10 – which is above the average of 16.7 % of all flights.

A1.18.4.3 Detailed investigation of notable flights

36 flights (16.7 % of the flights analysed) were identified as extremely notable and very high-risk with a score of 8 to 10. For these flights, single radar station data were collected. These tables were used to validate and verify the MRT data obtained and to estimate the radar accuracy on the relevant flight paths and in particular at the hotspots. These data tables can hold approximately 10 times more data than MRT tracks, which each consist of approximately 1,000 data points.

In addition, each data point of each of these MRT flight paths was corrected in terms of altitude using the method described in section A1.19.5.1. Deviations from the provisional estimates ranged between 30 and 50 m. The earlier, provisional estimate of the flight altitudes was higher than the more precise detailed calculation, apart from a few exceptions. This means that, on closer inspection, the majority of the flights analysed were carried out slightly lower and thus even closer to the terrain than originally assumed. Nevertheless, none of the flights was subsequently given a higher score than originally marked.

Apart from the evaluation for the scores, transponder altitudes of seven other flights as well as flights of the motor-powered Robin DR 400/140 B aircraft and sections of the flight path of a Cessna 152 which happened to fly past the Segnespass up ahead were also corrected. The altitudes of the Robin DR 400/140 B could also be compared with the aircraft’s GPS data of the same flights on 3 and 4 August 2018, confirming the accuracy of the corrected altitudes.

The transponders from the Ju-Air fleet were not regularly checked for accuracy of pressure measurement and thus altitude transmission at various altitudes. This is also not a legal requirement. In order to assess the precision and potential device inaccuracies of the transponders of the inspected aircraft (HB-HOT, HB-HOP, HB-HOS), transmitted altitudes were compared with known actual altitudes. In addition to existing comparison altitudes from individual GPS data, the transmitted as well as corrected transponder altitudes on the taxiways and on the runway in Dübendorf were compared with the aerodrome’s elevation.

The transponders of HB-HOT and HB-HOS displayed the readings correctly within the transponder’s discrete accuracy of 100 ft. The transponder altitudes of HB-HOP were regularly too high by approximately 60 ft (2 hPa). It can therefore be assumed that all of the HB-HOP flights analysed were carried out approximately 60 ft lower than calculated. This deviation did not result in an increased score either.

An excerpt covering 10 flights and 27 hotspots of all of these 36 flights analysed in detail is provided in section A1.18.6.

A1.18.4.4 Flight data monitoring

A1.18.4.4.1 Preventive possibilities in relation to the accident

Ju-Air did not carry out any flight data monitoring (FDM)[3]. Nevertheless, it was of interest to assess to what extent an actively managed FDM system with clear

[3] Since 1 January 2005, FDM has been made mandatory in ICAO annex 6, section 3.6.3 for aviation companies operating aircraft with a maximum take-off mass (MTOM) that exceeds 27,000 kg. Since as early as 1 January 2002, ICAO annex 6 has recommended running a voluntary FDM programme for aircraft exceeding 20,000 kg MTOM. As part of a safety management system, flight data is to be monitored continuously to reduce the number of incidents and accidents. Frequently, FDM is also used voluntarily for lighter aircraft.

guidelines in the operating manuals and on flying in the mountains could have identified abnormalities at an early stage.

A1.18.4.4.2 Flight data monitoring in general

FDM, also very aptly referred to as flight operations quality assurance (FOQA) in the USA, is a system in which as many flights as possible are recorded, analysed and compared against a standard benchmark for parameters such as position, altitude, speed, bank attitude, etc. The standard benchmarks and thus the acceptable limits are defined in an aviation company's operating manuals. FDM is considered part of the safety management system (SMS) and is intended to make aviation safety measurable within a company. The aim is to assess compliance with the defined parameters. The effectiveness of changes in flight crew operating manuals involving improved procedures and regulations as well as the effect of additional safety-related instructions can often be directly gauged using FDM.

Each individual flight is typically compared against defined criteria by computer programmes, and deviations are marked. The flight safety manager checks, investigates and classifies these deviations. In the event of infractions, they contact the crew or, depending on severity, even conduct an internal investigation. The aim is not to punish the crews, but to learn from mistakes and to prevent unwanted situations in flight operations from occurring. The flight data are then anonymised and used for statistical trend and risk analysis in the SMS.

The system can be designed in a variety of ways depending on the aviation company. The following is an example of one possible approach, which is quite common for smaller aviation companies nowadays.

These days, classification usually involves three exceedance levels or FDM levels. The severity of deviations is assessed for each individual flight. Statistical distribution and clusters are then important for risk assessment in flight operations.

An actively managed FDM system endeavours to reduce the number and severity of infractions by taking appropriate measures such as the introduction of additional instructions, training programmes and changes to procedures.

A1.18.4.4.3 Example FDM representation for the flights in summer 2018

The score analyses outlined in section A1.18.4.2 cover approximately 50 % of the flights that took place in the 2018 flight season, which lasted around four months.

These flights can also be illustrated within an FDM system using common criteria for flying in the mountains.

When applying the example approach described above for an assessment in line with FDM principles and assigning the scores to FDM levels, the data can be presented as in table 1, for example. This enables a flight safety manager and the head of flight operations to form an opinion on their own flight operations and make the necessary risk assessments.

If FDM analyses are presented more elaborately and the development of the individual figures is examined over time, undesired tendencies can be identified and corrected at an early stage.

When introducing measures, their effect can then be evaluated in the next analysis period. The effectiveness of an SMS with regard to flight safety can therefore be gauged using FDM.

As there were no instructions for flying in the mountains in the operating manuals and FDM was not carried out, such analyses of previous flights can only be conducted using examples and based on the assumption of acceptable critical values.

Score	FDM level		Description	Number of flights	Percentage [%]
2	0		Normal operation	65	30.1 %
3–4	1		Minor infraction	72	33.3 %
5–7	2		Major infraction	43	19.9 %
8–10	3		Massive infraction	36	16.7 %

Table 1: Table of the various exceedance levels and the distribution of the number of flights (216 in total) according to FDM classification with the assigned scores from figure 10.

In commercial aviation, a typical pattern in the annual statistical analysis of an actively managed and mature FDM system would include over 90 % of flights with no abnormalities (FDM level 0) and a high number of flights at FDM level 1. Only a few flights would be registered at FDM level 2. Flights at FDM level 3 should be an absolute exception.

A1.18.5 Methodology and definition of variables of the detailed flight path review

The detailed flight path review is based on the analysis of the flights in summer 2018 (see section A1.18.4). The definitions of variables and tolerances regarding GPS and radar position accuracy are outlined in section A1.18.2 and section A1.19.5.

The choice of flight path was qualitatively reviewed. The sister aircraft HB-HOT, HB-HOP and HB-HOS were examined equally, and no focus was placed on HB-HOT. The flights were assessed in the context of a sightseeing flight involving maximum bank attitudes of 30 degrees during turns with no wind. The prevailing general weather conditions, the extent of any cloud cover and the prevailing level of visibility along the route were not taken into account in this assessment.

The entire flight path for each flight is displayed in an overview. The identified risky situations (hotspots) are marked with a yellow circle (see figure 12). Each hotspot is shown in a separate figure. The screenshots do not include an indication of North. A red arrow indicating the direction of flight aids orientation (see figure 13).

Due to leeway in the lateral position, the radar flight path occasionally intersects the terrain (negative height, < 0 m above ground, see figure 40). The difference in altitude between the radar flight path and the terrain profile was determined at two different points. Height 1 is the difference in altitude between the radar flight path and the terrain profile. Height 2 is the difference in altitude at the lowest point of the terrain profile within 150 m either side of the centre line of the radar flight path. The heights were displayed graphically and rounded down to the nearest whole metre. In some cases, the differences in altitude of heights 1 and 2 are equal (see figures 14 and 15).

The following definitions have been used for the systematic breakdown of height 1:

- ≥ 75 m to < 150 m : low-level flight over the terrain
- < 0 m to < 75 m : very low-level flight over the terrain

The identified hotspots were assessed based on safety-related features. The overall assessment of the choice of flight path results from a combination of the individual features. The total points constitute the sum of the points of the individual safety-related features (see table 2):

Safety-related features		Points
Turning towards an obstacle	:	0.5
Rising terrain in the direction of flight	:	0.5
Low-level flight over the terrain	:	0.5
Restricted view of the following section of terrain	:	0.5
Limited possibility of an alternative flight path	:	1
Approaching an obstacle whilst climbing	:	1
Very low-level flight over the terrain	:	1
No possibility of an alternative flight path for a prolonged period of time	:	3

Evaluation categories		
0.5 to < 2 points	2 to < 3 points	3 or more points
Moderate-risk choice of flight path	High-risk choice of flight path	Very high-risk choice of flight path

Table 2: Overview of safety-related features and evaluation categories.

An overview of flights involving a risky flight path, classified as ‘moderate-risk’, ‘high-risk’ or ‘very high-risk’, are listed in section A1.18.6. Other flights, such as line checks assessing the pilots during regular flight operations, are listed separately in section A1.18.7.

A1.18.6 Representative selection of risky Ju-Air flights and hotspots

A1.18.6.1 General

The following selection of 10 risky flights with a total of 27 rated hotspots, which have been classified as either 'moderate-risk', 'high-risk' or 'very high-risk', are described in detail on the upcoming pages.

A1.18.6.2 Flight_0525_01_HOT

A1.18.6.2.1 Overview of the flight path

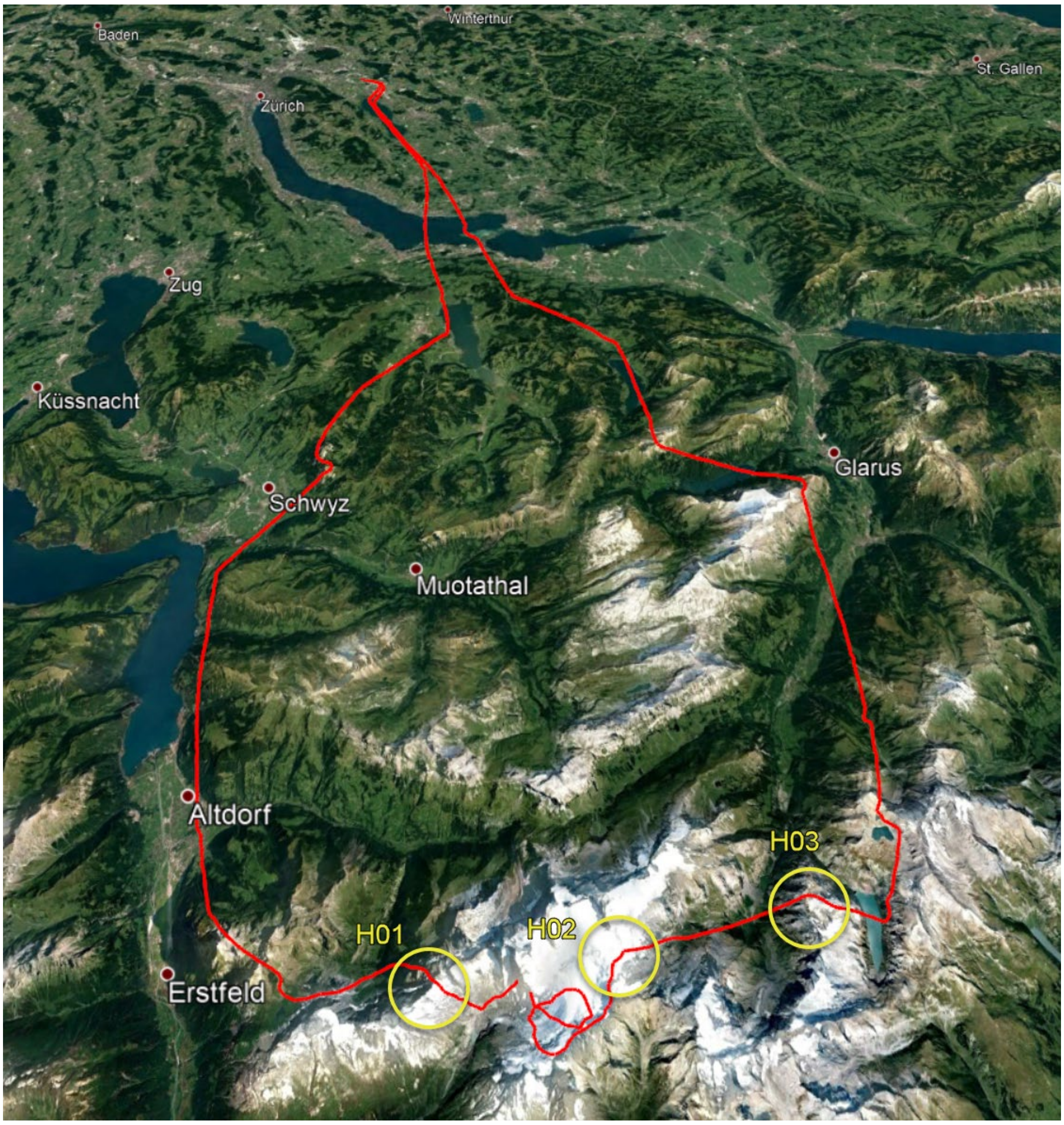

Figure 12: Overview of the flight path including hotspots H01 to H03 (yellow circles). Shown on Google Earth.

A1.18.6.2.2 Hotspot H01

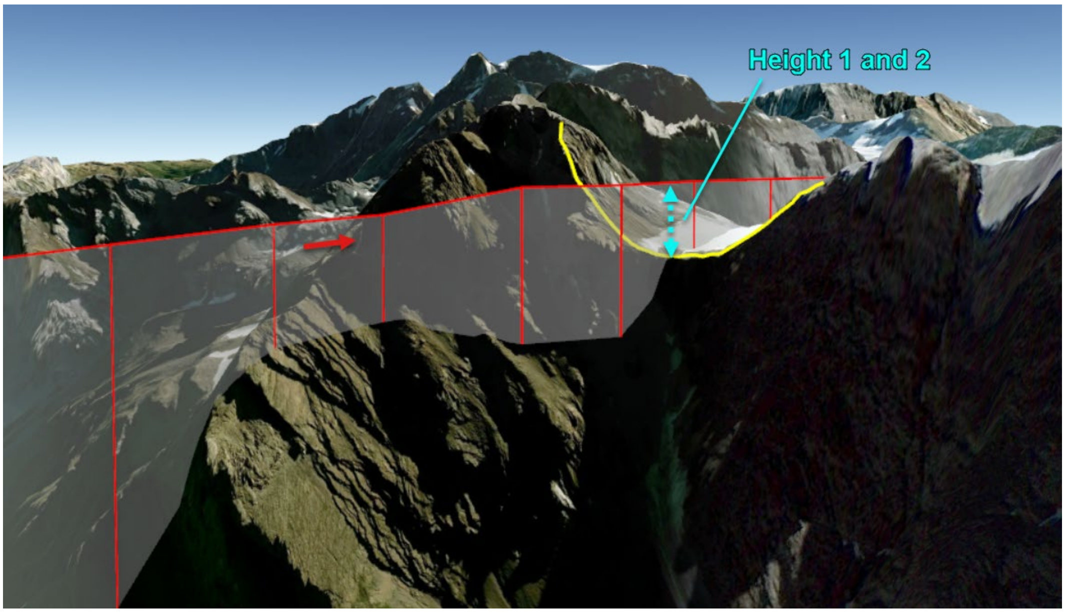

Figure 13: Climbing overflight at 90 degrees to the saddle of the mountain ridge at an altitude of 2,732 m AMSL with a height of 122 m above ground directly below the radar flight path (height 1) and 122 m above ground with respect to the lowest point of the terrain profile (height 2). Shown on Google Earth.

Figure 13 shows a choice of flight path classified as ‘very high-risk’, which is characterised by the following safety-related features:

- Low-level flight over the terrain;
- Restricted view of the following section of terrain;
- Approaching an obstacle whilst climbing;
- No possibility of an alternative flight path for a prolonged period of time.

A1.18.6.2.2.1 Height 1

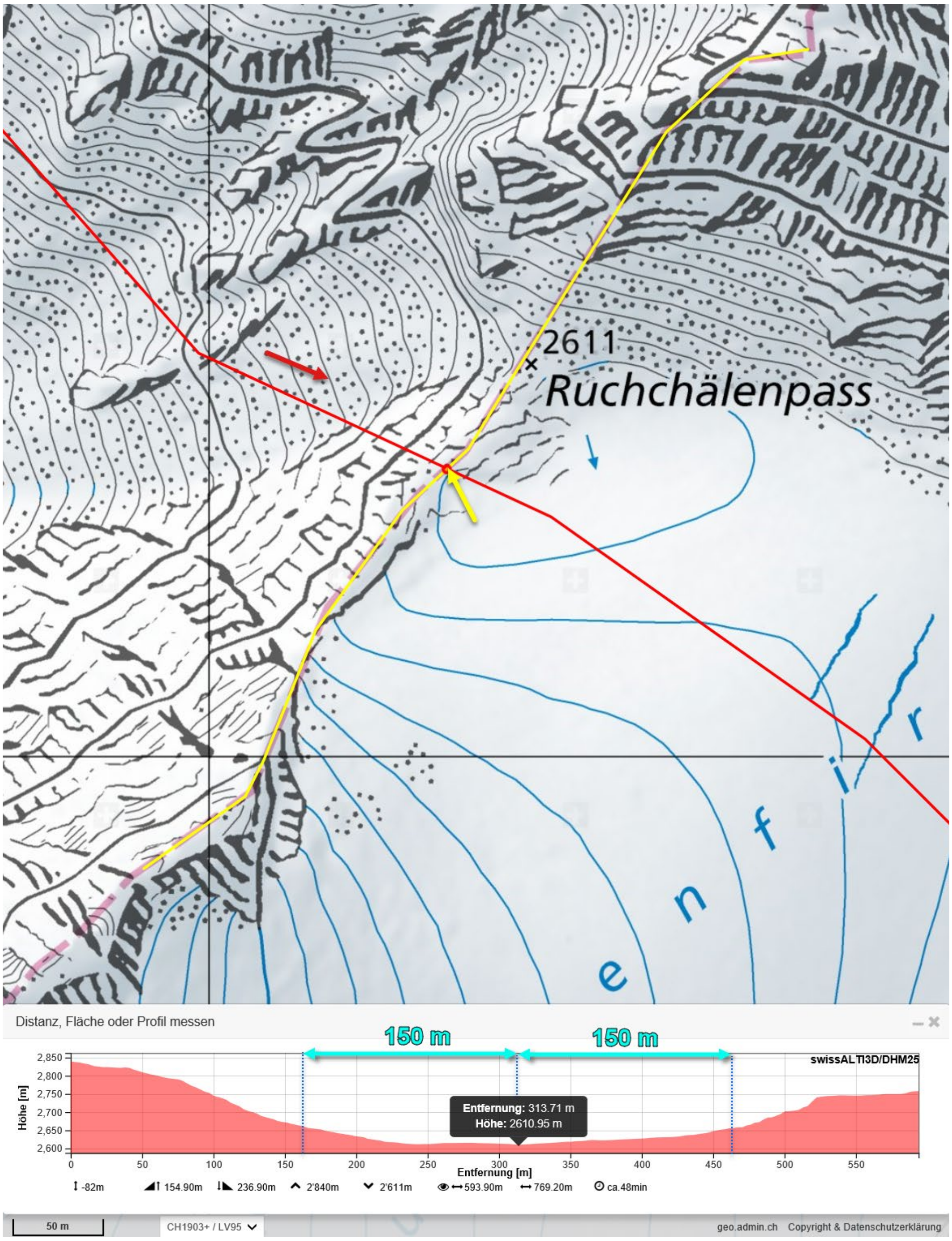

Figure 14: Depiction of the radar flight path (red line) in the direction of flight (red arrow) and the terrain profile (yellow line) with a height of 122 m above ground (2,610 m AMSL) directly below the radar flight path (yellow arrow) as well as a cross-section of the terrain 150 m to either side of the flight path (turquoise). Source of the base map: Swiss Federal Office of Topography.

A1.18.6.2.2.2 Height 2

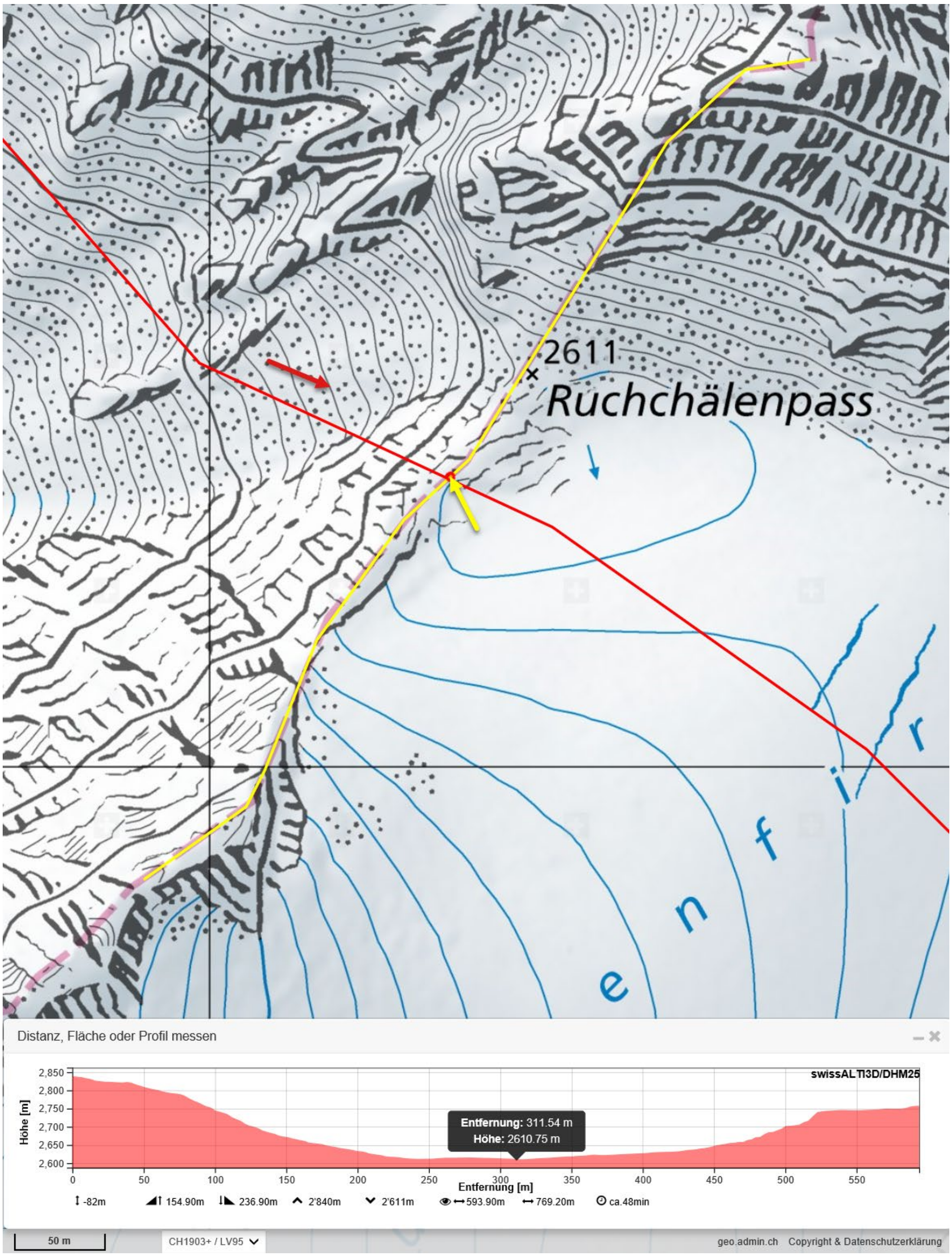

Figure 15: Depiction of the radar flight path (red line) in the direction of flight (red arrow) and the terrain profile (yellow line) with a height of 122 m above ground (2,610 m AMSL) at the lowest point of the terrain profile (yellow arrow). Source of the base map: Swiss Federal Office of Topography.

A1.18.6.2.3 Hotspot H02

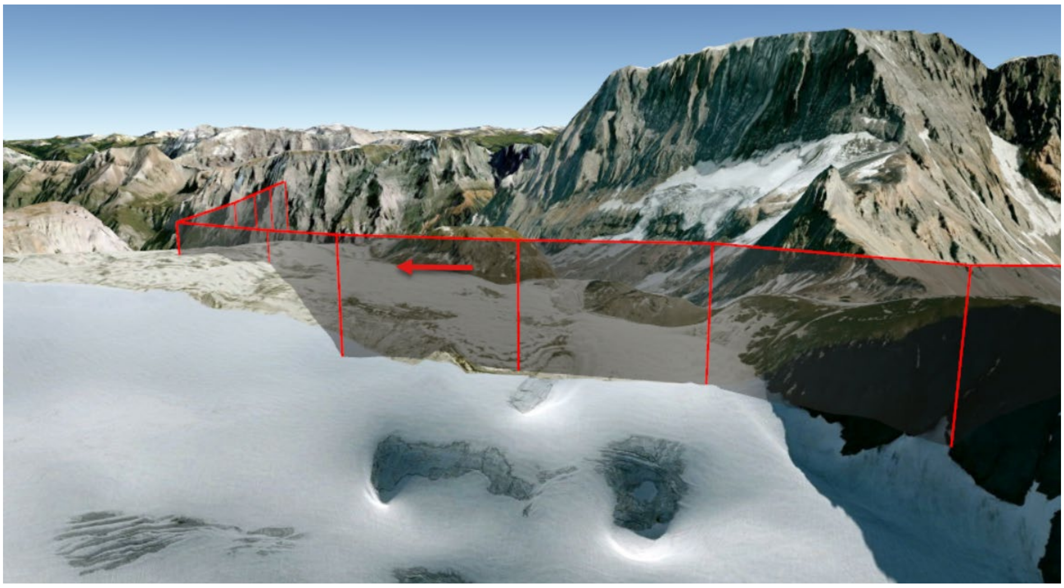

Figure 16: Descending flight over the terrain at an altitude of 3,014 m AMSL with a height of 73 m above ground directly below the radar flight path and 78 m above ground with respect to the lowest point of the terrain profile. Shown on Google Earth.

Figure 16 shows a choice of flight path classified as ‘very high-risk’, which is characterised by the following safety-related features:

- Rising terrain in the direction of flight;
- Restricted view of the following section of terrain;
- Very low-level flight over the terrain;
- No possibility of an alternative flight path for a prolonged period of time.

A1.18.6.2.4 Hotspot H03

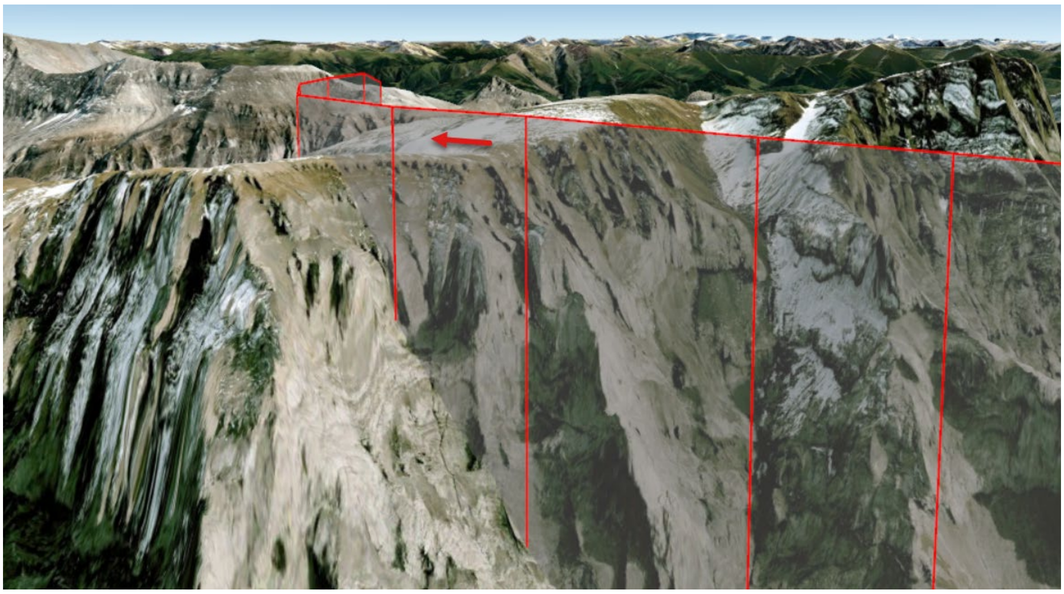

Figure 17: Horizontal overflight at 90 degrees to the crest of the mountain ridge at an altitude of 2,982 m AMSL with a height of 88 m above ground directly below the radar flight path and 96 m above ground with respect to the lowest point of the terrain profile. Shown on Google Earth.

Figure 17 shows a choice of flight path classified as 'high-risk', which is characterised by the following safety-related features:

- Low-level flight over the terrain;
- Restricted view of the following section of terrain;
- Limited possibility of an alternative flight path.

A1.18.6.3 Flight_0526_05_HOT

A1.18.6.3.1 Overview of the flight path

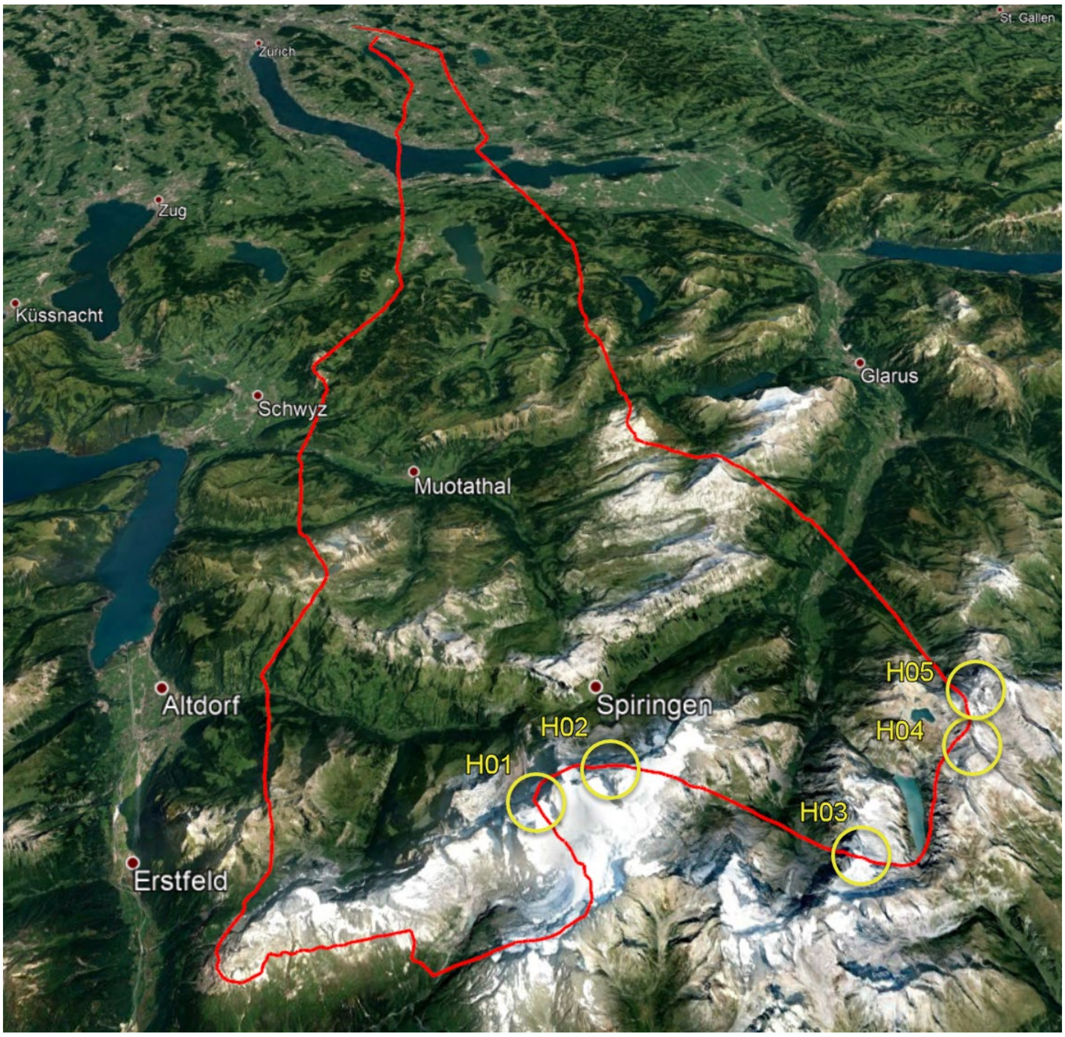

Figure 18: Overview of the flight path including hotspots H01 to H05 (yellow circles). Shown on Google Earth.

A1.18.6.3.2 Hotspot H01

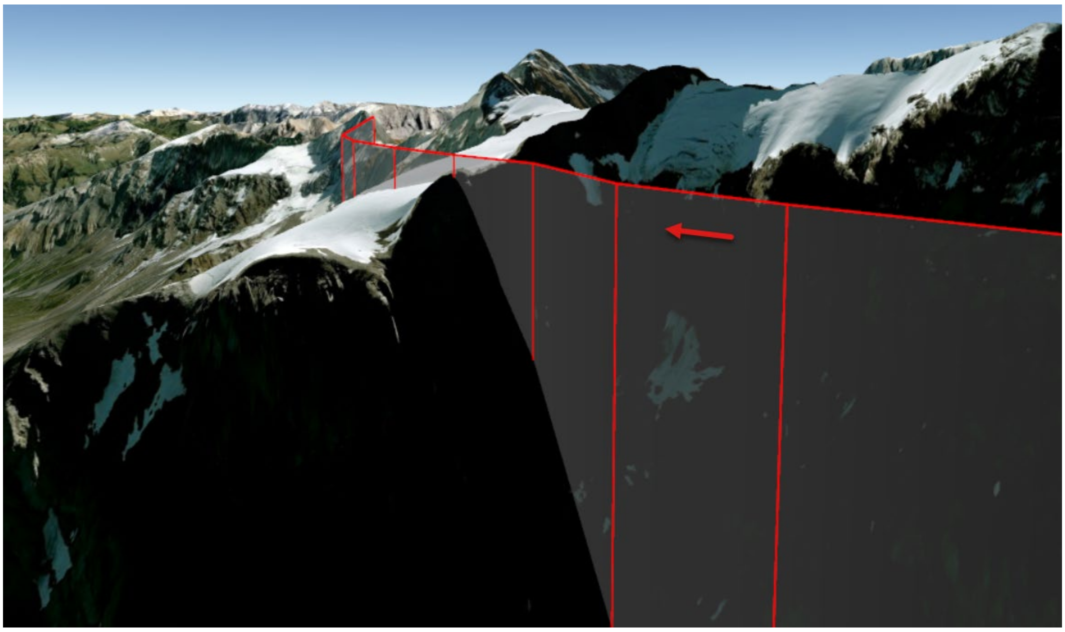

Figure 19: Horizontal flight over the crest of the mountain ridge at an altitude of 3,053 m AMSL with a height of 40 m above ground directly below the radar flight path and 101 m above ground with respect to the lowest point of the terrain profile. Shown on Google Earth.

Figure 19 shows a choice of flight path classified as 'high-risk', which is characterised by the following safety-related features:

- Restricted view of the following section of terrain;
- Limited possibility of an alternative flight path;
- Very low-level flight over the terrain.

A1.18.6.3.3 Hotspot H02

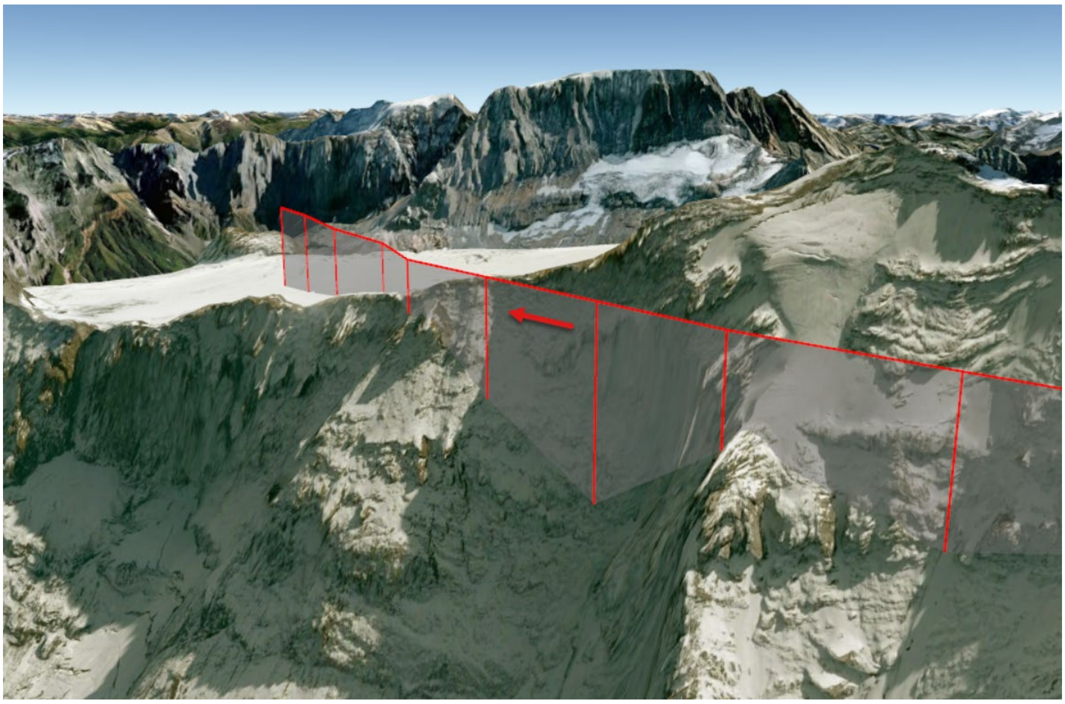

Figure 20: Horizontal flight over the crest of the mountain ridge at an altitude of 3,084 m AMSL with a height of 69 m above ground directly below the radar flight path and 92 m above ground with respect to the lowest point of the terrain profile. Shown on Google Earth.

Figure 20 shows a choice of flight path classified as 'high-risk', which is characterised by the following safety-related features:

- Restricted view of the following section of terrain;
- Limited possibility of an alternative flight path;
- Very low-level flight over the terrain.

A1.18.6.3.4 Hotspot H03

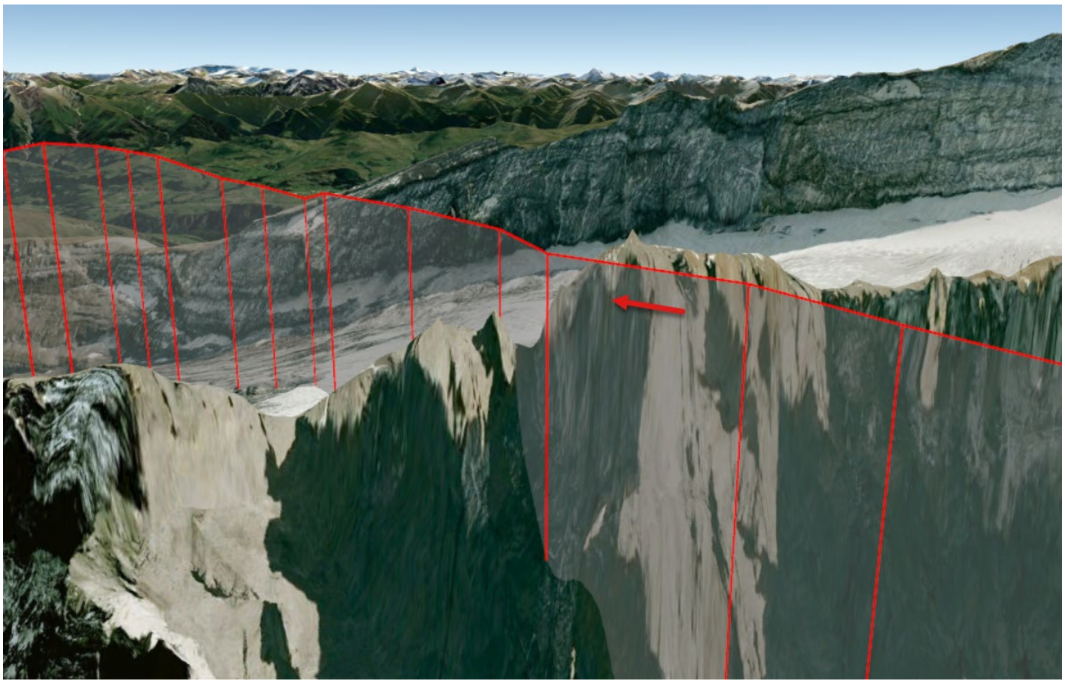

Figure 21: Horizontal overflight at almost 90 degrees to the crest of the mountain ridge at an altitude of 3,084 m AMSL with a height of 116 m above ground directly below the radar flight path and 187 m above ground with respect to the lowest point of the terrain profile. Shown on Google Earth.

Figure 21 shows a choice of flight path classified as 'high-risk', which is characterised by the following safety-related features:

- Low-level flight over the terrain;
- Restricted view of the following section of terrain;
- Limited possibility of an alternative flight path.

A1.18.6.3.5 Hotspot H04

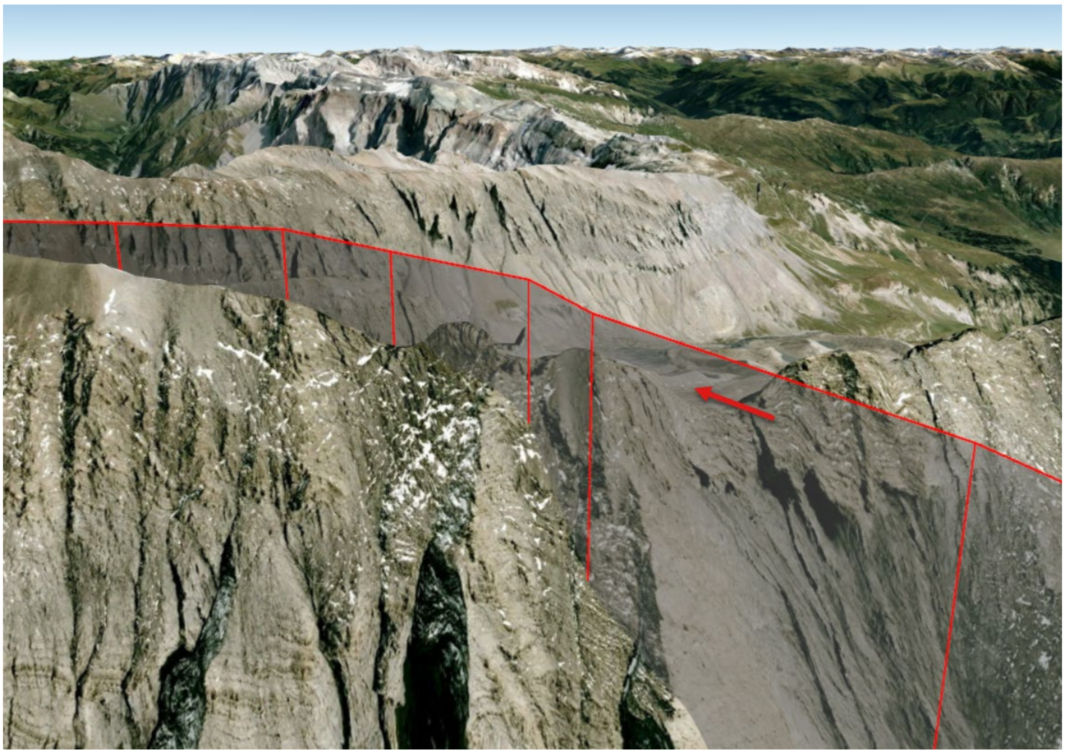

Figure 22: Horizontal flight over the crest of the mountain ridge at an altitude of 3,112 m AMSL with a height of 85 m above ground directly below the radar flight path and 96 m above ground with respect to the lowest point of the terrain profile. Shown on Google Earth.

Figure 22 shows a choice of flight path classified as ‘high-risk’, which is characterised by the following safety-related features:

- Low-level flight over the terrain;
- Restricted view of the following section of terrain;
- Limited possibility of an alternative flight path.

A1.18.6.3.6 Hotspot H05

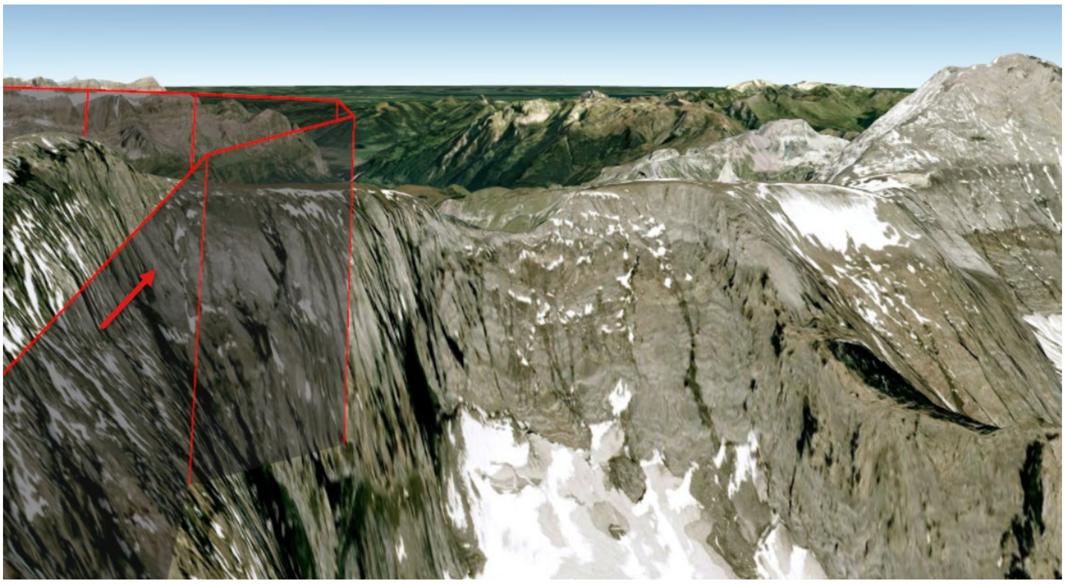

Figure 23: Horizontal overflight at an altitude of 3,112 m AMSL with a height of 62 m above ground directly below the radar flight path and 106 m above ground with respect to the lowest point of the terrain profile. Shown on Google Earth.

Figure 23 shows a choice of flight path classified as 'high-risk', which is characterised by the following safety-related features:

- Restricted view of the following section of terrain;
- Limited possibility of an alternative flight path;
- Very low-level flight over the terrain.

A1.18.6.4 Flight_0602_01_HOS

A1.18.6.4.1 Overview of the flight path

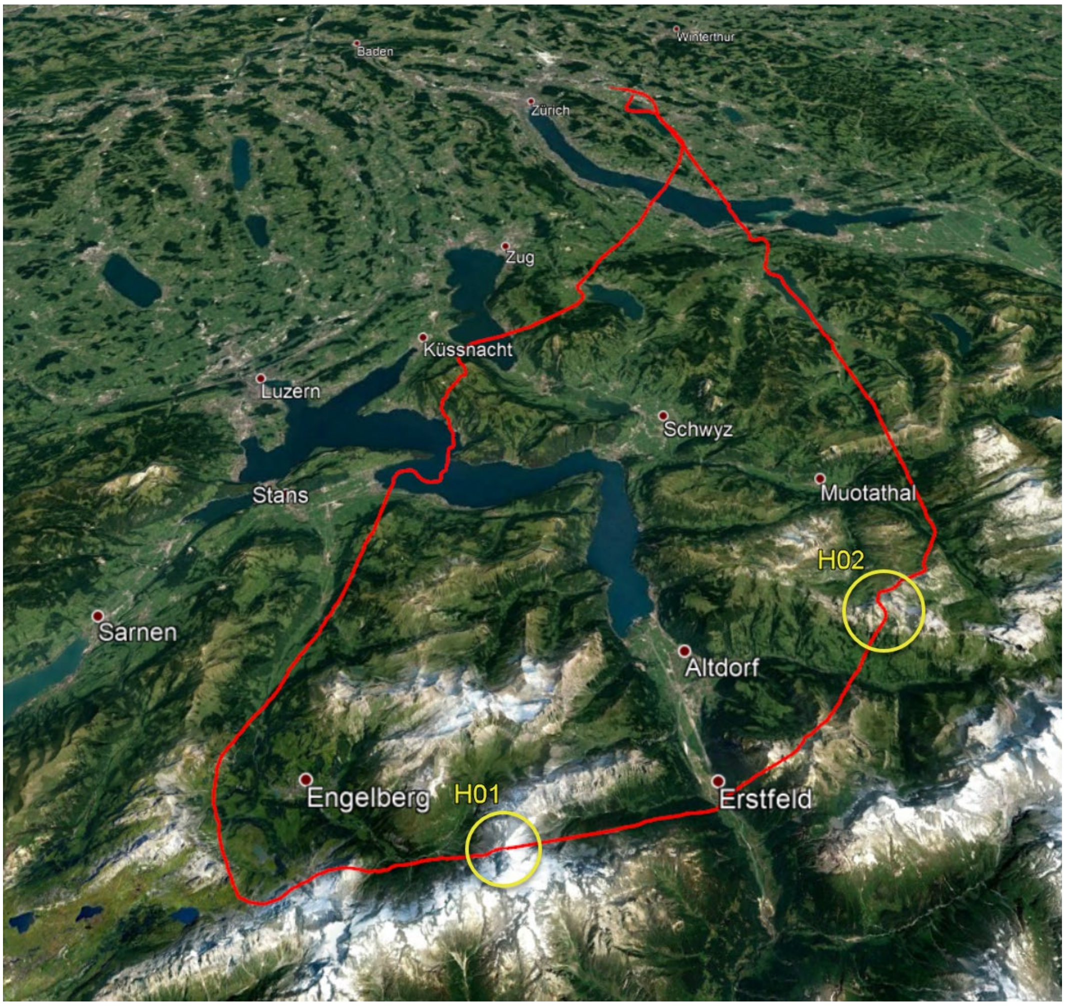

Figure 24: Overview of the flight path including hotspots H01 and H02 (yellow circles). Shown on Google Earth.

A1.18.6.4.2 Hotspot H01

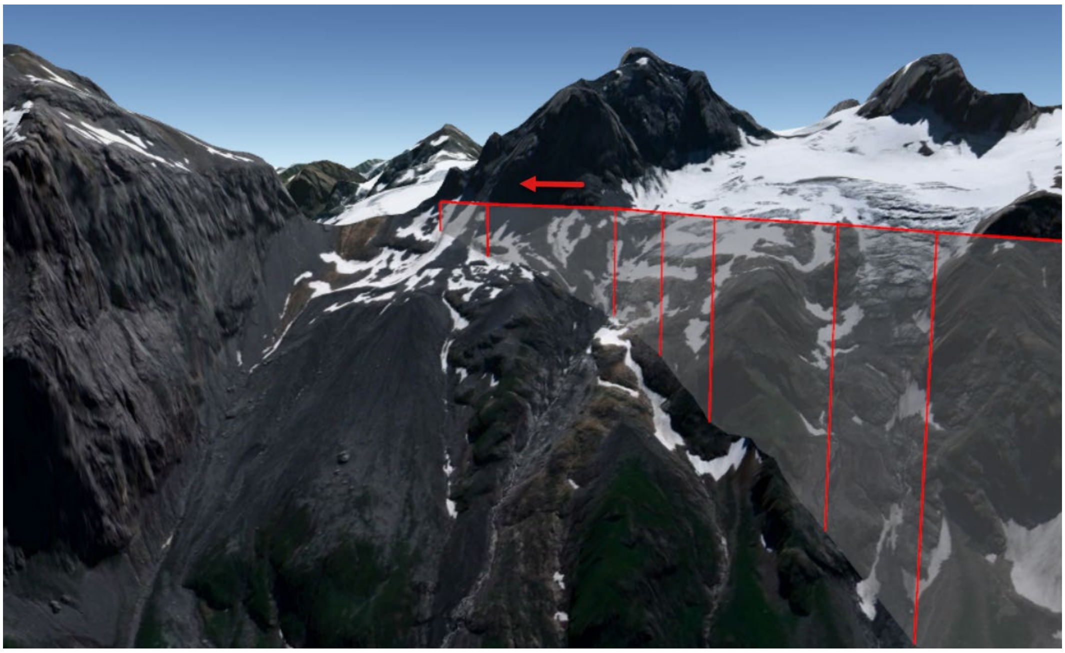

Figure 25: Horizontal flight over the crest of the mountain ridge at an altitude of 2,704 m AMSL with a resulting height at a constant flying altitude of 46 m above ground directly below the radar flight path and 75 m above ground with respect to the lowest point of the terrain profile. Data extrapolated by the radar system were omitted. Shown on Google Earth.

Figure 25 shows a choice of flight path classified as ‘very high-risk’, which is characterised by the following safety-related features:

- Rising terrain in the direction of flight;
- Restricted view of the following section of terrain;
- Very low-level flight over the terrain;
- No possibility of an alternative flight path for a prolonged period of time.

A1.18.6.4.3 Hotspot H02

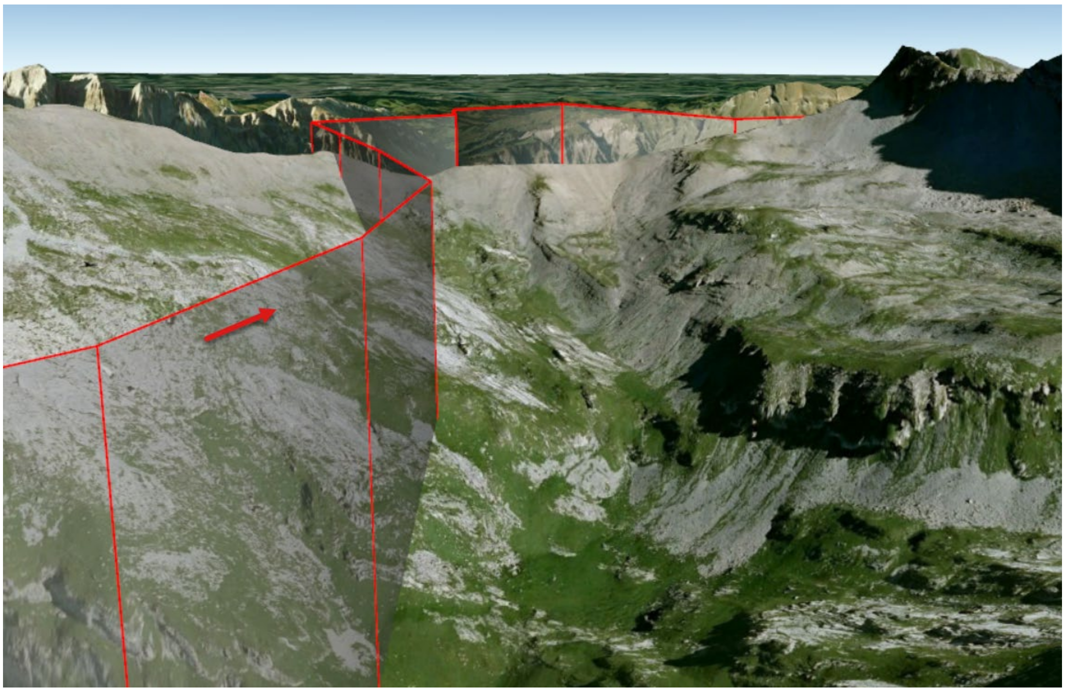

Figure 26: Horizontal overflight at 90 degrees to the crest of the mountain ridge at an altitude of 2,418 m AMSL with a height of 26 m above ground directly below the radar flight path and 59 m above ground with respect to the lowest point of the terrain profile. Shown on Google Earth.

Figure 26 shows a choice of flight path classified as ‘very high-risk’, which is characterised by the following safety-related features:

- Rising terrain in the direction of flight;
- Restricted view of the following section of terrain;
- Very low-level flight over the terrain;
- No possibility of an alternative flight path for a prolonged period of time.

A1.18.6.5 Flight_0606_01_HOP

A1.18.6.5.1 Overview of the flight path

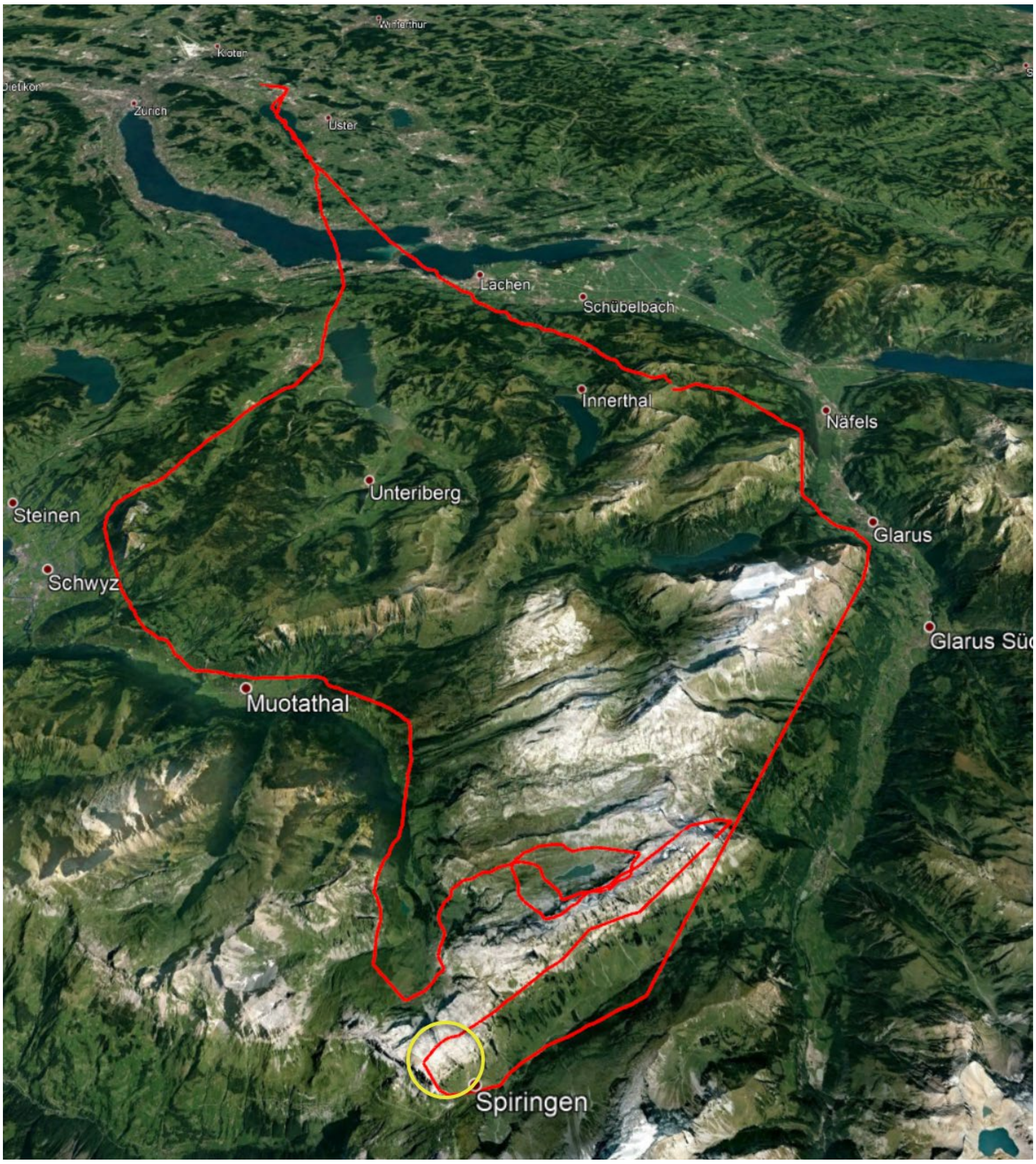

Figure 27: Overview of the flight path including hotspot (yellow circle). Shown on Google Earth.

A1.18.6.5.2 Hotspot

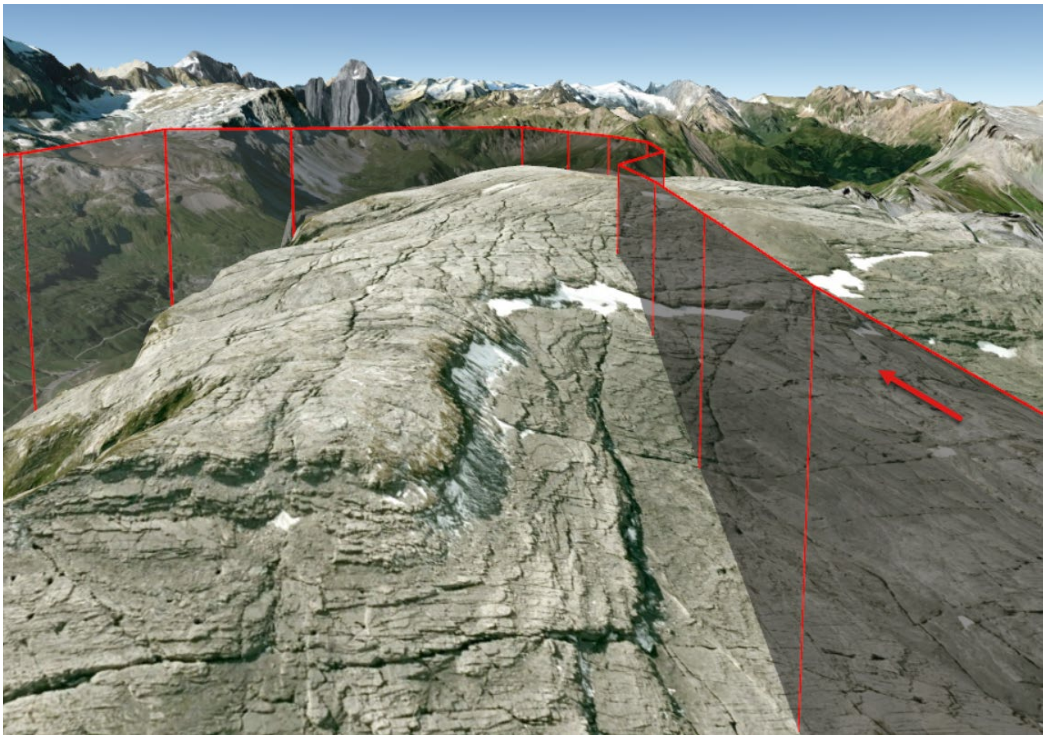

Figure 28: Horizontal flight over the terrain at an altitude of 2,541 m AMSL with a height of 60 m above ground directly below the radar flight path and 76 m above ground with respect to the lowest point of the terrain profile. Shown on Google Earth.

Figure 28 shows a choice of flight path classified as 'very high-risk', which is characterised by the following safety-related features:

- Rising terrain in the direction of flight;
- Limited possibility of an alternative flight path;
- Restricted view of the following section of terrain;
- Very low-level flight over the terrain.

A1.18.6.6 Flight_0623_02_HOT

A1.18.6.6.1 Overview of the flight path

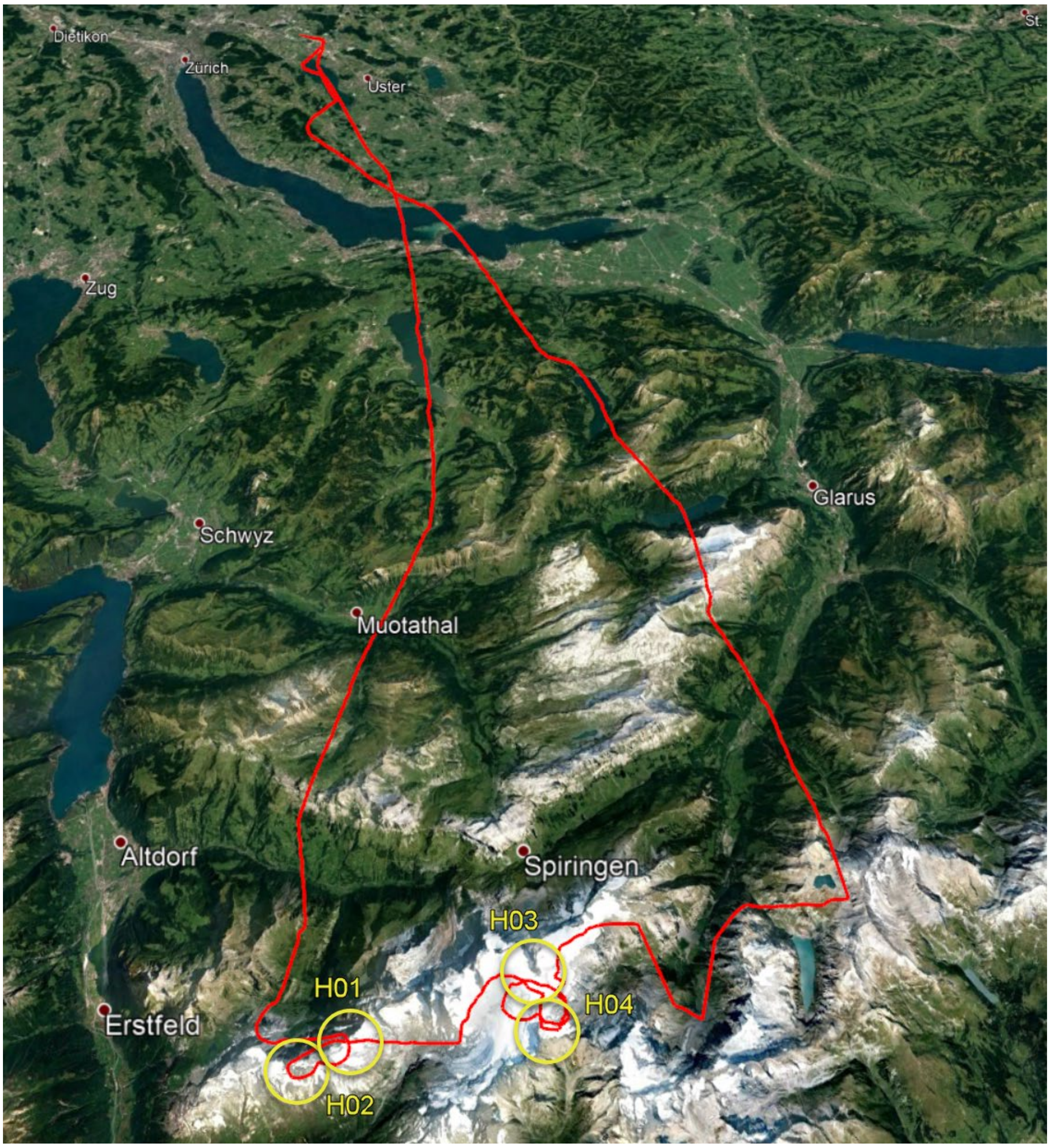

Figure 29: Overview of the flight path including hotspots H01 to H04 (yellow circles). Shown on Google Earth.

A1.18.6.6.2 Hotspot H01

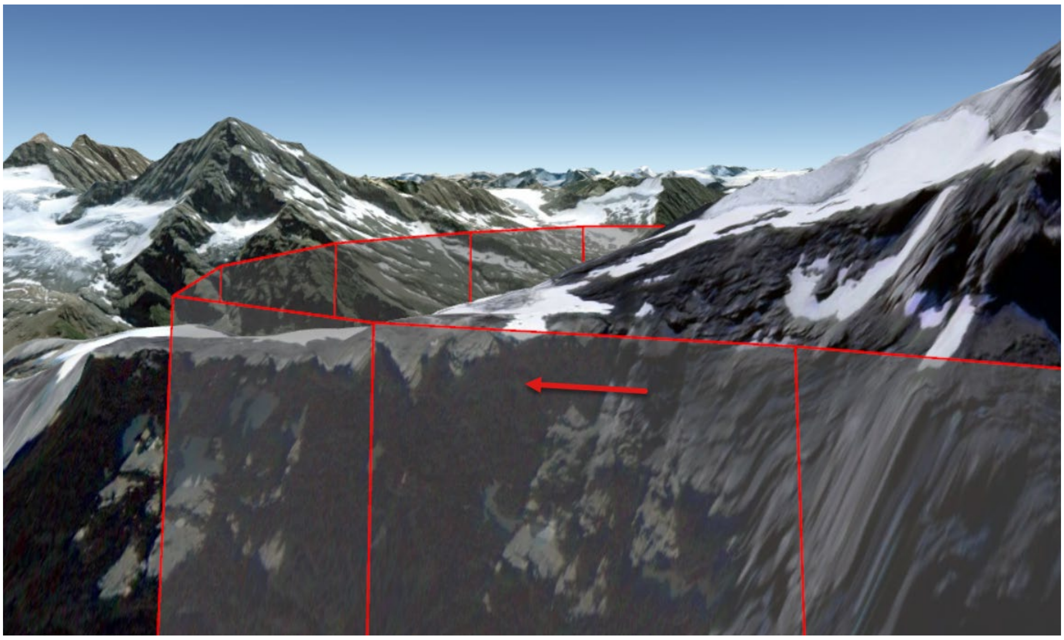

Figure 30: Horizontal overflight at 90 degrees to the crest of the mountain ridge at an altitude of 2,887 m AMSL with a height of 65 m above ground directly below the radar flight path and 81 m above ground with respect to the lowest point of the terrain profile. Shown on Google Earth.

Figure 30 shows a choice of flight path classified as 'high-risk', which is characterised by the following safety-related features:

- Restricted view of the following section of terrain;
- Limited possibility of an alternative flight path;
- Very low-level flight over the terrain.

A1.18.6.6.3 Hotspot H02

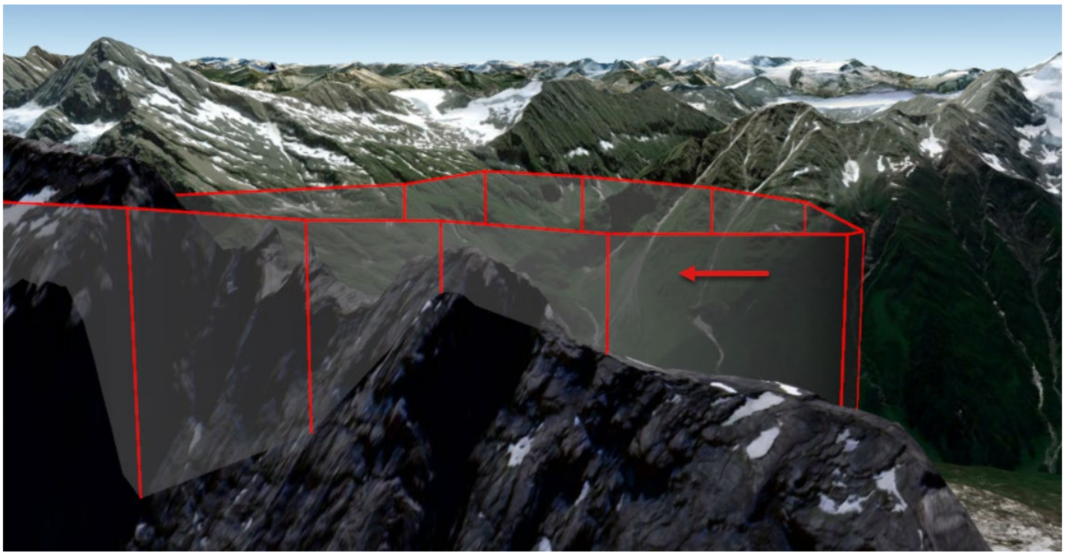

Figure 31: Climbing flight over the crest of the mountain ridge at an altitude of 2,949 m AMSL with a height of 95 m above ground directly below the radar flight path and 121 m above ground with respect to the lowest point of the terrain profile. Shown on Google Earth.

Figure 31 shows a choice of flight path classified as ‘very high-risk’, which is characterised by the following safety-related features:

- Low-level flight over the terrain;
- Restricted view of the following section of terrain;
- Limited possibility of an alternative flight path;
- Approaching an obstacle whilst climbing.

A1.18.6.6.4 Hotspot H03

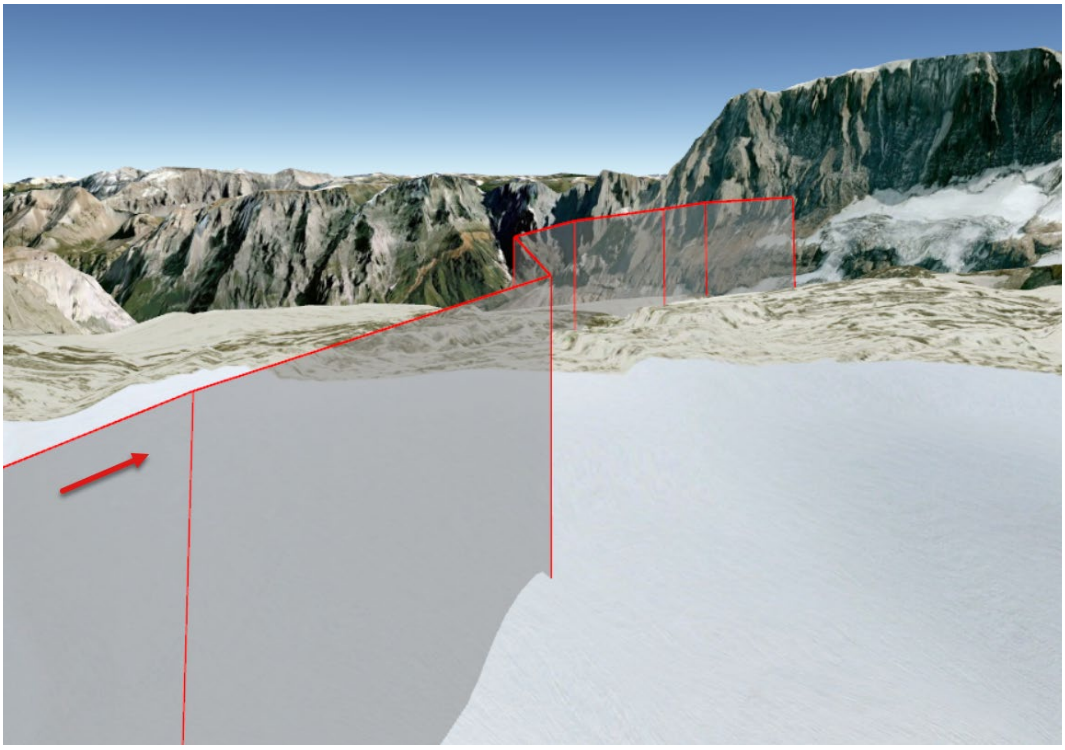

Figure 32: Horizontal flight over the terrain at an altitude of 3,045 m AMSL with a height of 102 m above ground directly below the radar flight path and 102 m above ground with respect to the lowest point of the terrain profile. Shown on Google Earth.

Figure 32 shows a choice of flight path classified as ‘high-risk’, which is characterised by the following safety-related features:

- Rising terrain in the direction of flight;
- Low-level flight over the terrain;
- Restricted view of the following section of terrain;
- Limited possibility of an alternative flight path.

A1.18.6.6.5 Hotspot H04

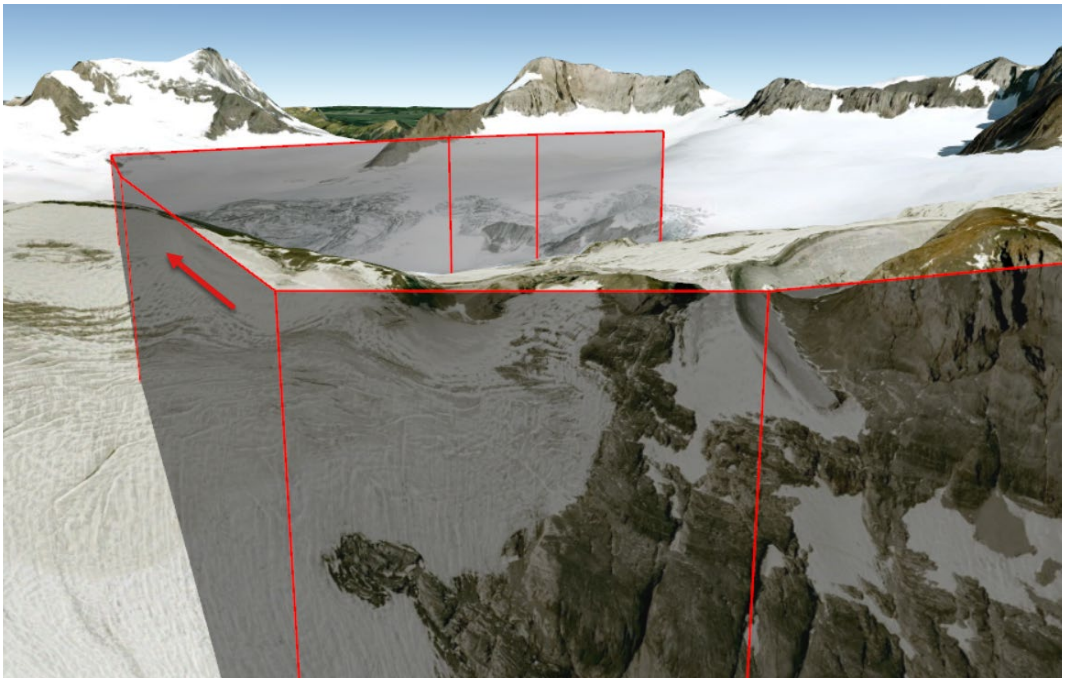

Figure 33: Horizontal flight over the crest of the mountain ridge at an altitude of 3,045 m AMSL with a height of 84 m above ground directly below the radar flight path and 121 m above ground with respect to the lowest point of the terrain profile. Shown on Google Earth.

Figure 33 shows a choice of flight path classified as 'very high-risk', which is characterised by the following safety-related features:

- Rising terrain in the direction of flight;
- Low-level flight over the terrain;
- No possibility of an alternative flight path for a prolonged period of time.

A1.18.6.7 Flight_0712_01_HOS

A1.18.6.7.1 Overview of the flight path

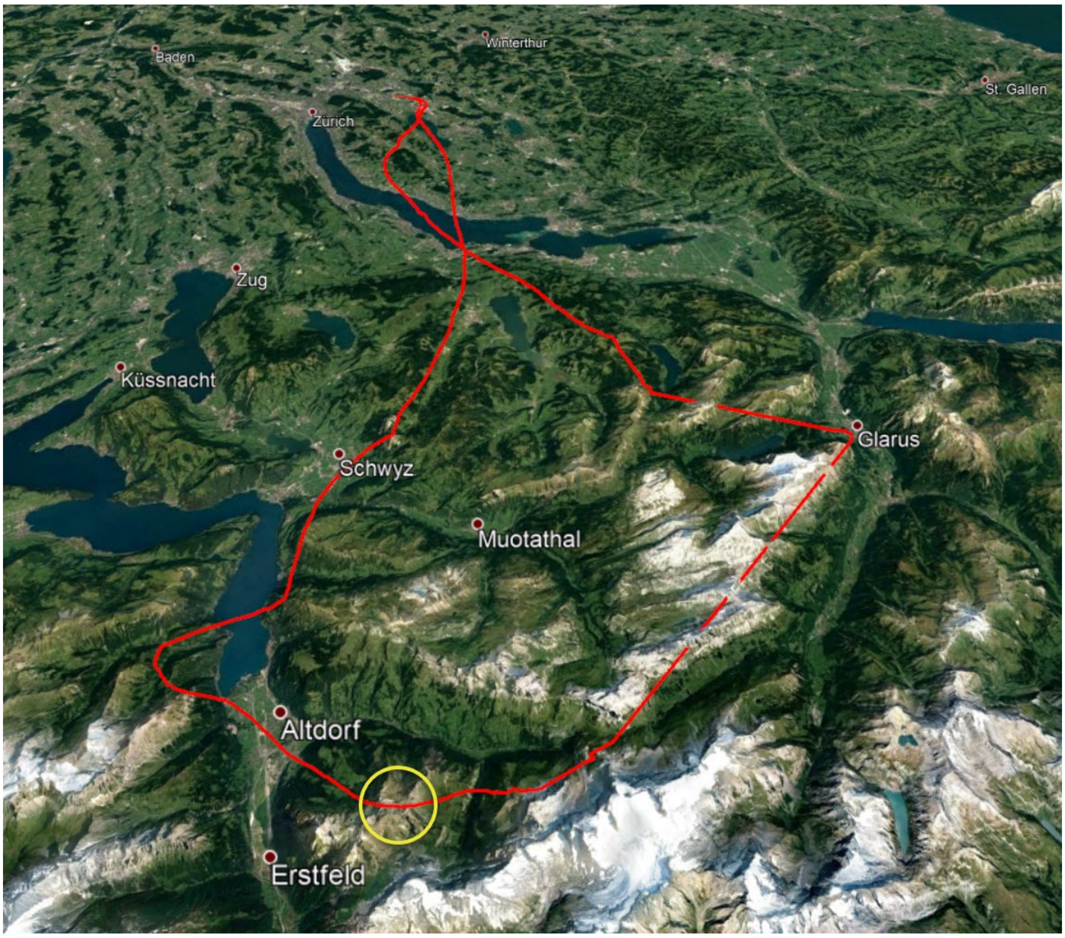

Figure 34: Overview of the flight path including hotspot (yellow circle). Shown on Google Earth.

A1.18.6.7.2 Hotspot

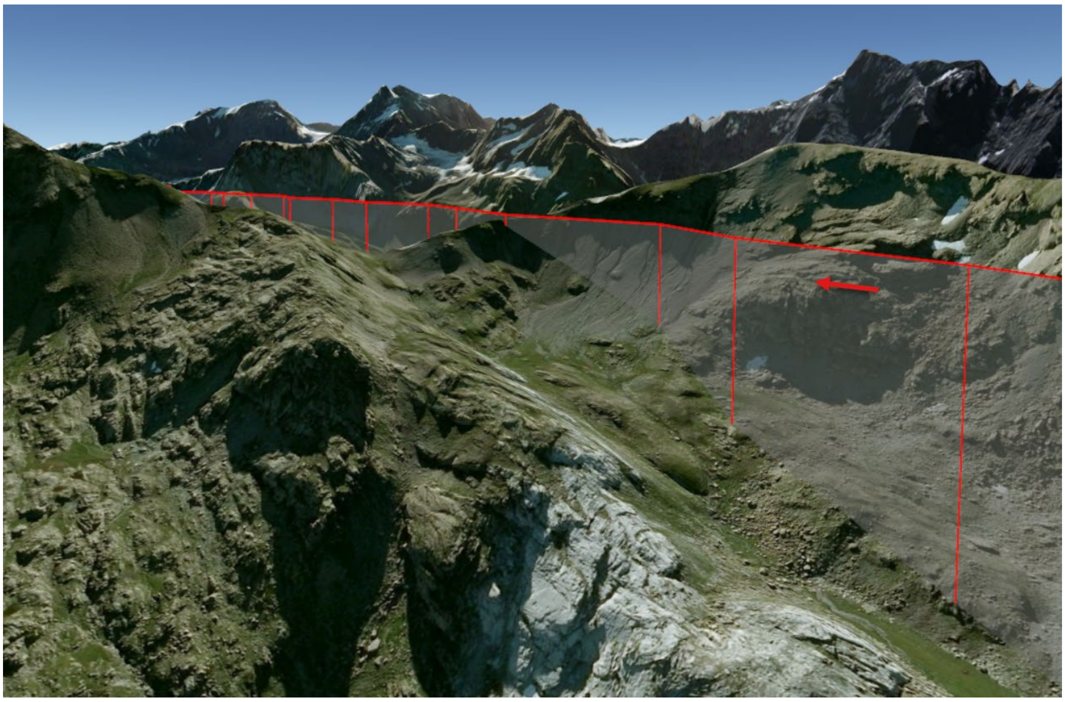

Figure 35: Horizontal overflight at 90 degrees to the crest of the mountain ridge at an altitude of 2,375 m AMSL with a height of 9 m above ground directly below the radar flight path and 42 m above ground with respect to the lowest point of the terrain profile. Shown on Google Earth.

Figure 35 shows a choice of flight path classified as ‘very high-risk’, which is characterised by the following safety-related features:

- Rising terrain in the direction of flight;
- Restricted view of the following section of terrain;
- Very low-level flight over the terrain;
- No possibility of an alternative flight path for a prolonged period of time.

A1.18.6.8 Flight_0713_02_HOT

A1.18.6.8.1 Overview of the flight path

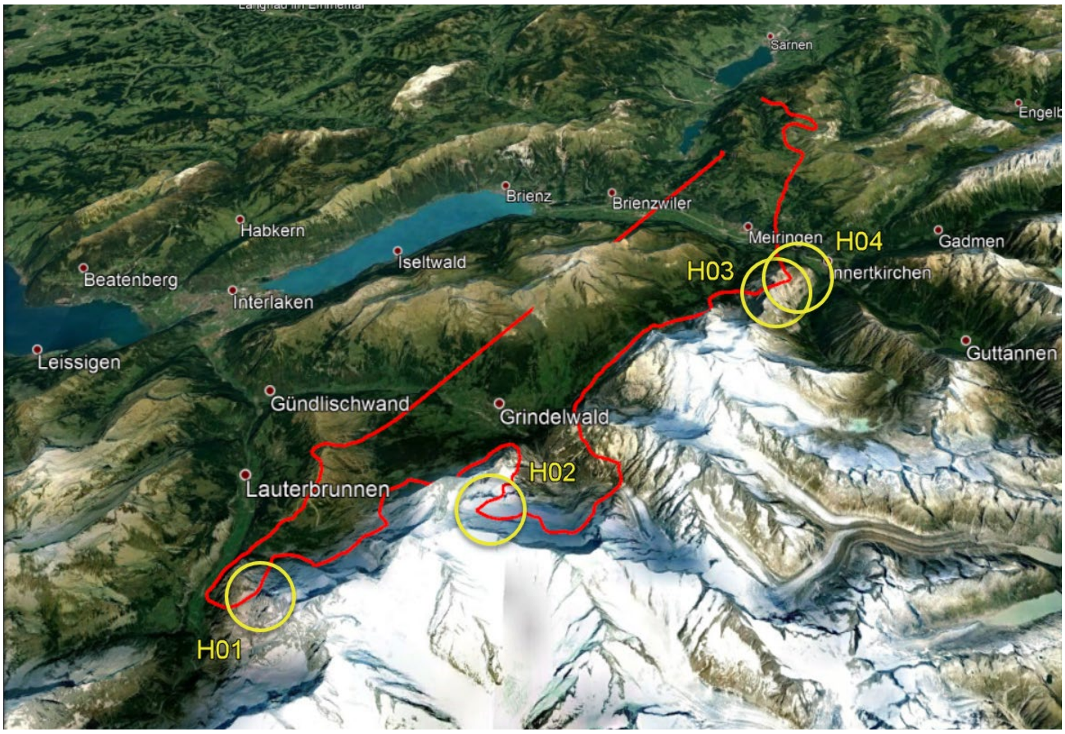

Figure 36: Overview of the flight path including hotspots H01 to H04 (yellow circles). Shown on Google Earth.

A1.18.6.8.2 Overview of the approach path

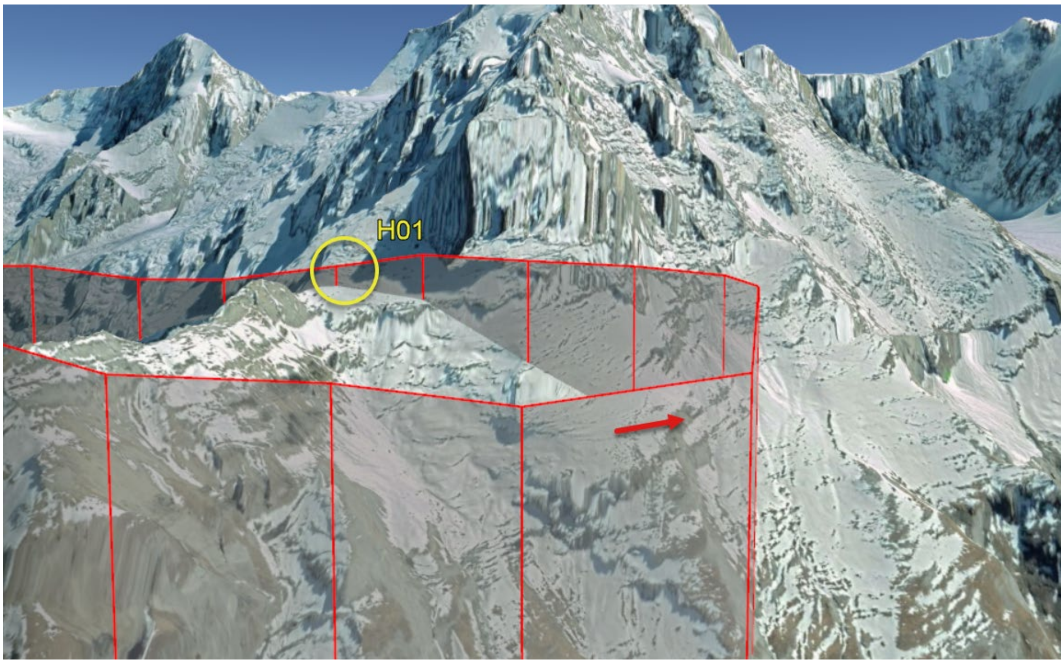

Figure 37: Representation of the approach path to hotspot H01 (yellow circle). Shown on Google Earth.

A1.18.6.8.3 Hotspot H01

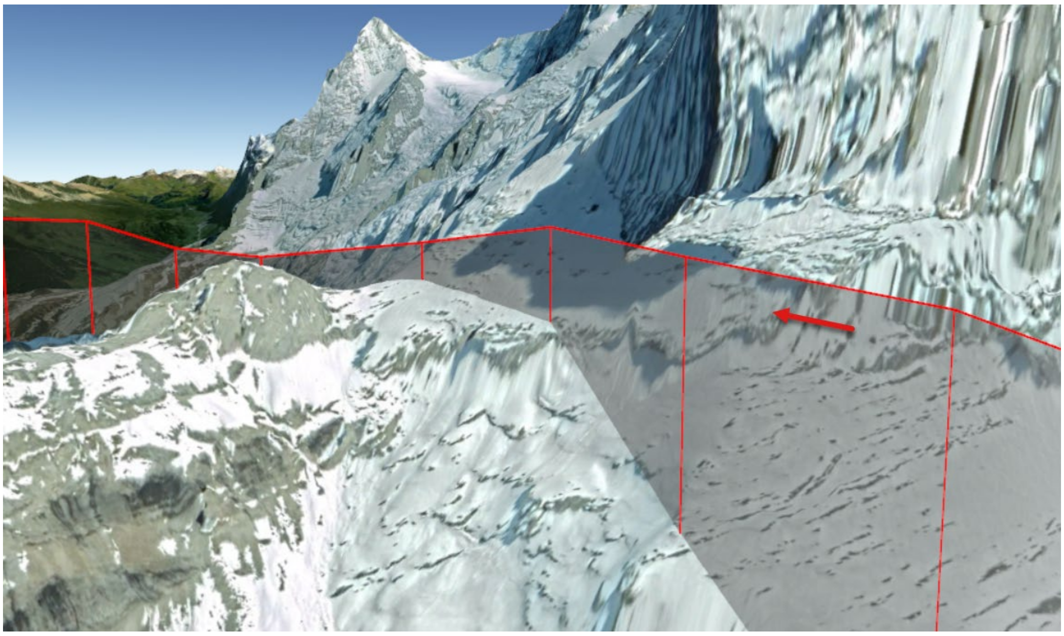

Figure 38: Descending overflight at almost 90 degrees to the crest of the mountain ridge at an altitude of 2,720 m AMSL with a height of 58 m above ground directly below the radar flight path and 71 m above ground with respect to the lowest point of the terrain profile. Shown on Google Earth.

Figure 38 shows a choice of flight path classified as 'high-risk', which is characterised by the following safety-related features:

- Limited possibility of an alternative flight path;
- Very low-level flight over the terrain.

A1.18.6.8.4 Hotspot H02

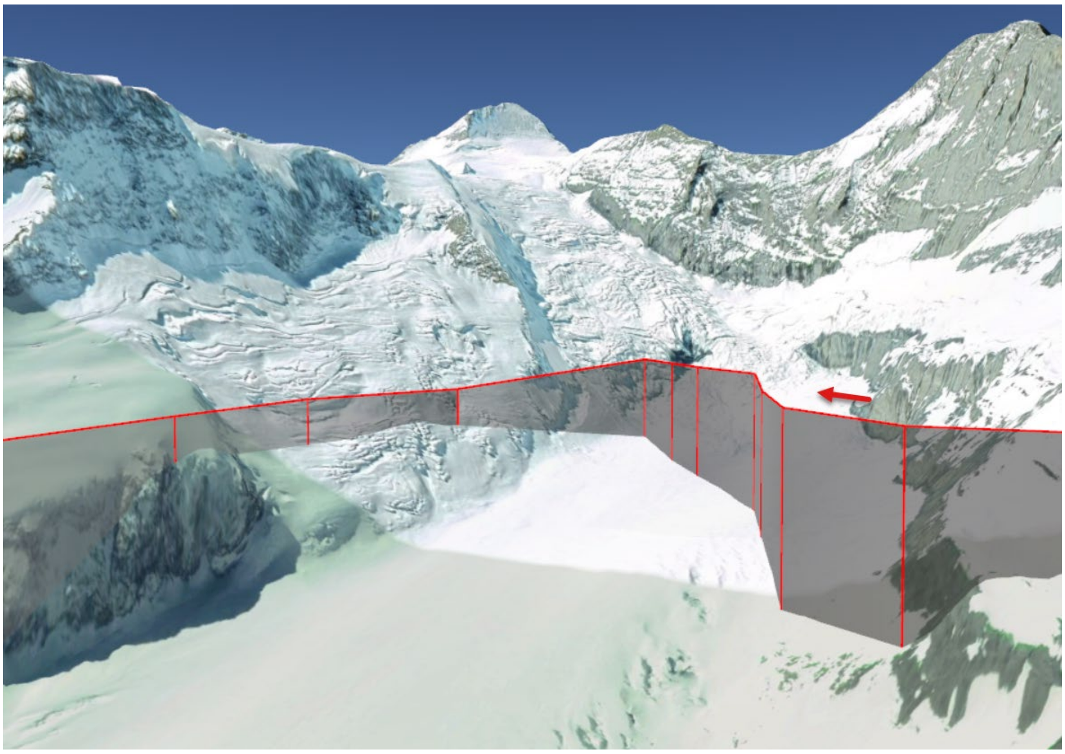

Figure 39: Descending overflight at an altitude of 2,908 m AMSL with a height of 95 m above ground directly below the radar flight path and 178 m above ground with respect to the lowest point of the terrain profile. Shown on Google Earth.

Figure 39 shows a choice of flight path classified as 'moderate-risk', which is characterised by the following safety-related features:

- Turning towards an obstacle;
- Low-level flight over the terrain.

In addition, when turning into a left turn, the 'belly to the wall' flight attitude bears the risk of the pilots not being able to assess the aircraft's position in space due to missing vertical and horizontal visual references in the terrain.

A1.18.6.8.5 Hotspot H03

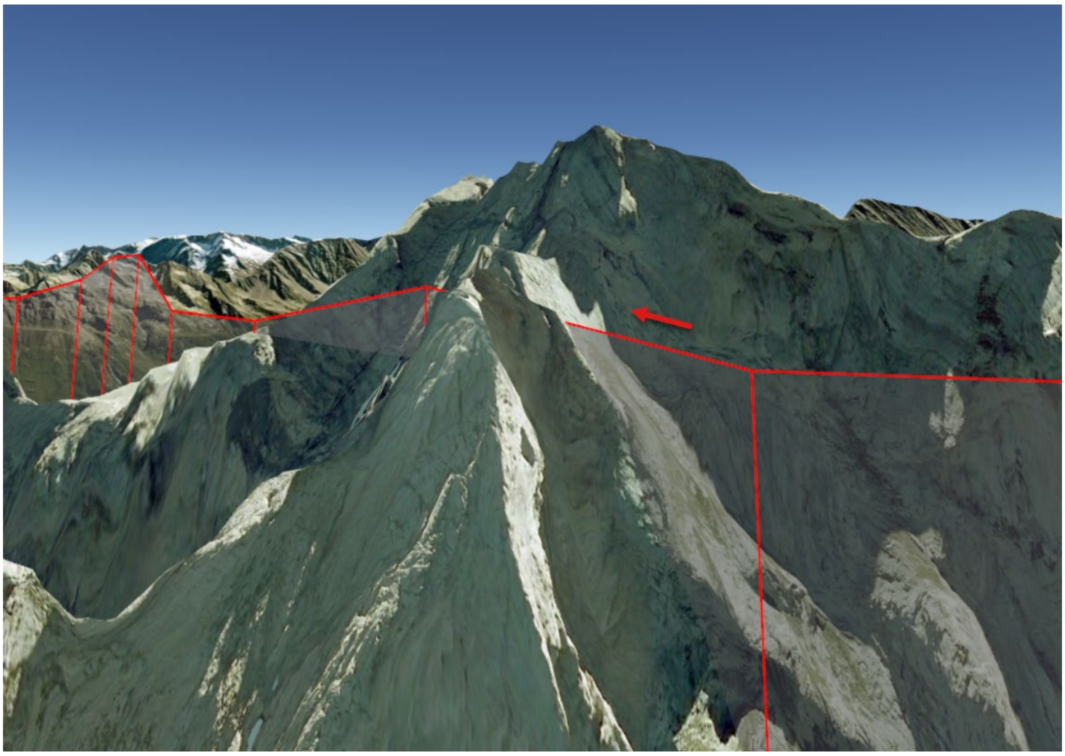

Figure 40: Horizontal flight over the crest of the mountain ridge at an altitude of 2,623 m AMSL with a height of -35 m above ground directly below the radar flight path and 43 m above ground with respect to the lowest point of the terrain profile. Shown on Google Earth.

Figure 40 shows a choice of flight path classified as ‘high-risk’, which is characterised by the following safety-related features:

- Limited possibility of an alternative flight path;
- Very low-level flight over the terrain.

Due to leeway in the lateral position of the radar flight path, the flight path intersects the terrain here. The overflight therefore took place close to the terrain.

A1.18.6.8.6 Hotspot H04

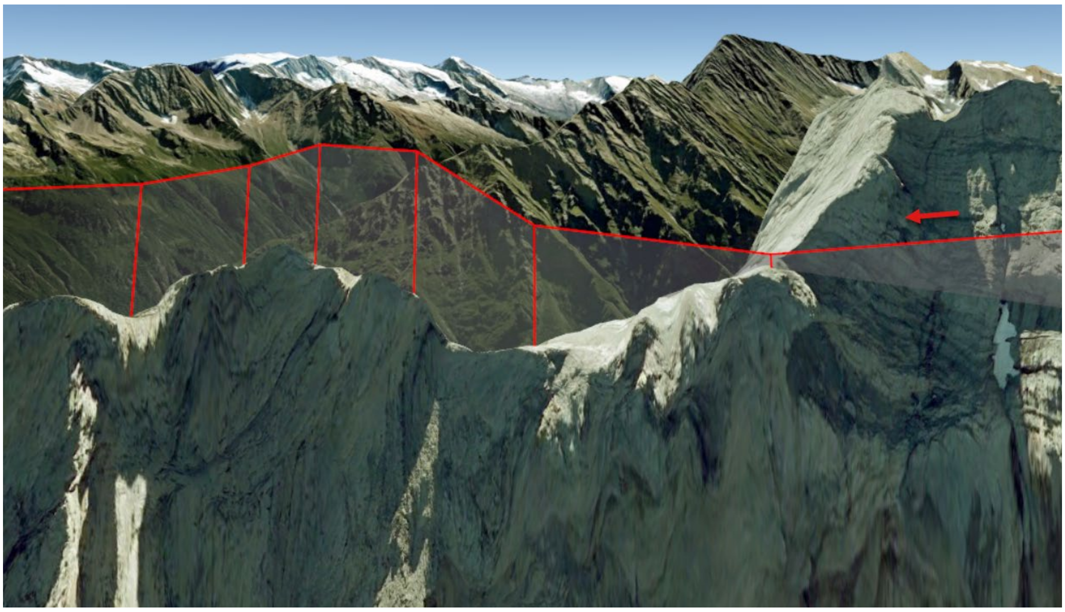

Figure 41: Horizontal flight over the crest of the mountain ridge at an altitude of 2,623 m AMSL with a height of 5 m above ground directly below the radar flight path and 58 m above ground with respect to the lowest point of the terrain profile. Shown on Google Earth.

Figure 41 shows a choice of flight path classified as 'high-risk', which is characterised by the following safety-related features:

- Restricted view of the following section of terrain;
- Limited possibility of an alternative flight path;
- Very low-level flight over the terrain.

A1.18.6.9 Flight_0803_01_HOP

A1.18.6.9.1 Overview of the flight path

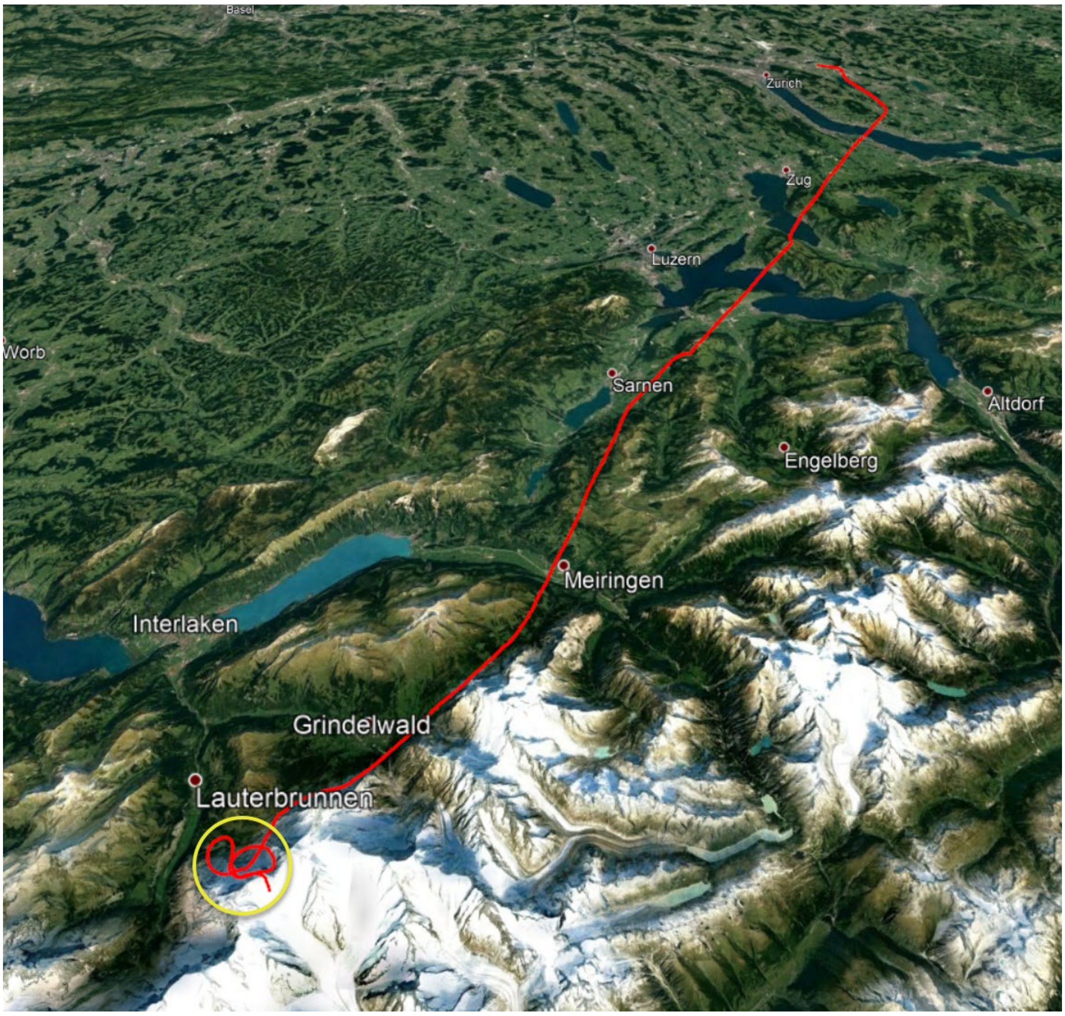

Figure 42: Overview of the flight path including hotspot (yellow circle). Shown on Google Earth.

A1.18.6.9.2 Overview of the approach path

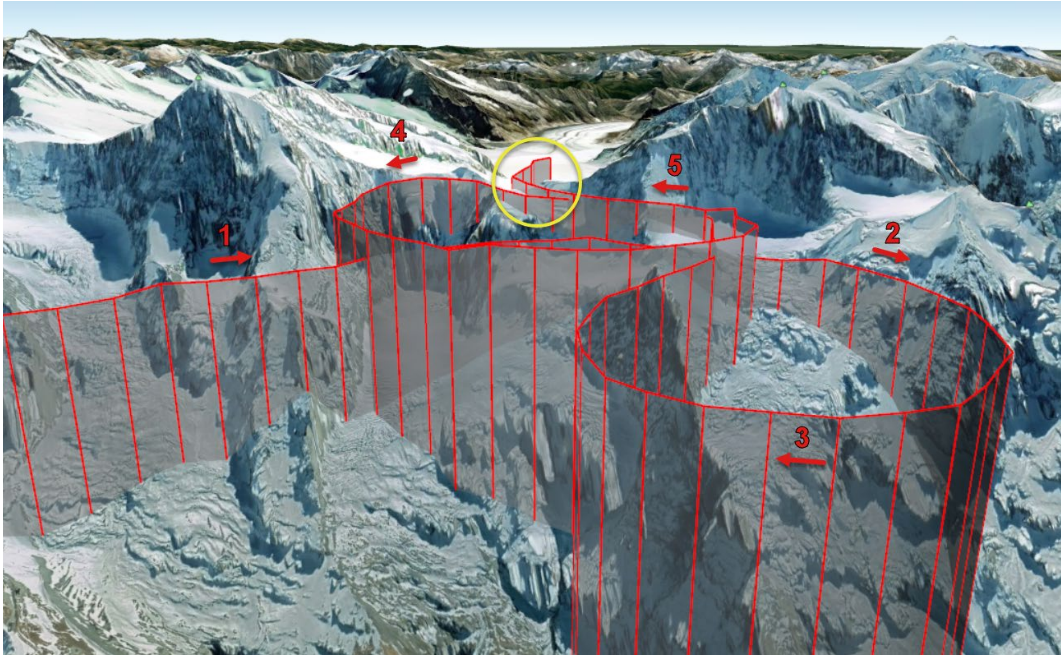

Figure 43: Representation of the approach path (travelling from 1 to 5) and hotspot (yellow circle). Shown on Google Earth.

A1.18.6.9.3 Hotspot

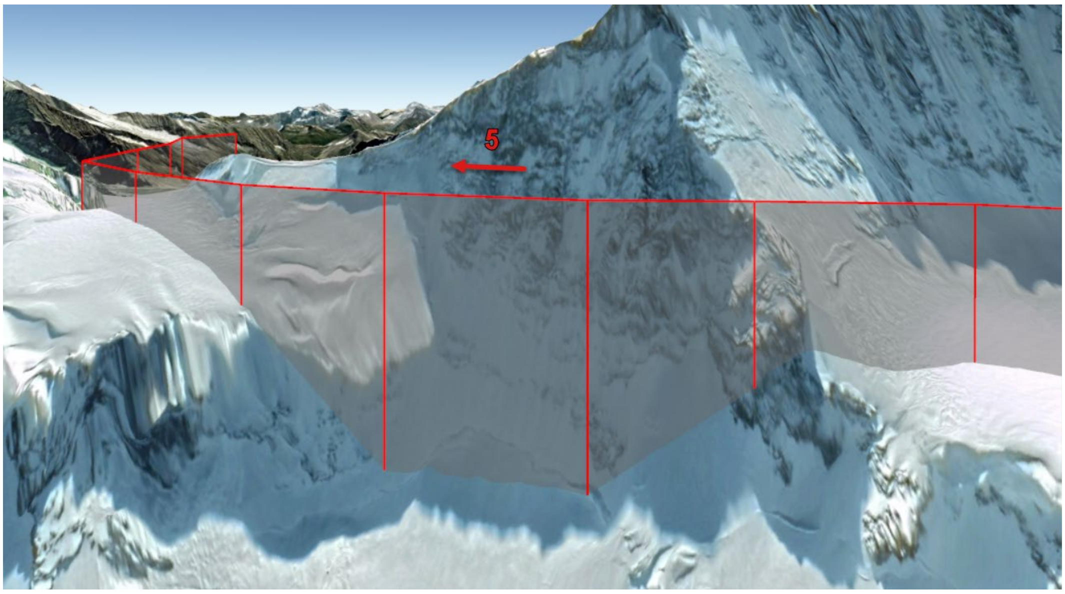

Figure 44: Horizontal flight over the terrain at an altitude of 3,539 m AMSL with a height of 74 m above ground directly below the radar flight path and 74 m above ground with respect to the lowest point of the terrain profile. Shown on Google Earth.

Figure 44 shows a choice of flight path classified as 'very high-risk', which is characterised by the following safety-related features:

- Restricted view of the following section of terrain;
- Very low-level flight over the terrain;
- No possibility of an alternative flight path for a prolonged period of time.

A1.18.6.10 Flight_0804_02_HOP

A1.18.6.10.1 Overview of the flight path

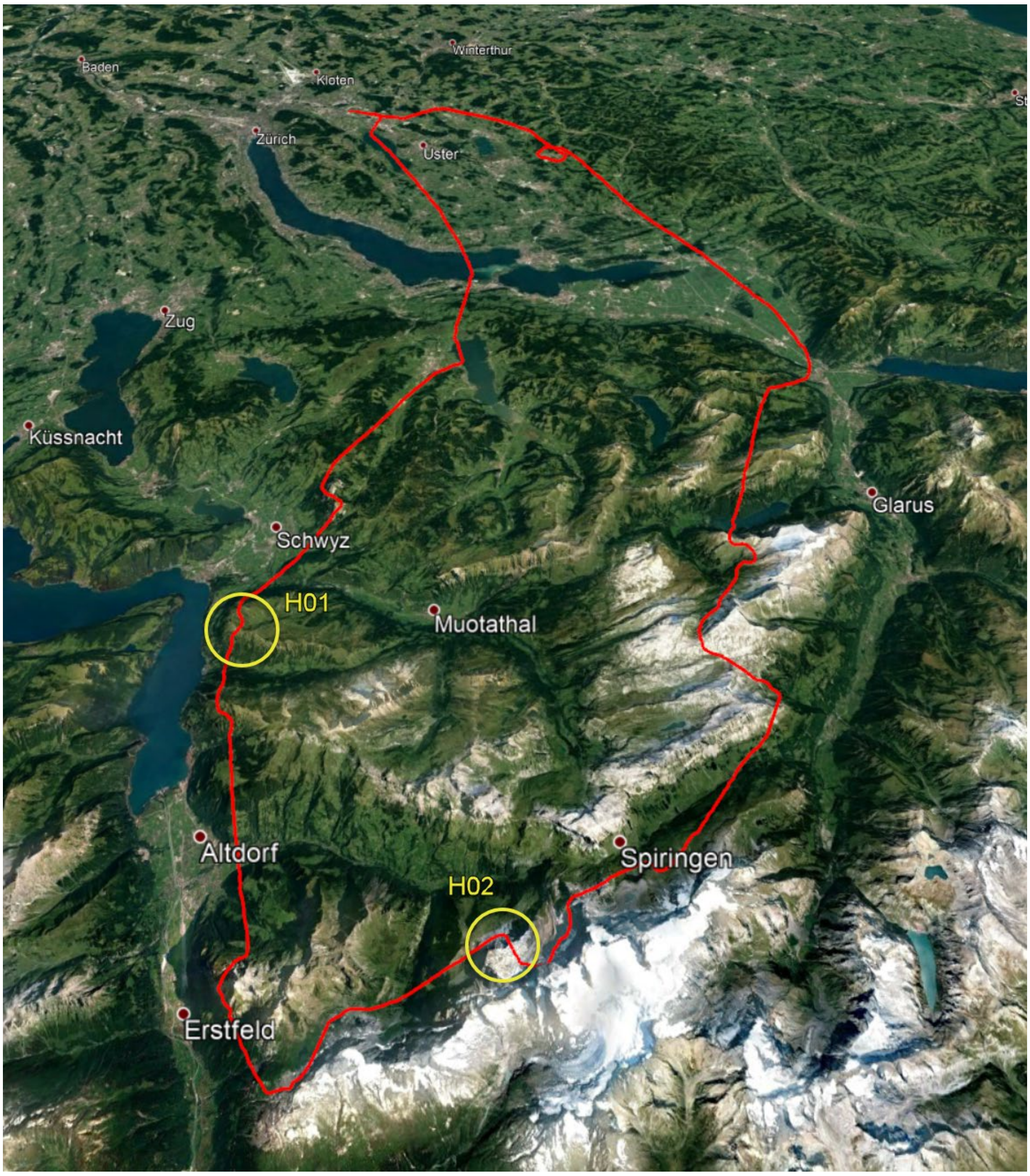

Figure 45: Overview of the flight path including hotspots H1 and H2 (yellow circles). Shown on Google Earth.

A1.18.6.10.2 Hotspot H01

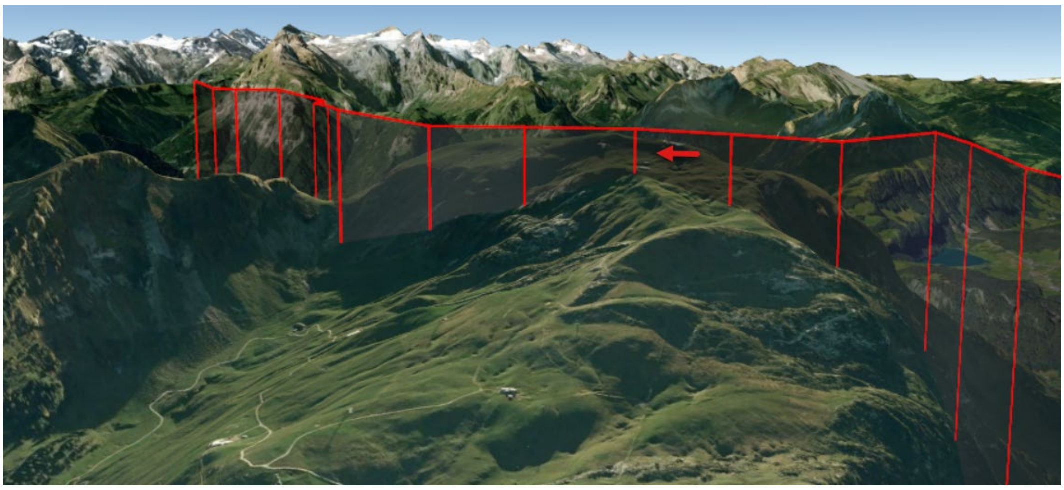

Figure 46: Horizontal flight over the terrain at an altitude of 1,951 m AMSL with a height of 98 m above ground directly below the radar flight path and 177 m above ground with respect to the lowest point of the terrain profile. Shown on Google Earth.

Figure 46 shows a choice of flight path classified as 'moderate-risk', which is characterised by the following safety-related feature:

- Low-level flight over the terrain.

A1.18.6.10.3 Hotspot H02

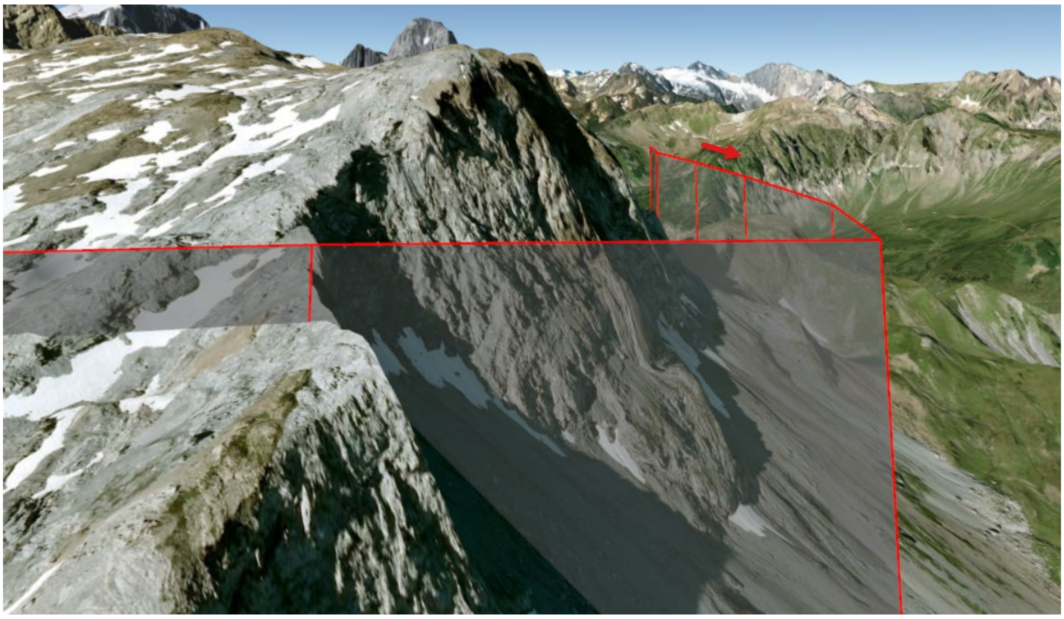

Figure 47: Climbing overflight at almost 90 degrees to the crest of the mountain ridge at an altitude of 2,525 m AMSL with a height of 45 m above ground directly below the radar flight path and 58 m above ground with respect to the lowest point of the terrain profile. Shown on Google Earth.

Figure 47 shows a choice of flight path classified as 'high-risk', which is characterised by the following safety-related features:

- Limited possibility of an alternative flight path;
- Very low-level flight over the terrain.

A1.18.6.11 Flight_0804_04_HOP

A1.18.6.11.1 Overview of the flight path

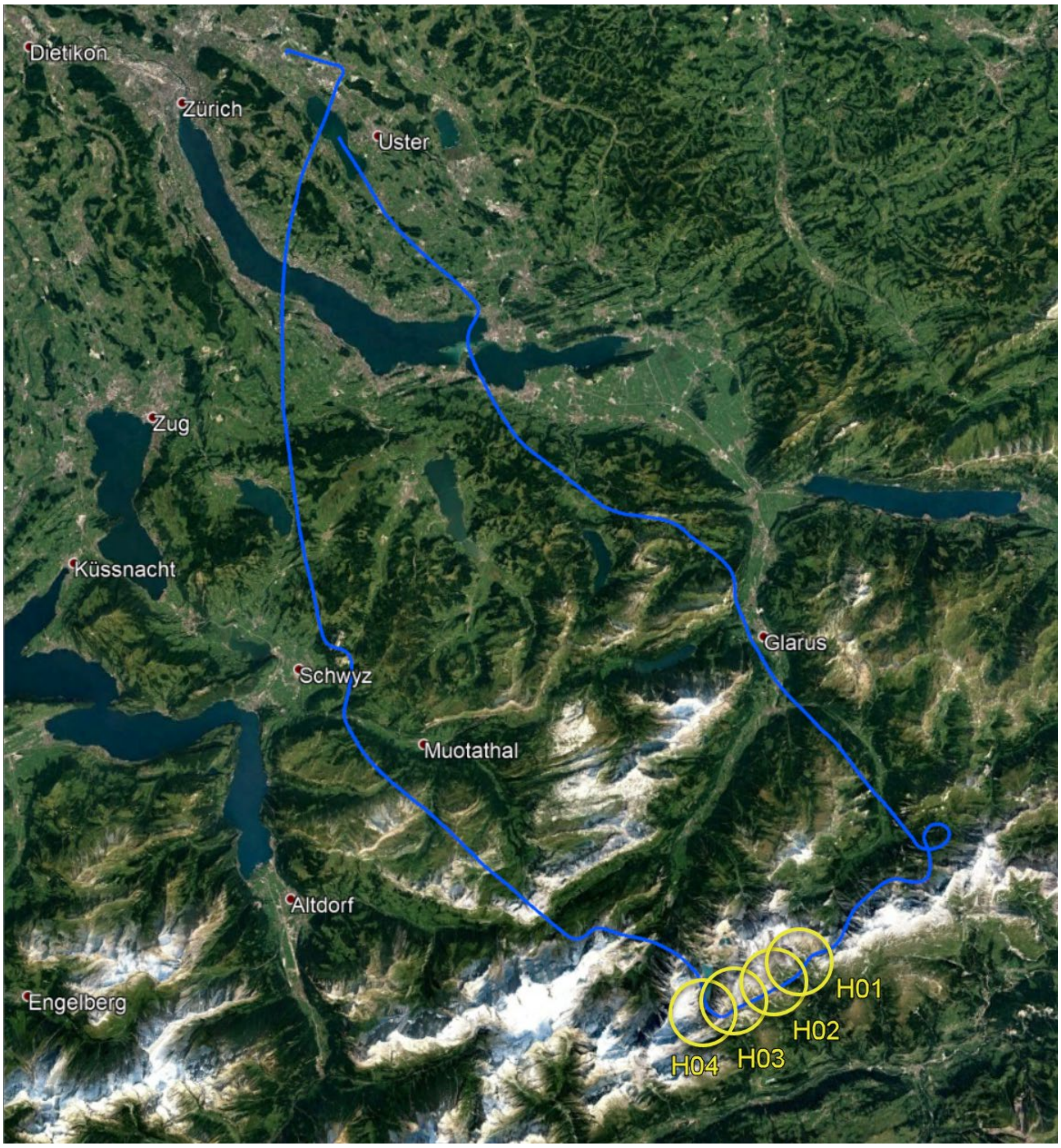

Figure 48: Overview of the GPS flight path (blue) including hotspots H01 to H04 (yellow circles). Shown on Google Earth.

A1.18.6.11.2 Overview of the approach path

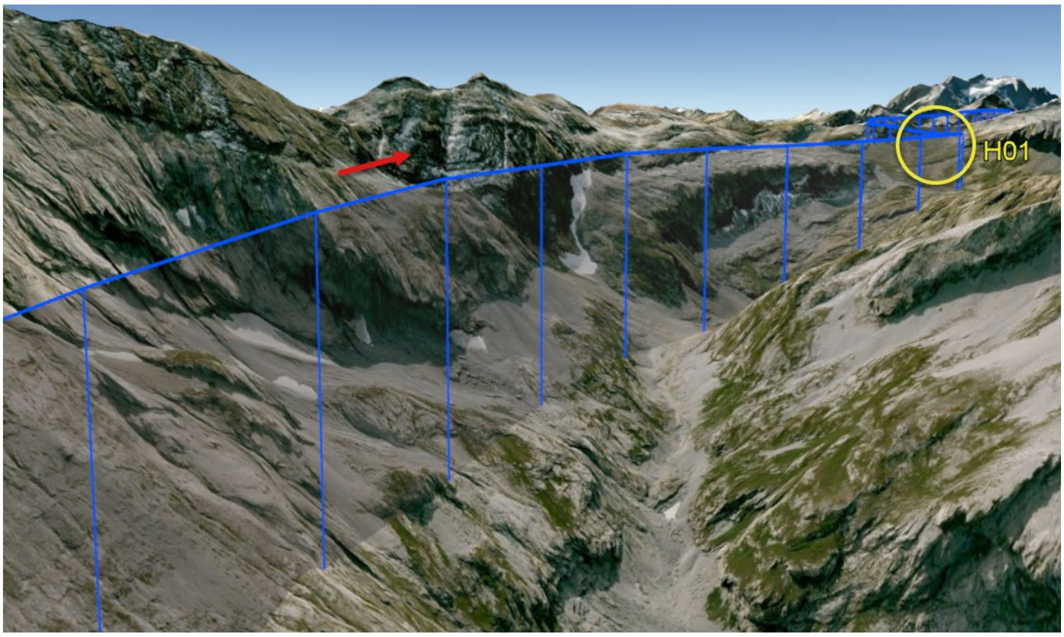

Figure 49: Representation of the GPS approach path (blue) to hotspot H01 (yellow circle). Shown on Google Earth.

A1.18.6.11.3 Hotspot H01

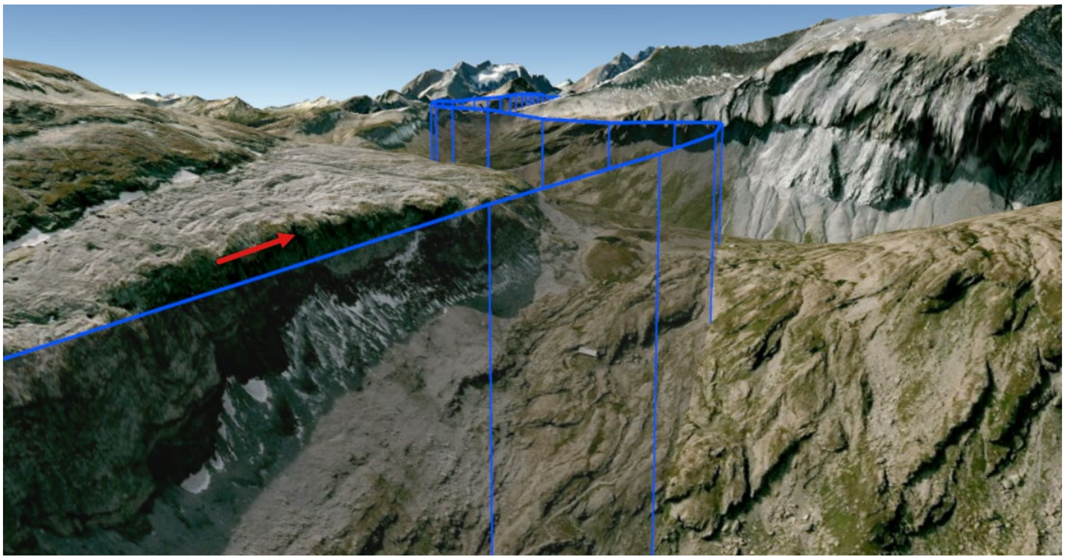

Figure 50: Climbing overflight at almost 90 degrees to the crest of the mountain ridge at a GPS altitude of 2,545 m AMSL with a height of 141 m above ground directly below the GPS flight path and 141 m above ground with respect to the lowest point of the terrain profile. Shown on Google Earth.

Figure 50 shows a choice of flight path classified as 'very high-risk', which is characterised by the following safety-related features:

- Rising terrain in the direction of flight;
- Low-level flight over the terrain;
- Approaching an obstacle whilst climbing;
- No possibility of an alternative flight path for a prolonged period of time.

A1.18.6.11.4 Hotspot H02

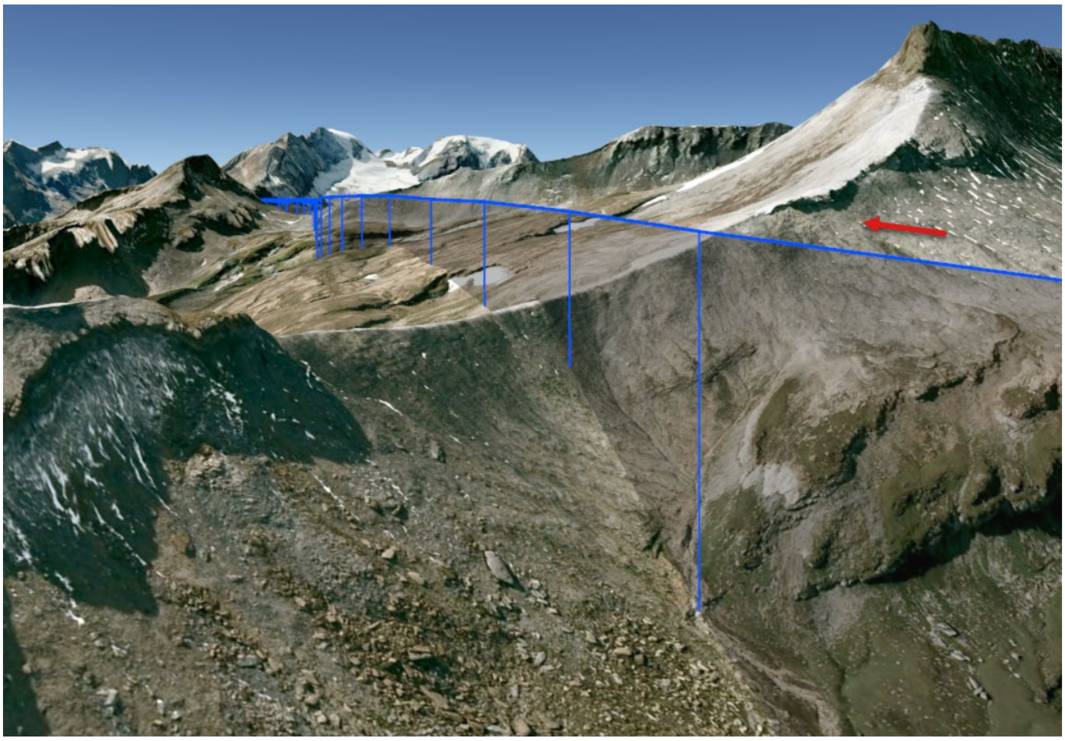

Figure 51: Climbing overflight at 90 degrees to the crest of the mountain ridge at a GPS altitude of 2,610 m AMSL with a height of 75 m above ground directly below the GPS flight path and 84 m above ground with respect to the lowest point of the terrain profile. Shown on Google Earth.

Figure 51 shows a choice of flight path classified as 'very high-risk', which is characterised by the following safety-related features:

- Rising terrain in the direction of flight;
- Low-level flight over the terrain;
- Restricted view of the following section of terrain;
- Limited possibility of an alternative flight path;
- Approaching an obstacle whilst climbing.

A1.18.6.11.5 Hotspot H03

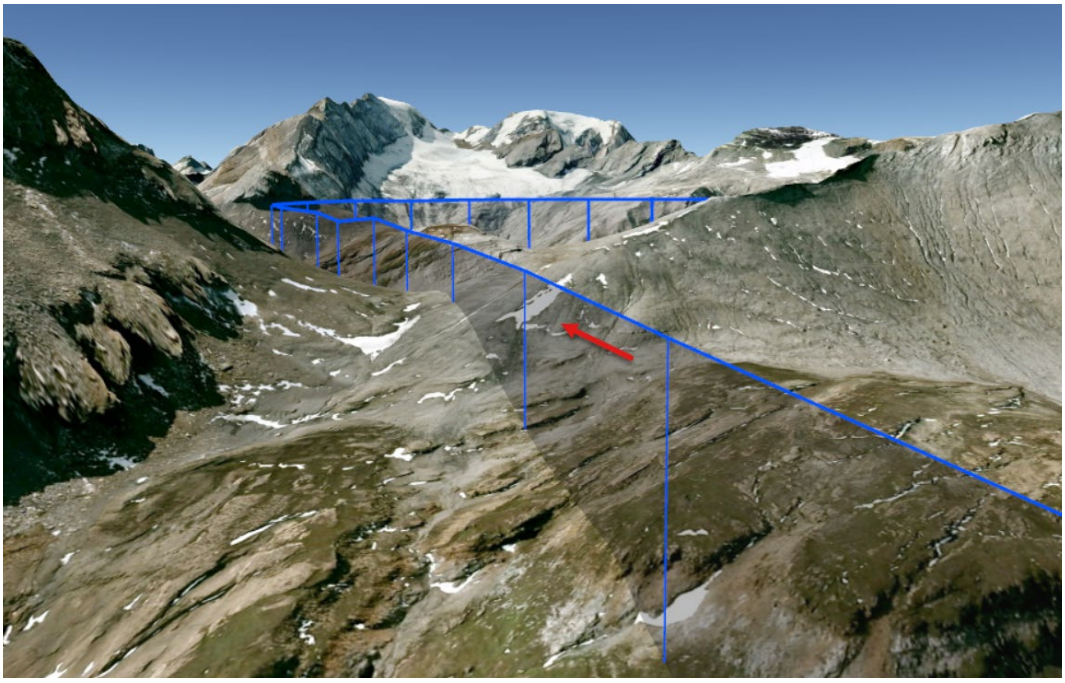

Figure 52: Climbing overflight at 90 degrees to the crest of the mountain ridge at a GPS altitude of 2,624 m AMSL with a height of 48 m above ground directly below the GPS flight path and 58 m above ground with respect to the lowest point of the terrain profile. Shown on Google Earth.

Figure 52 shows a choice of flight path classified as 'very high-risk', which is characterised by the following safety-related features:

- Rising terrain in the direction of flight;
- Restricted view of the following section of terrain;
- Approaching an obstacle whilst climbing;
- Very low-level flight over the terrain;
- No possibility of an alternative flight path for a prolonged period of time.

A1.18.6.11.6 Hotspot H04

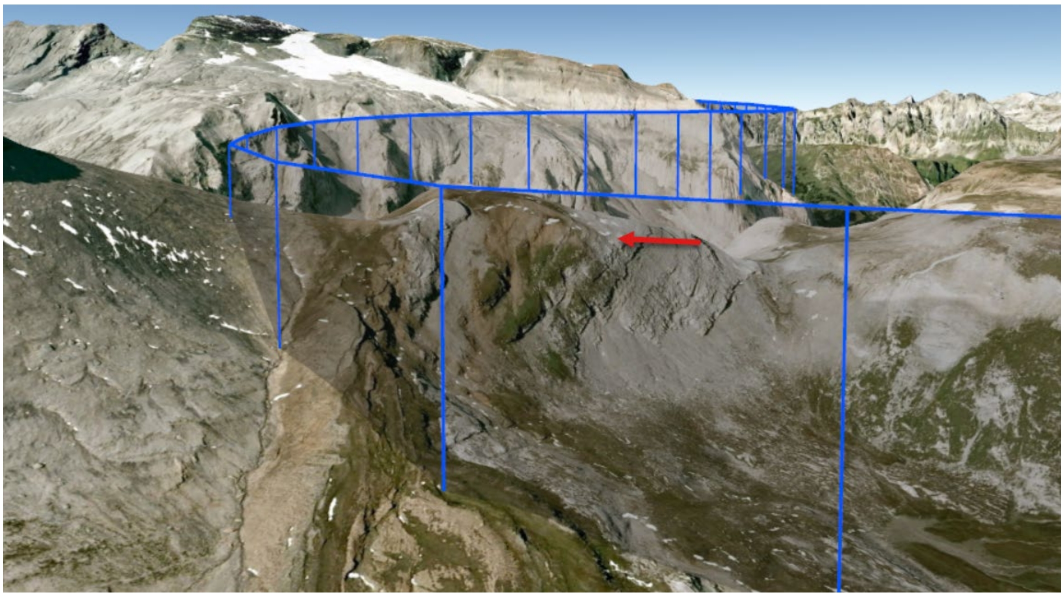

Figure 53: Horizontal overflight at 90 degrees to the crest of the mountain ridge at a GPS altitude of 2,642 m AMSL with a height of 64 m above ground directly below the GPS flight path and 84 m above ground with respect to the lowest point of the terrain profile. Shown on Google Earth.

Figure 53 shows a choice of flight path classified as 'high-risk', which is characterised by the following safety-related features:

- Restricted view of the following section of terrain;
- Limited possibility of an alternative flight path;
- Very low-level flight over the terrain.

A1.18.7 Further Ju-Air flights examined

A1.18.7.1 General

The following list of other Ju-Air flights, which were classified as 'moderate-risk', 'high-risk' or 'very high-risk', are described in detail on the upcoming pages. They are relevant due to their systemic importance:

Line check, pilot A	:	Flight_0407_04_HOP	:	H01, H02, H03
Line checks, pilot B	:	Flight_0512_01_HOS	:	H01, H02, H03, H04
	:	Flight_0512_02_HOS	:	H01, H02
FOCA inspection flight	:	Flight_0913_00_HOS	:	H01, H02, H03
Flights already undertaken by pilot B on the day of the accident	:	Flight_0804_01_HOP	:	H01, H02, H03
	:	Flight_0804_03_HOP	:	H
In-cloud fly-by	:	Flight_0602_03_HOS	:	H

A1.18.7.2 Flight_0407_04_HOP

A1.18.7.2.1 Overview of the flight path

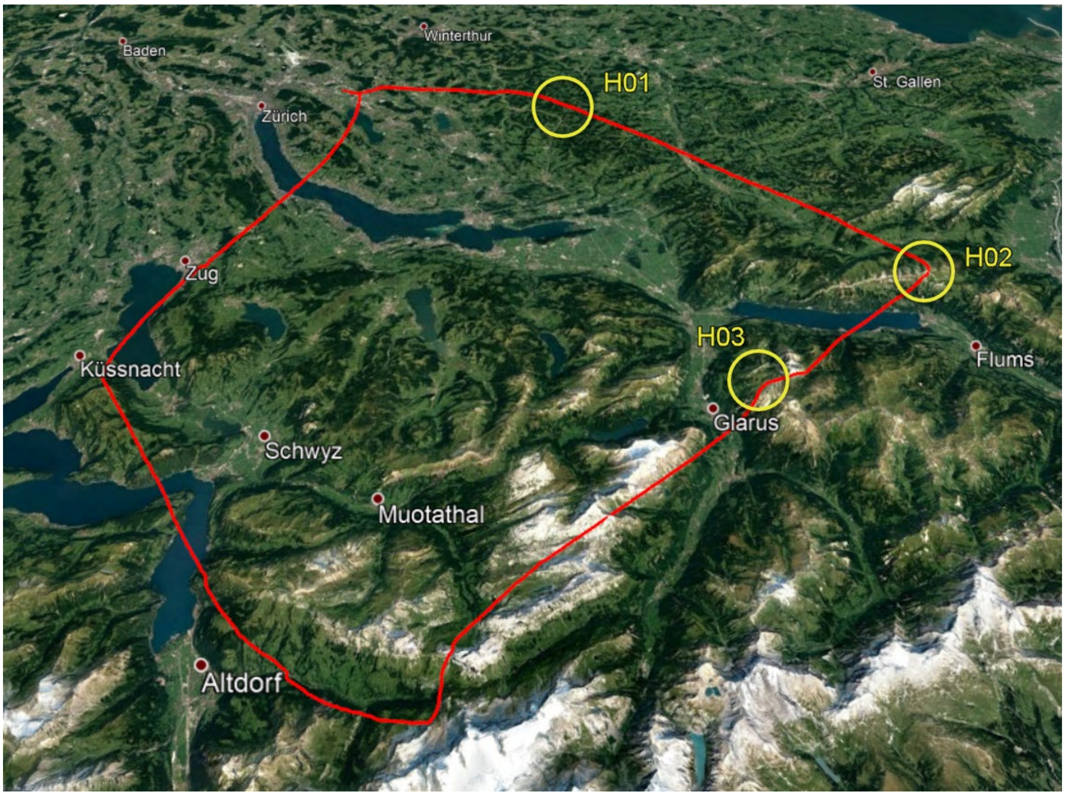

Figure 54: Overview of the flight path including hotspots H01 to H03 (yellow circles). Shown on Google Earth.

A1.18.7.2.2 Hotspot H01

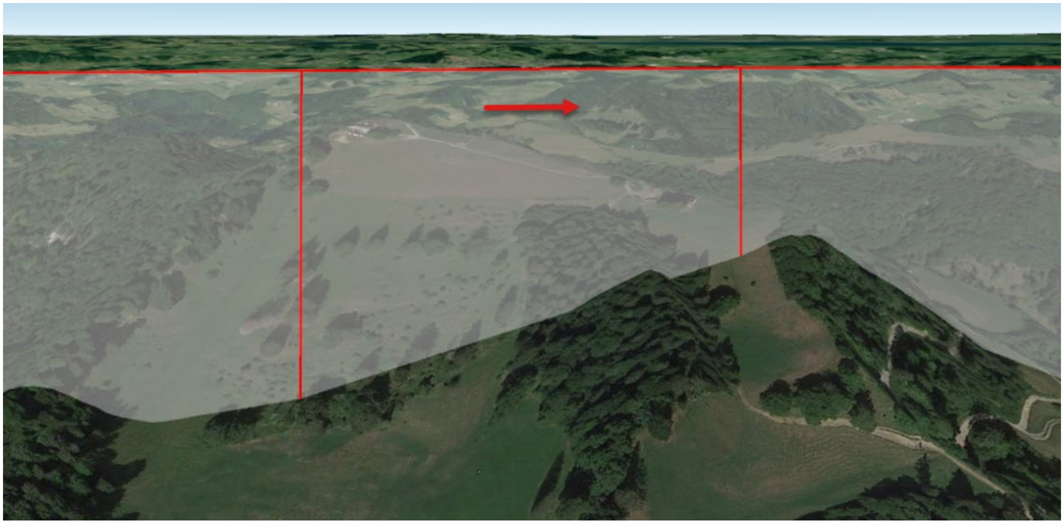

Figure 55: Horizontal flight over the terrain at an altitude of 1,189 m AMSL with a height of 107 m above ground directly below the radar flight path and 165 m above ground with respect to the lowest point of the terrain profile. Shown on Google Earth.

Figure 55 shows a choice of flight path classified as 'moderate-risk', which is characterised by the following safety-related feature:

- Low-level flight over the terrain.

A1.18.7.2.3 Hotspot H02

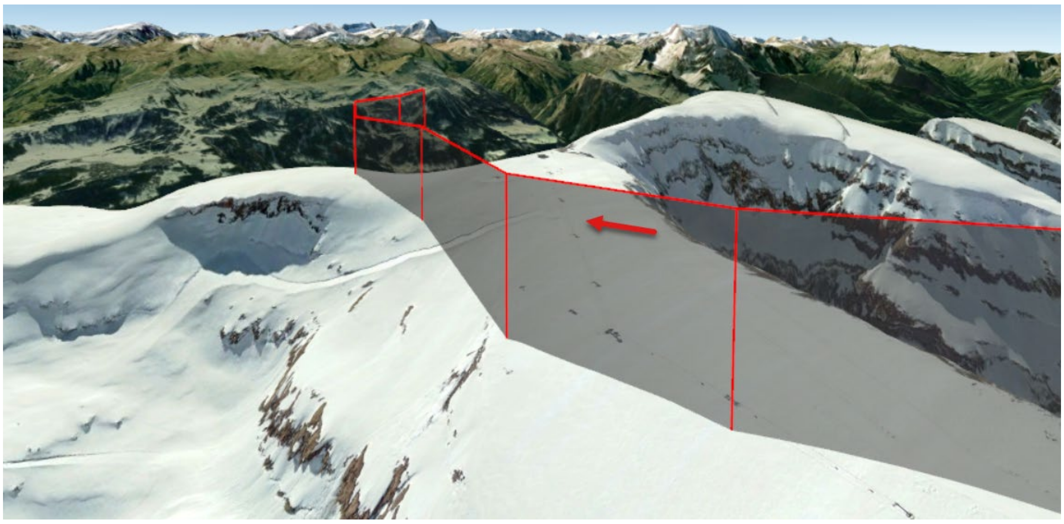

Figure 56: Horizontal overflight at almost 90 degrees to the crest of the mountain ridge at an altitude of 2,310 m AMSL with a height of 74 m above ground directly below the radar flight path and 85 m above ground with respect to the lowest point of the terrain profile. Shown on Google Earth.

Figure 56 shows a choice of flight path classified as 'high-risk', which is characterised by the following safety-related features:

- Restricted view of the following section of terrain;
- Limited possibility of an alternative flight path;
- Very low-level flight over the terrain.

A1.18.7.2.4 Hotspot H03

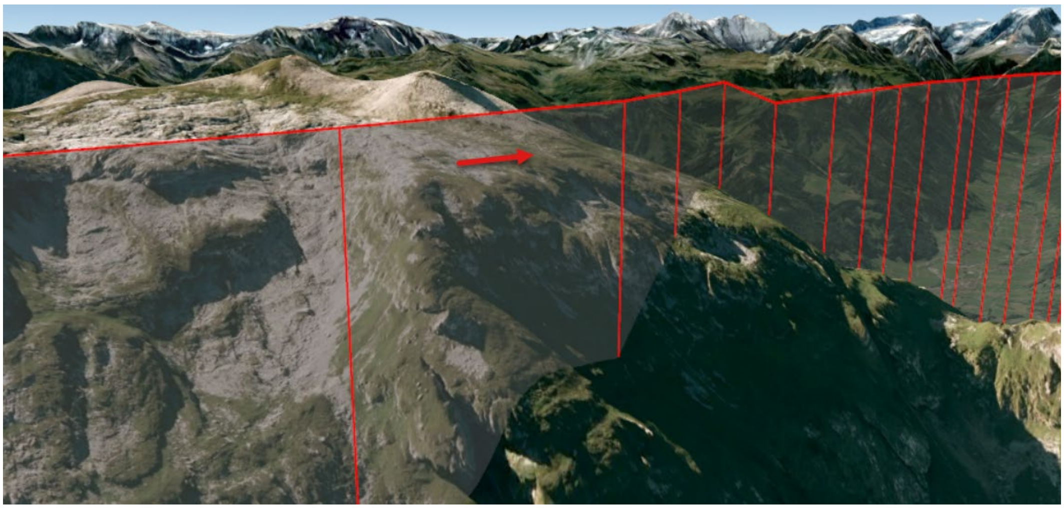

Figure 57: Horizontal overflight at 90 degrees to the crest of the mountain ridge at an altitude of 2,269 m AMSL with a height of 111 m above ground directly below the radar flight path and 219 m above ground with respect to the lowest point of the terrain profile. Shown on Google Earth.

Figure 57 shows a choice of flight path classified as 'moderate-risk', which is characterised by the following safety-related feature:

- Low-level flight over the terrain.

A1.18.7.3 Flight_0512_01_HOS

A1.18.7.3.1 Overview of the flight path

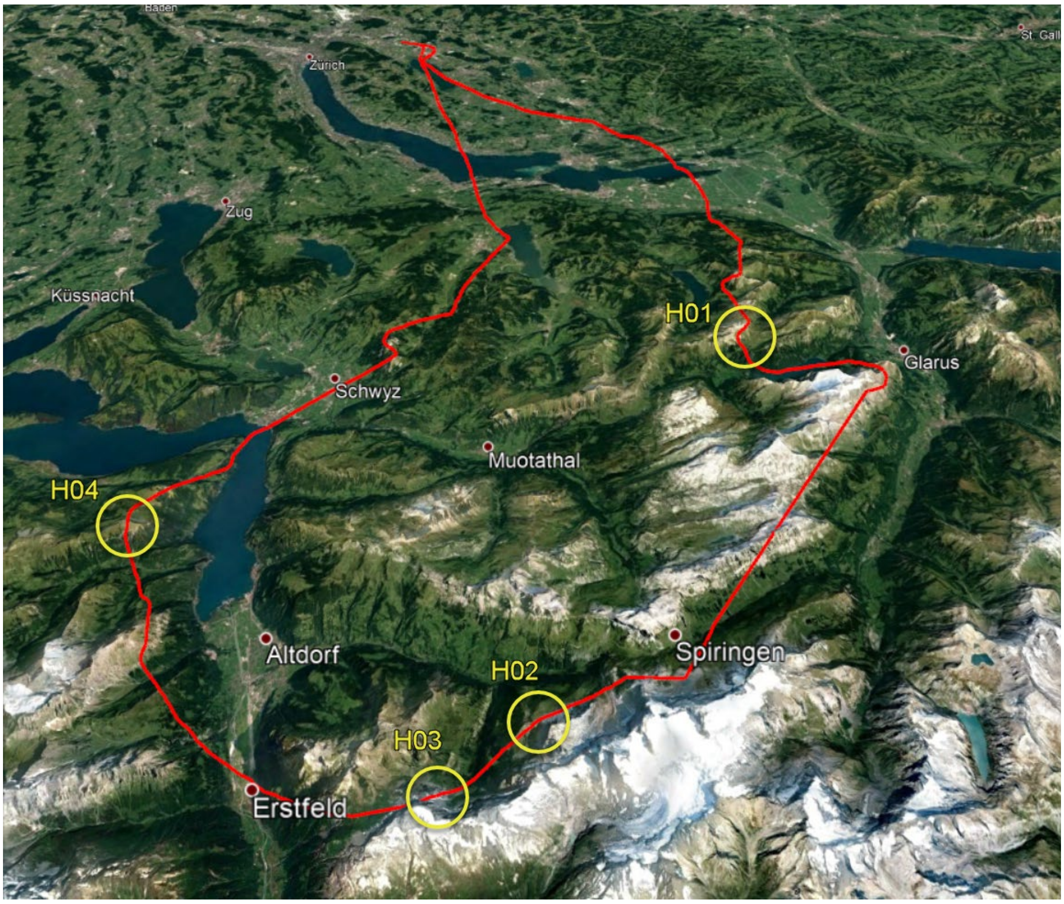

Figure 58: Overview of the flight path including hotspots H01 to H04 (yellow circles). Shown on Google Earth.

A1.18.7.3.2 Hotspot H01

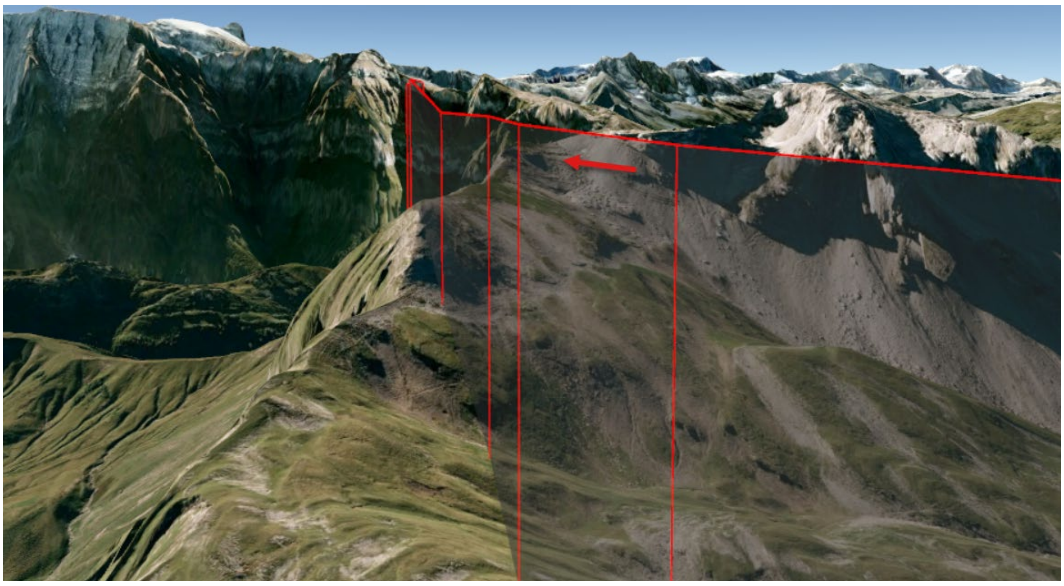

Figure 59: Climbing flight over the terrain at an altitude of 2,285 m AMSL with a height of 129 m above ground directly below the radar flight path and 190 m above ground with respect to the lowest point of the terrain profile. Shown on Google Earth.

Figure 59 shows a choice of flight path classified as 'moderate-risk', which is characterised by the following safety-related features:

- Low-level flight over the terrain;
- Approaching an obstacle whilst climbing.

A1.18.7.3.3 Hotspot H02

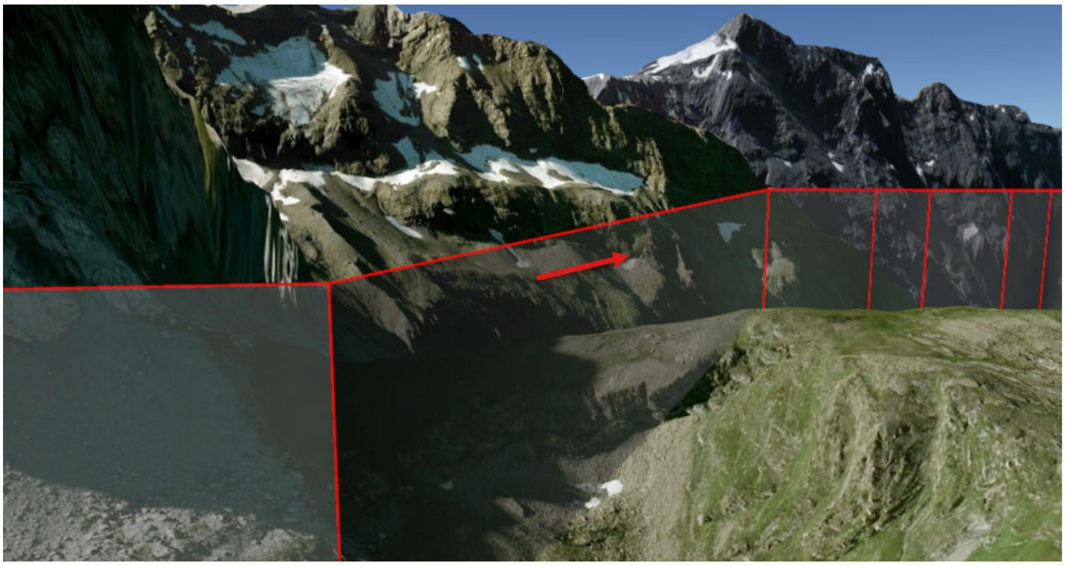

Figure 60: Horizontal flight over the terrain at an altitude of 2,412 m AMSL with a height of 75 m above ground directly below the radar flight path and 115 m above ground with respect to the lowest point of the terrain profile. Shown on Google Earth.

Figure 60 shows a choice of flight path classified as 'moderate-risk', which is characterised by the following safety-related feature:

- Low-level flight over the terrain.

A1.18.7.3.4 Hotspot H03

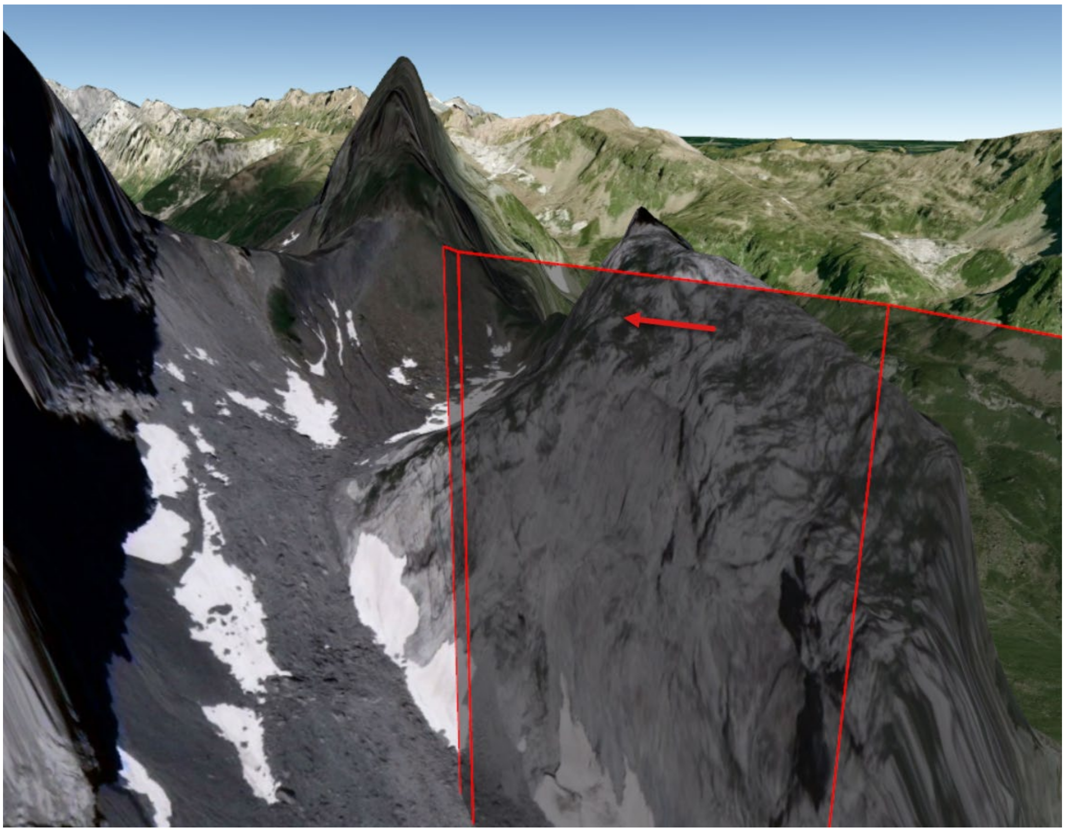

Figure 61: Horizontal flight over the crest of the mountain ridge at an altitude of 2,413 m AMSL with a resulting height at a constant flying altitude of 78 m above ground directly below the radar flight path and 80 m above ground with respect to the lowest point of the terrain profile. Data extrapolated by the radar system were omitted. Shown on Google Earth.

Figure 61 shows a choice of flight path classified as 'very high-risk', which is characterised by the following safety-related features:

- Rising terrain in the direction of flight;
- Low-level flight over the terrain;
- Restricted view of the following section of terrain;
- No possibility of an alternative flight path for a prolonged period of time.

A1.18.7.3.5 Hotspot H04

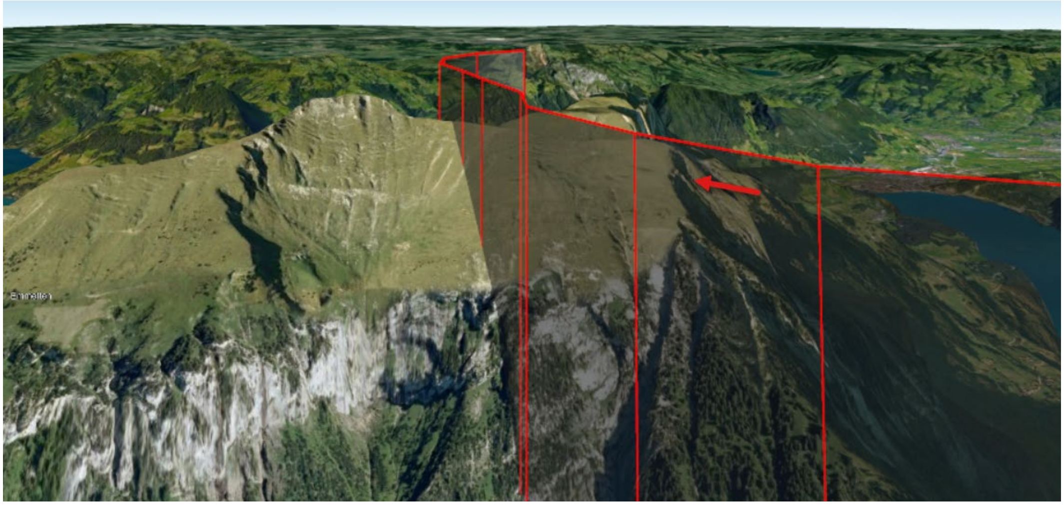

Figure 62: Horizontal overflight at 90 degrees to the crest of the mountain ridge at an altitude of 2,170 m AMSL with a height of 110 m above ground directly below the radar flight path and 127 m above ground with respect to the lowest point of the terrain profile. Shown on Google Earth.

Figure 62 shows a choice of flight path classified as 'moderate-risk', which is characterised by the following safety-related feature:

- Low-level flight over the terrain.

A1.18.7.4 Flight_0512_02_HOS

A1.18.7.4.1 Overview of the flight path

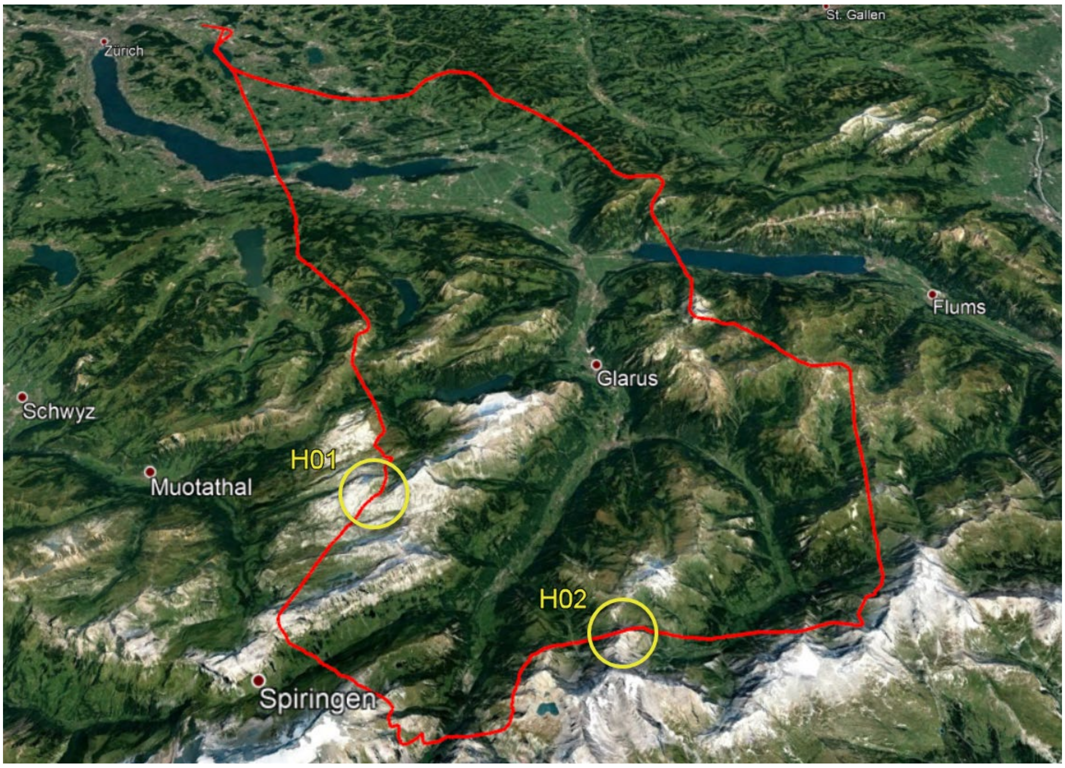

Figure 63: Overview of the flight path including hotspots H01 and H02 (yellow circles). Shown on Google Earth.

A1.18.7.4.2 Hotspot H01

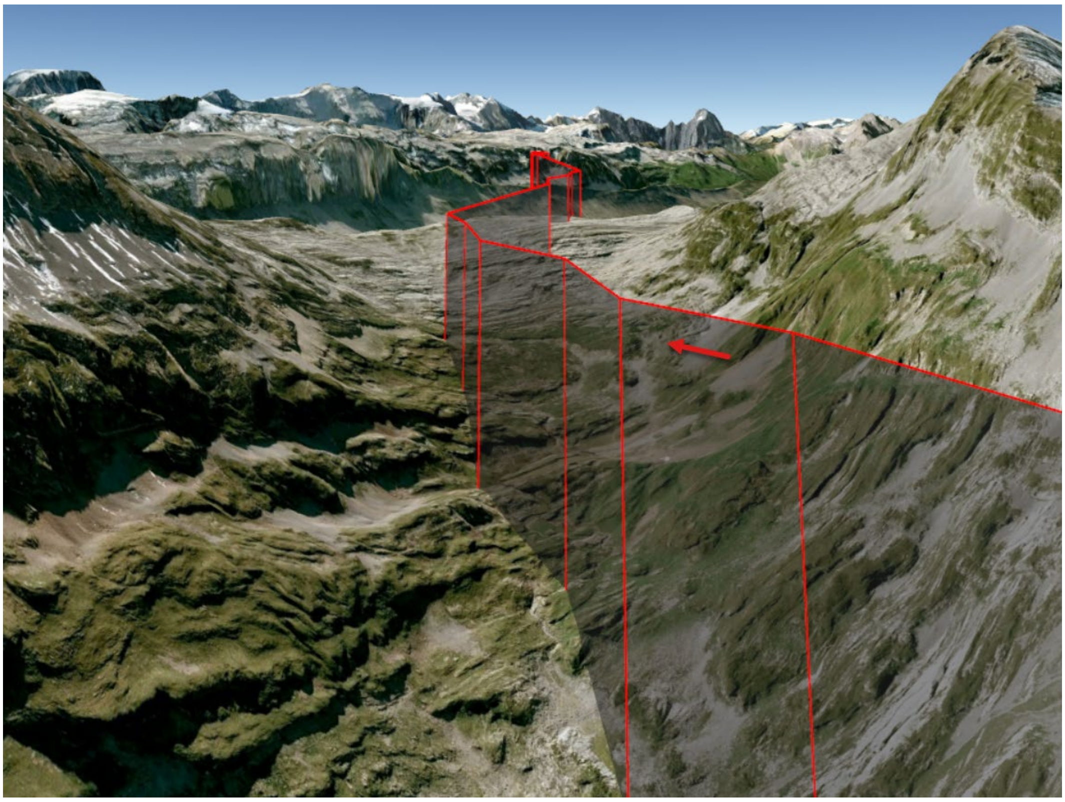

Figure 64: Climbing flight over the terrain at an altitude of 2,313 m AMSL with a height of 107 m above ground directly below the radar flight path and 127 m above ground with respect to the lowest point of the terrain profile. Shown on Google Earth.

Figure 64 shows a choice of flight path classified as ‘very high-risk’, which is characterised by the following safety-related features:

- Rising terrain in the direction of flight;
- Low-level flight over the terrain;
- Approaching an obstacle whilst climbing;
- No possibility of an alternative flight path for a prolonged period of time.

A1.18.7.4.3 Hotspot H02

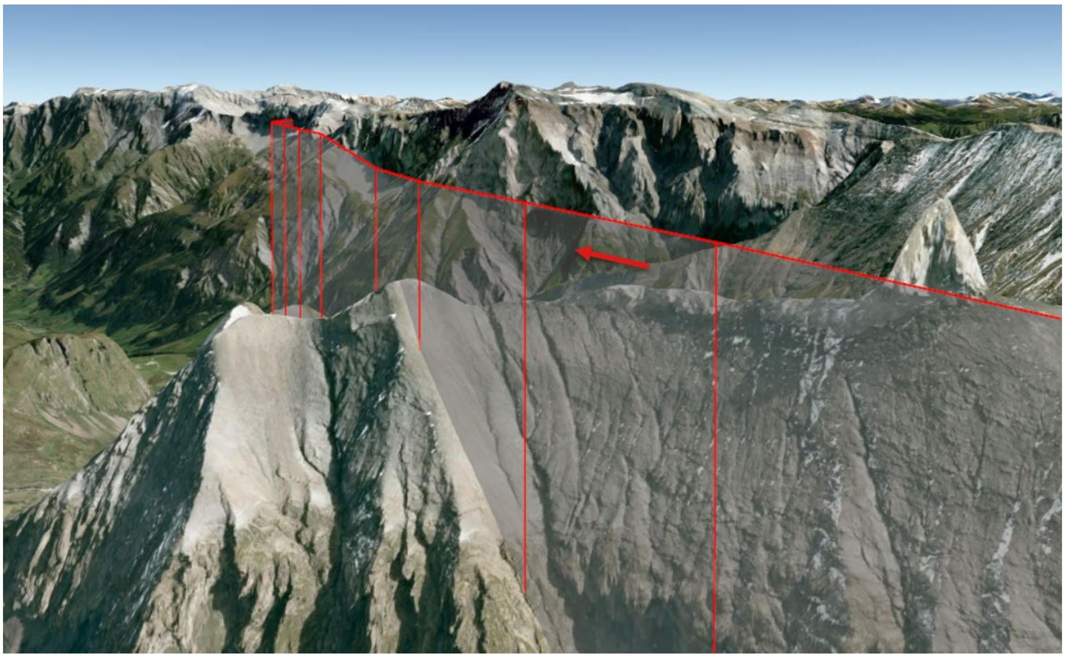

Figure 65: Horizontal flight over the terrain at an altitude of 2,811 m AMSL with a height of 106 m above ground directly below the radar flight path and 153 m above ground with respect to the lowest point of the terrain profile. Shown on Google Earth.

Figure 65 shows a choice of flight path classified as 'moderate-risk', which is characterised by the following safety-related features:

- Low-level flight over the terrain;
- Restricted view of the following section of terrain.

A1.18.7.5 Flight_0913_00_HOS

A1.18.7.5.1 Overview of the flight path

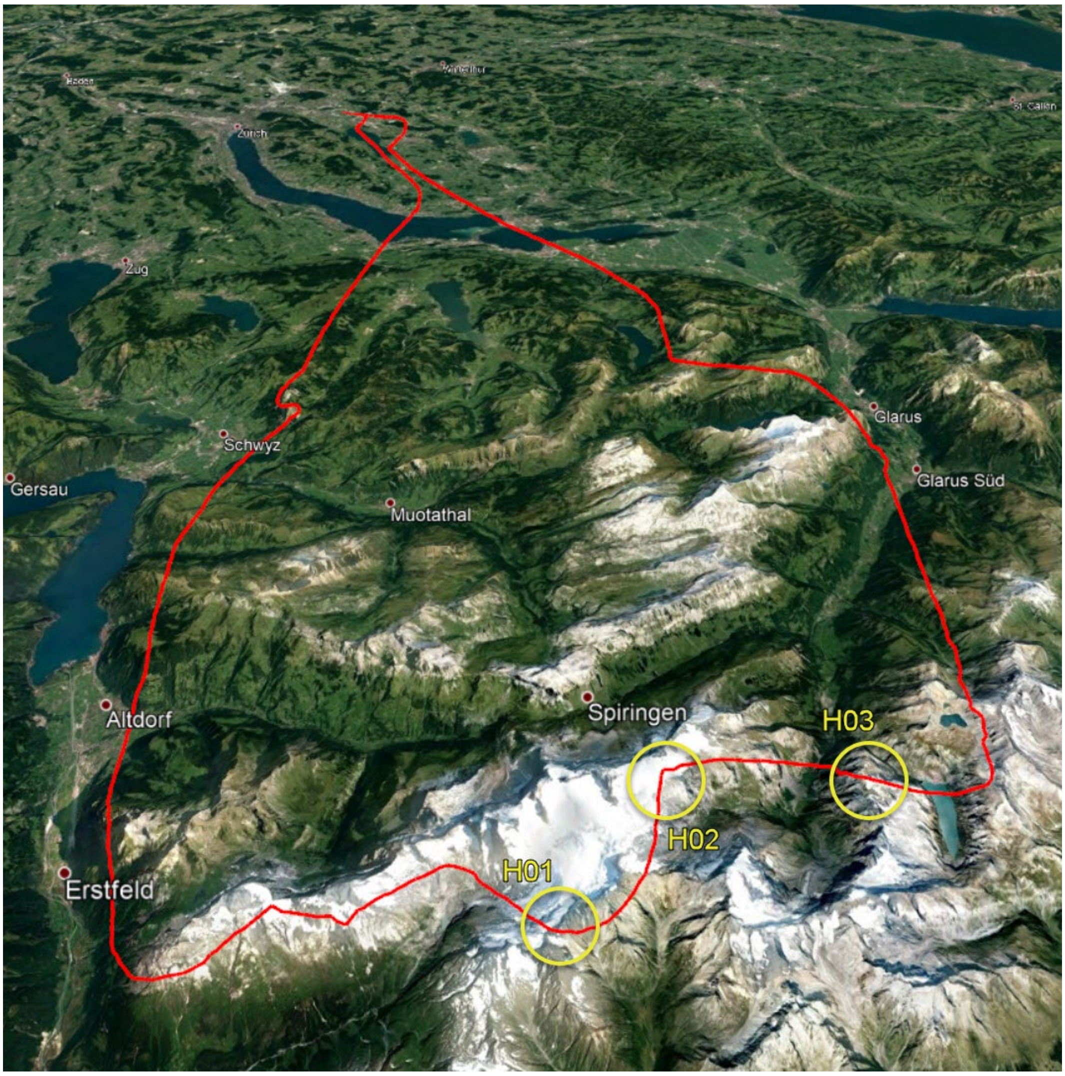

Figure 66: Overview of the flight path including hotspots H01 to H03 (yellow circles). Shown on Google Earth.

A1.18.7.5.2 Hotspot H01

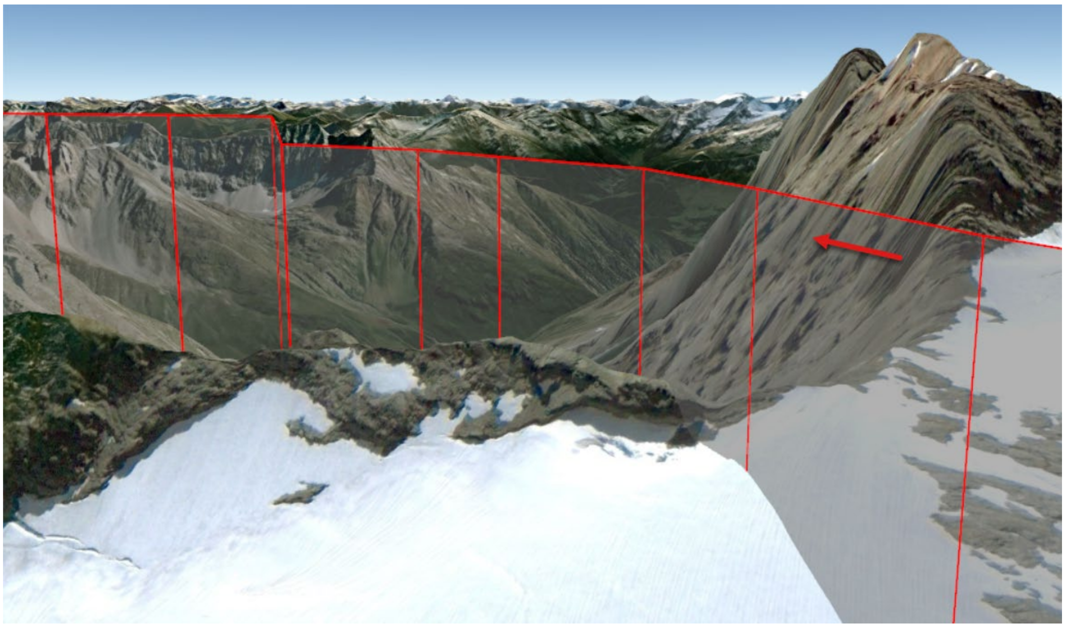

Figure 67: Climbing flight over the crest of the mountain ridge at an altitude of 3,060 m AMSL with a height of 163 m above ground directly below the radar flight path and 194 m above ground with respect to the lowest point of the terrain profile. Shown on Google Earth.

A1.18.7.5.3 Hotspot H02

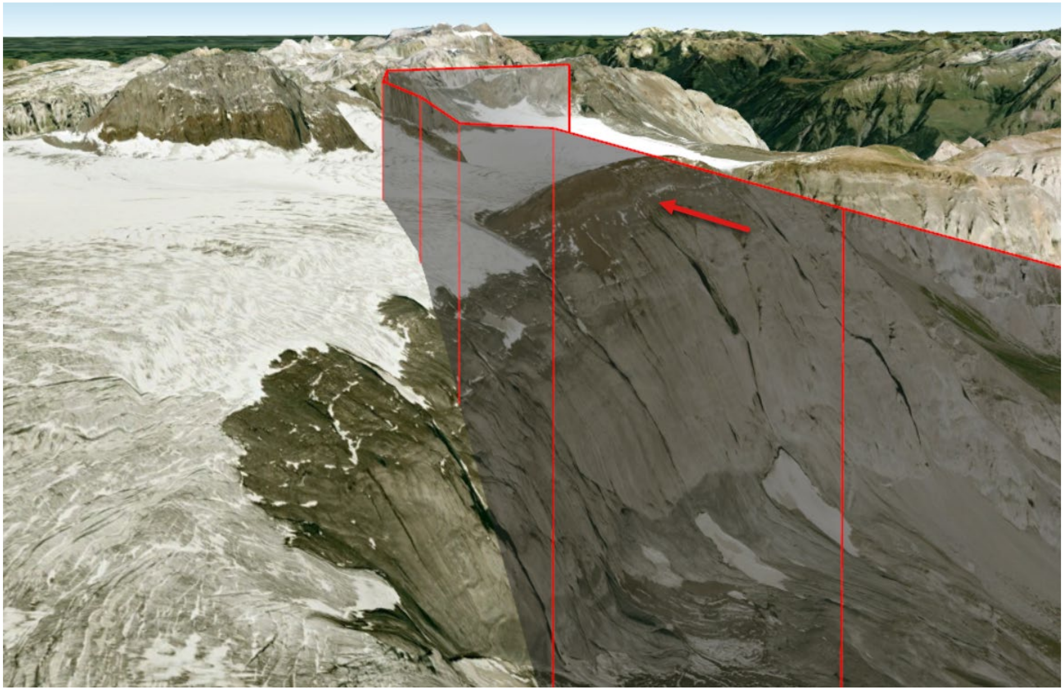

Figure 68: Descending overflight at an altitude of 3,060 m AMSL with a height of 185 m above ground directly below the radar flight path and 218 m above ground with respect to the lowest point of the terrain profile. Shown on Google Earth.

A1.18.7.5.4 Hotspot H03

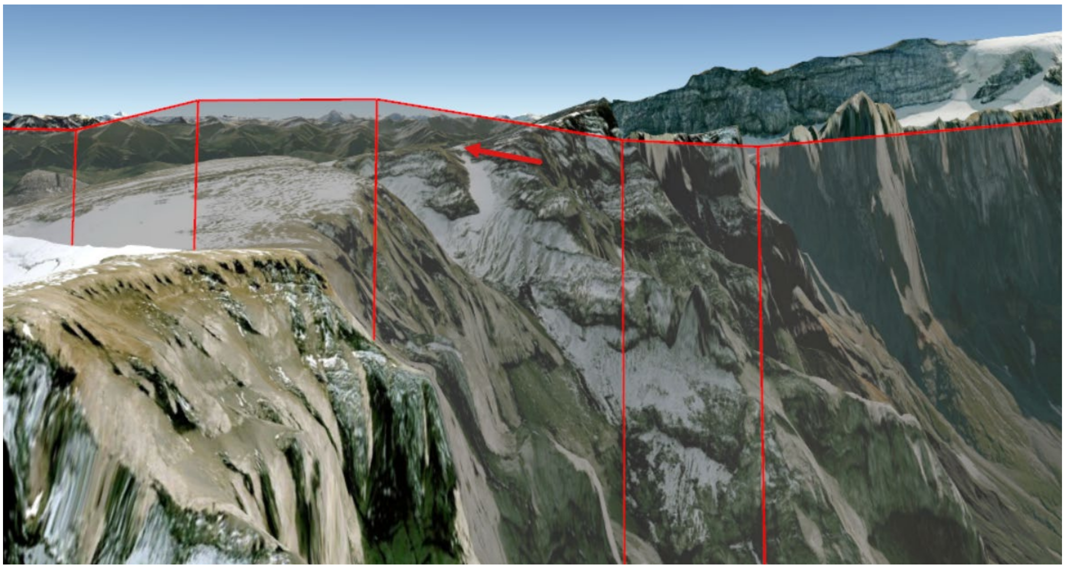

Figure 69: Horizontal overflight at 90 degrees to the crest of the mountain ridge at an altitude of 3,027 m AMSL with a height of 141 m above ground directly below the radar flight path and 142 m above ground with respect to the lowest point of the terrain profile. Shown on Google Earth.

Figure 69 shows a choice of flight path classified as ‘moderate-risk’, which is characterised by the following safety-related feature:

- Low-level flight over the terrain.

Figures 67, 68 and 69 show that during the FOCA inspection flight, the Ju-Air aircraft was also flown in mountainous areas well below the safety margin of at least 1,000 ft AGL (300 m above ground). Furthermore, basic principles for safely flying in mountainous areas were disregarded. The choice of flight path clearly contradicted the guidelines for flights in the Alps drawn up by FOCA itself, as published in the Aeronautical Information Publication (AIP) of Switzerland, VFR guide RAC 6-3 (see section A1.17.6.2.2).

A1.18.7.6 Flight_0804_01_HOP

A1.18.7.6.1 Overview of the flight path

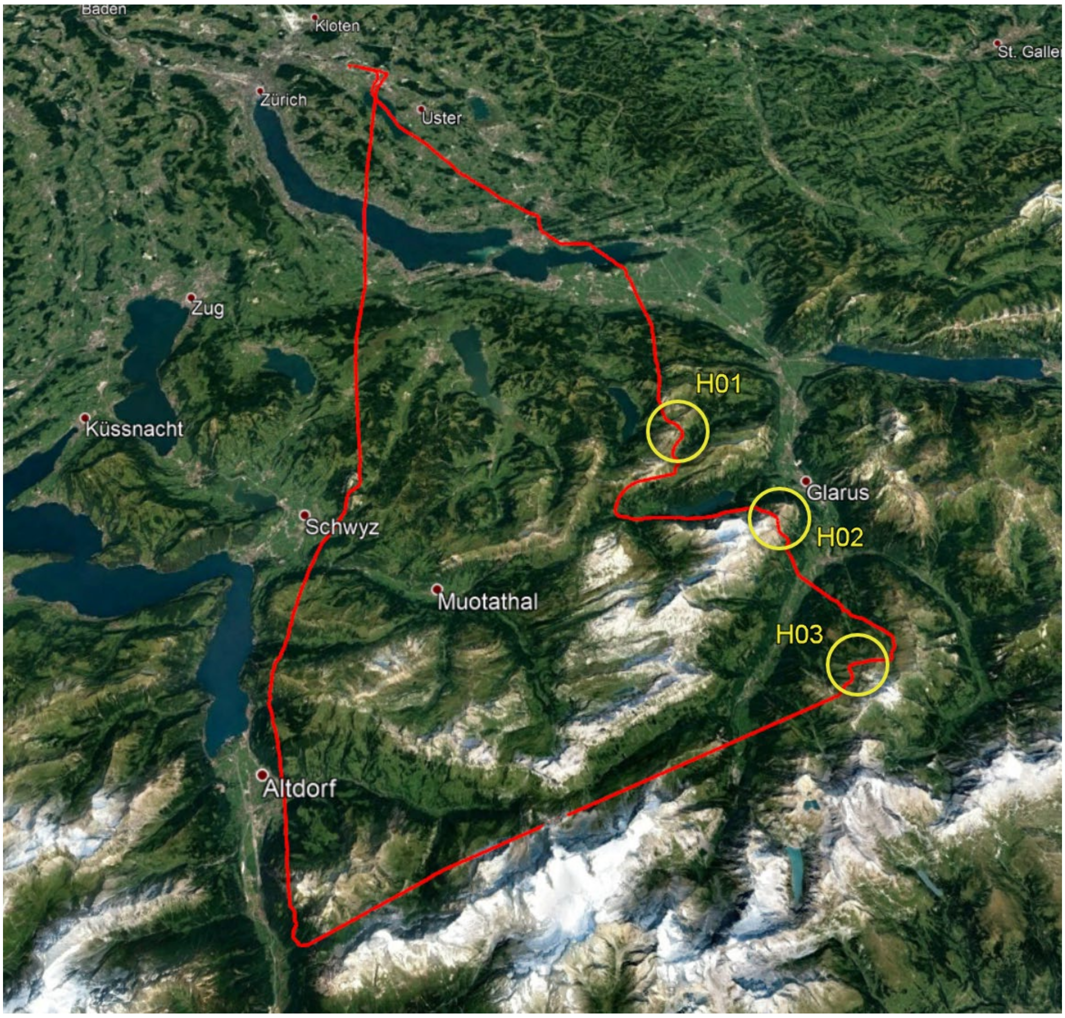

Figure 70: Overview of the flight path including hotspots H01 to H03 (yellow circles). Shown on Google Earth.

A1.18.7.6.2 Hotspot H01

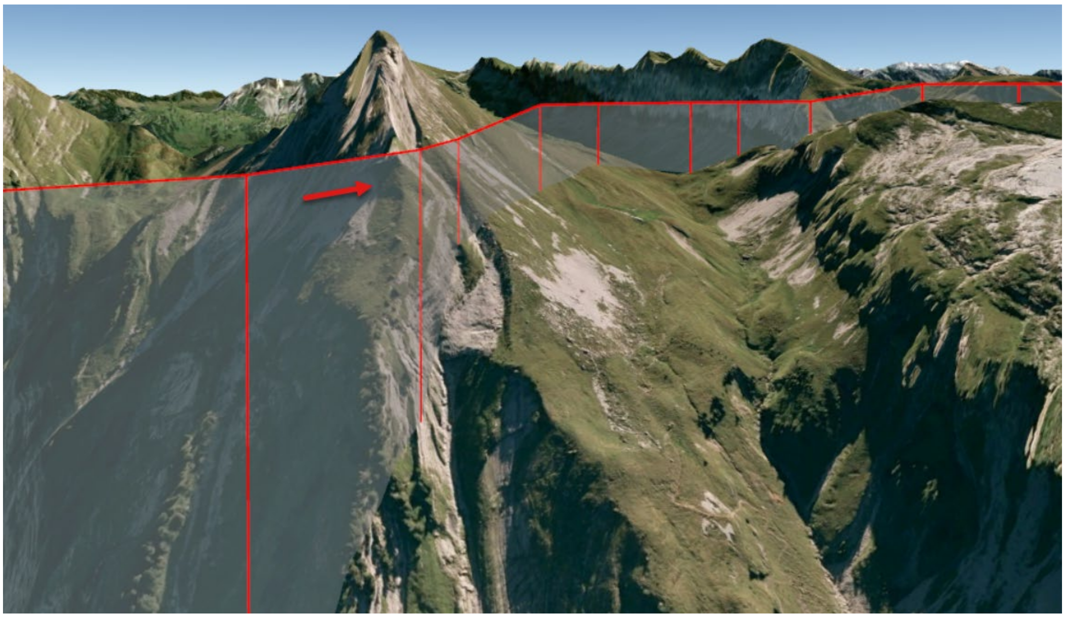

Figure 71: Horizontal overflight at almost 90 degrees to the terrain feature at an altitude of 1,994 m AMSL with a height of 104 m above ground directly below the radar flight path and 111 m above ground with respect to the lowest point of the terrain profile. Shown on Google Earth.

Figure 71 shows a choice of flight path classified as 'very high-risk', which is characterised by the following safety-related features:

- Rising terrain in the direction of flight;
- Low-level flight over the terrain;
- Restricted view of the following section of terrain;
- No possibility of an alternative flight path for a prolonged period of time.

A1.18.7.6.3 Hotspot H02

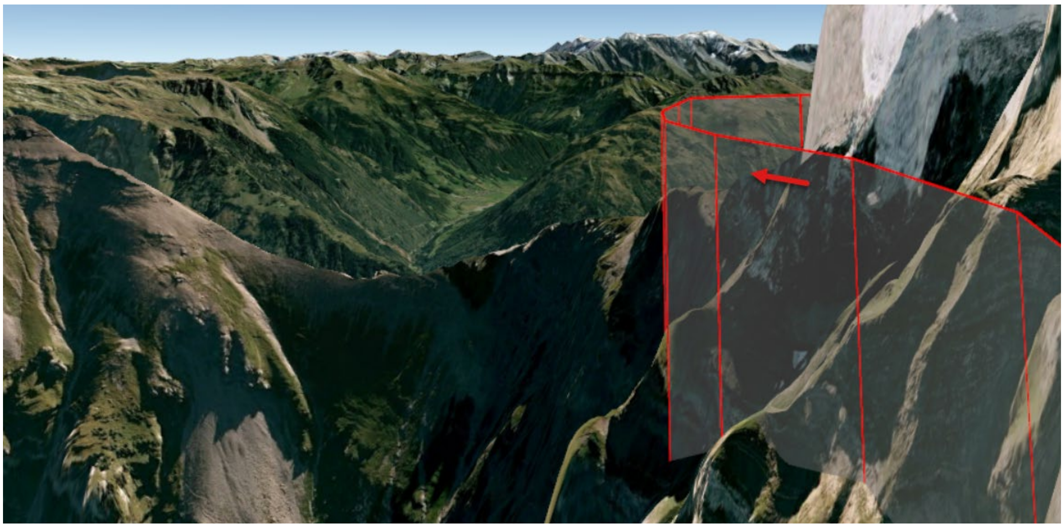

Figure 72: Horizontal overflight at almost 90 degrees to the terrain feature at an altitude of 2,362 m AMSL with a height of 100 m above ground directly below the radar flight path and 184 m above ground with respect to the lowest point of the terrain profile. Shown on Google Earth.

Figure 72 shows a choice of flight path classified as 'very high-risk', which is characterised by the following safety-related features:

- Low-level flight over the terrain;
- Restricted view of the following section of terrain;
- No possibility of an alternative flight path for a prolonged period of time.

A1.18.7.6.4 Hotspot H03

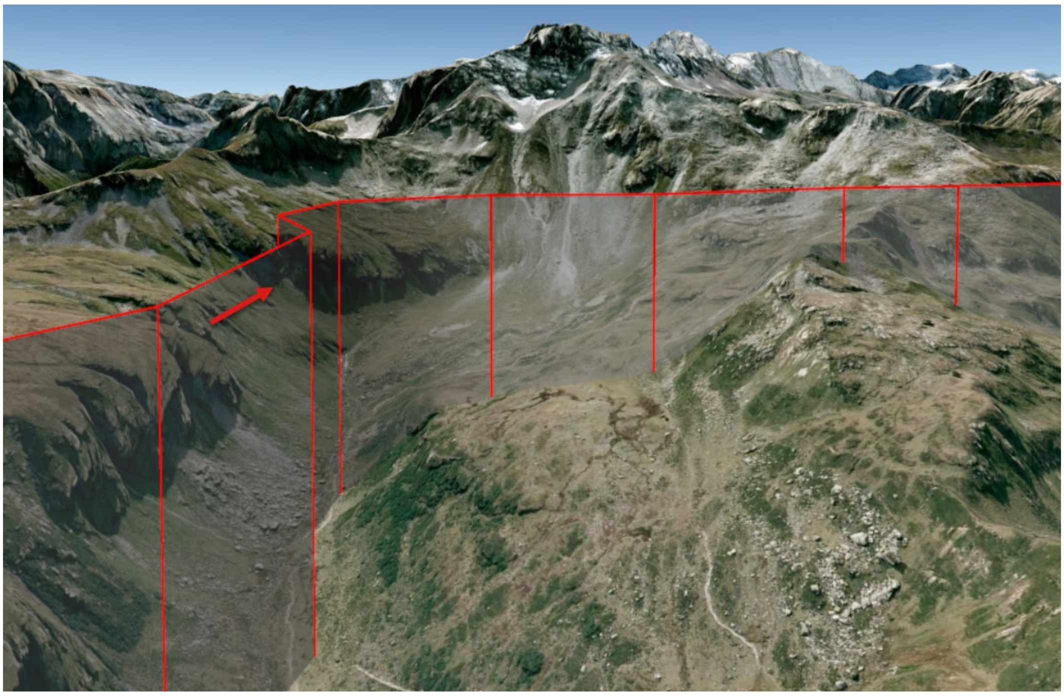

Figure 73: Horizontal flight over the terrain at an altitude of 2,298 m AMSL with a height of 93 m above ground directly below the radar flight path and 149 m above ground with respect to the lowest point of the terrain profile. Shown on Google Earth.

Figure 73 shows a choice of flight path classified as 'moderate-risk', which is characterised by the following safety-related feature:

- Low-level flight over the terrain.

A1.18.7.7 Flight_0804_03_HOP

A1.18.7.7.1 Overview of the flight path

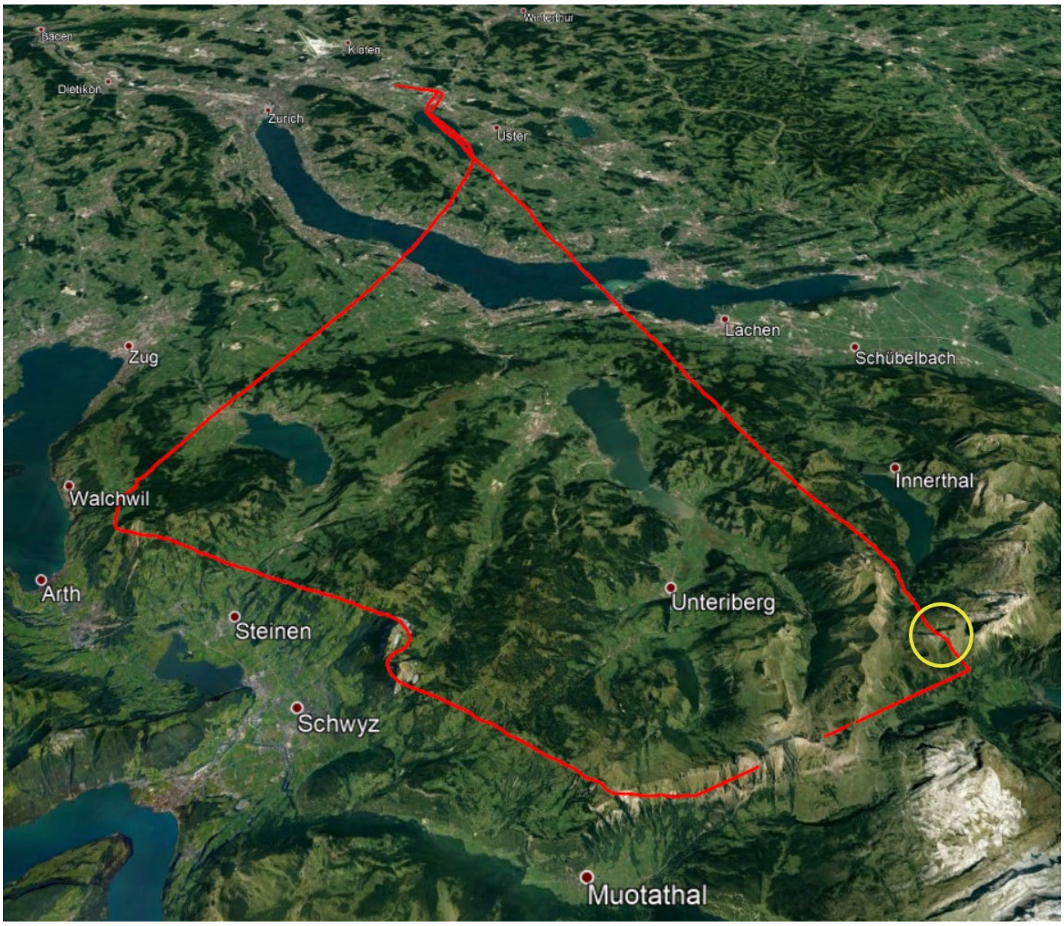

Figure 74: Overview of the flight path including hotspot (yellow circle). Shown on Google Earth.

A1.18.7.7.2 Hotspot

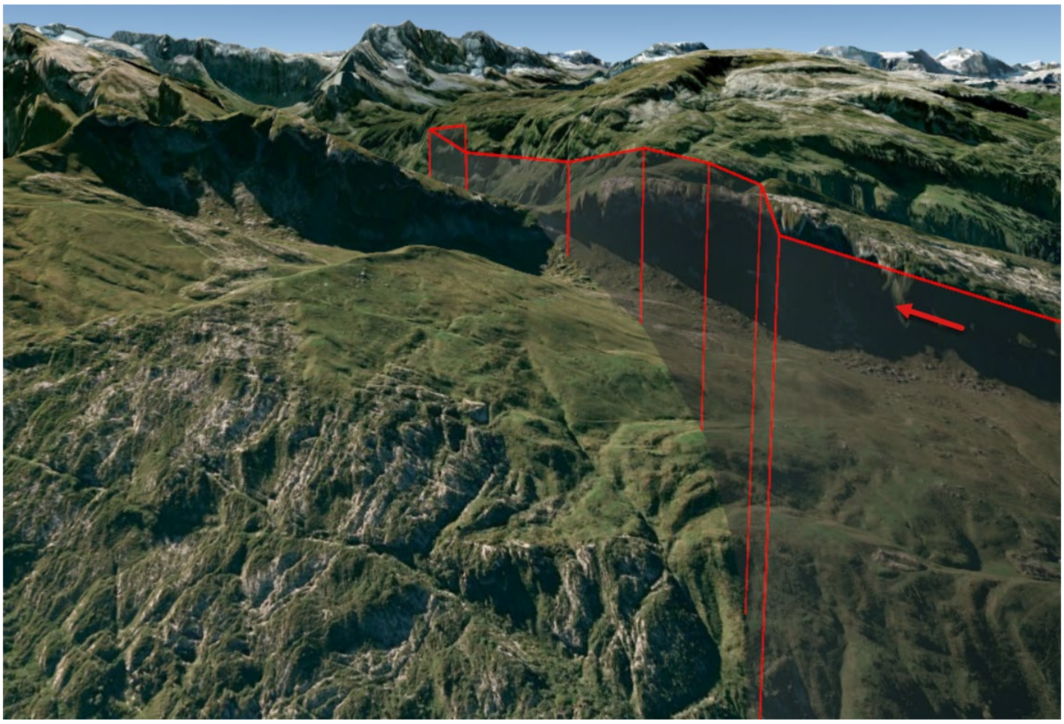

Figure 75: Descending overflight at almost 90 degrees to the terrain feature at an altitude of 1,901 m AMSL with a height of 78 m above ground directly below the radar flight path and 81 m above ground with respect to the lowest point of the terrain profile. Shown on Google Earth.

Figure 75 shows a choice of flight path classified as ‘high-risk’, which is characterised by the following safety-related features:

- Rising terrain in the direction of flight;
- Low-level flight over the terrain;
- Restricted view of the following section of terrain;
- Limited possibility of an alternative flight path.

A1.18.7.8 Flight_0602_03_HOS

A1.18.7.8.1 Overview of the flight path

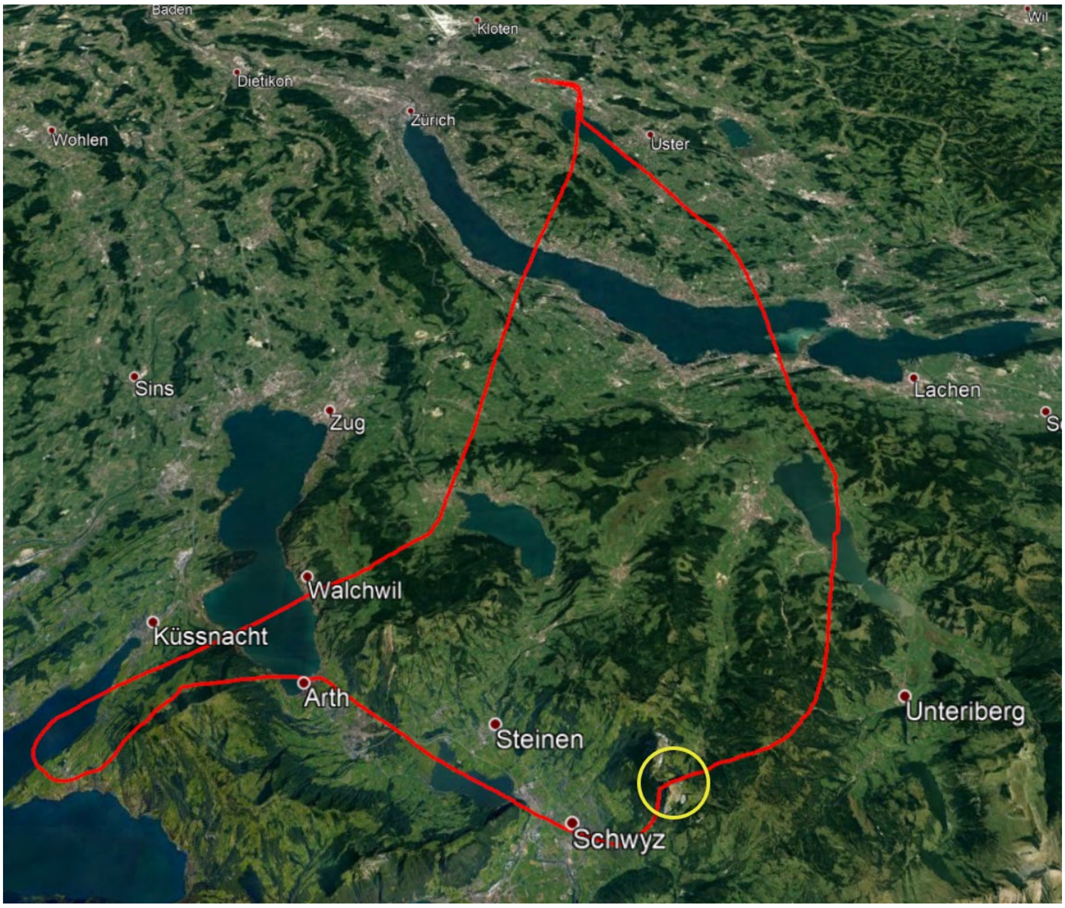

Figure 76: Overview of the flight path including hotspot (yellow circle). Shown on Google Earth.

A1.18.7.8.2 Hotspot

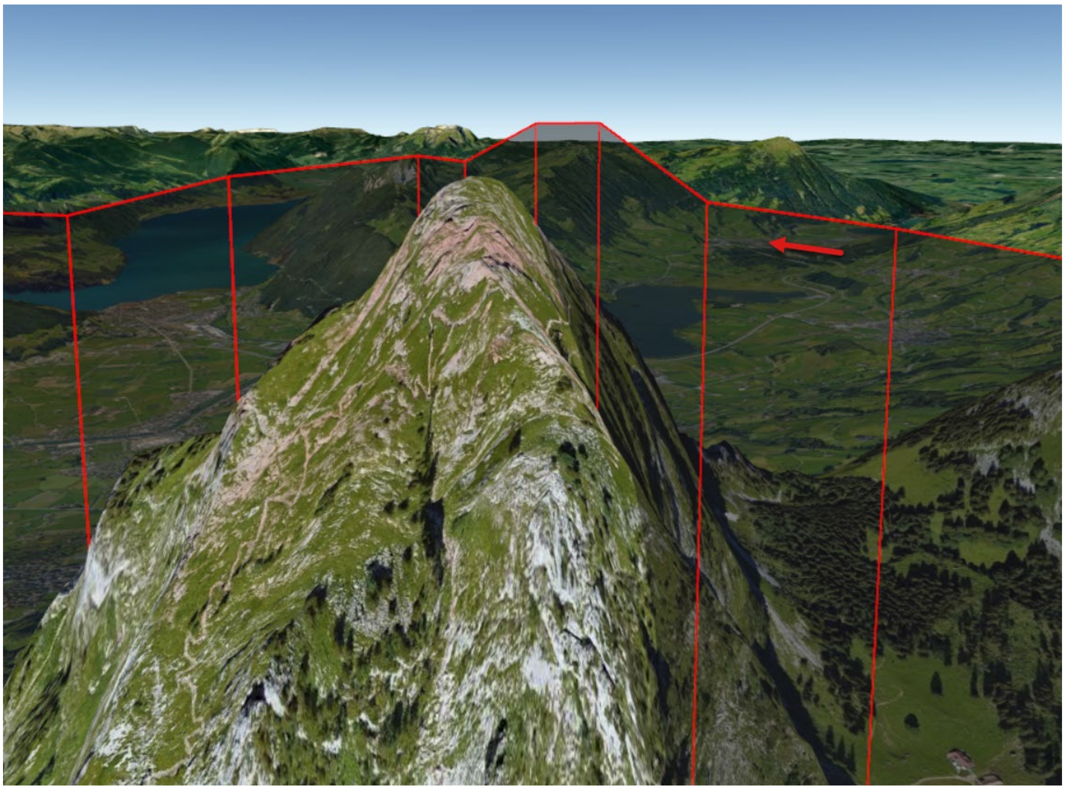

Figure 77: Climbing flight over the terrain at an altitude of 1,944 m AMSL with a height of 87 m above ground directly below the radar flight path and 353 m above ground with respect to the lowest point of the terrain profile. Shown on Google Earth.

Figure 77 shows a choice of flight path classified as ‘high-risk’[4], which is characterised by the following safety-related features:

- Low-level flight over the terrain;
- Restricted view of the following section of terrain;
- Approaching an obstacle whilst climbing.

The lateral distance from the rocky outcrop when passing Gross Mythen was approximately 33 m (see figure 78).

[4] Chosen flight path classified as ‘very high-risk’ due to the instrument meteorological conditions at the time

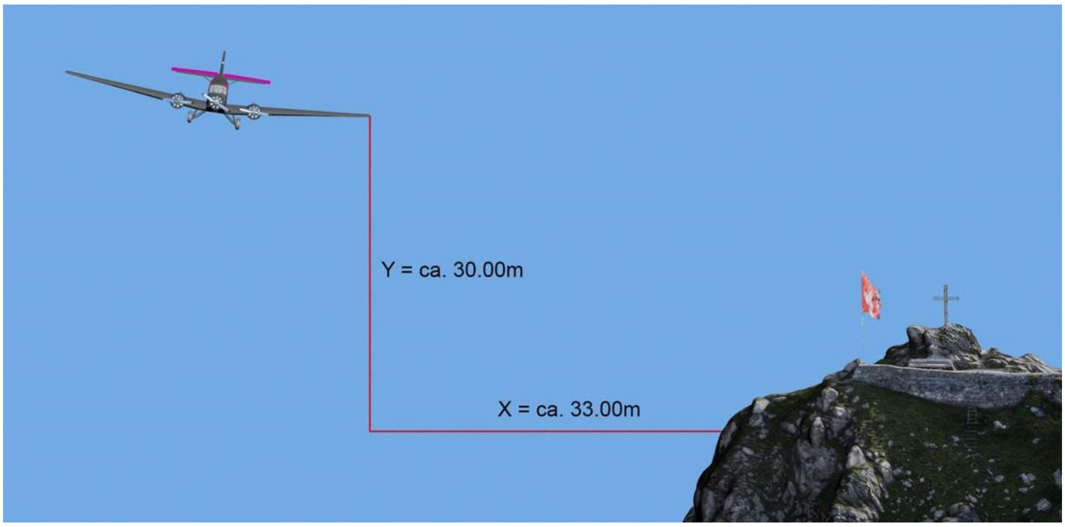

Figure 78: Reconstructed position and attitude using a three-dimensional model of an aircraft flying past Gross Mythen. Lateral distance from the rocky outcrop approximately 33 m, with a vertical distance of approximately 30 m.

The radar flight path (see figure 77) shows the climbing and very high-risk approach to Gross Mythen, with an approach up to the summit cross under temporary instrument meteorological conditions (IMC). A descent is initiated after passing the summit cross. In addition, screenshots from a video file show the level of visibility prevailing on that day and the Ju-52's near-terrain fly-by at Gross Mythen (see figures 79 and 80). During the daytime, visual flight rules (VFR) operations for aircraft in class Golf airspace are to be conducted in such a way that the aircraft is outside of the clouds with a constant view of the ground or water.

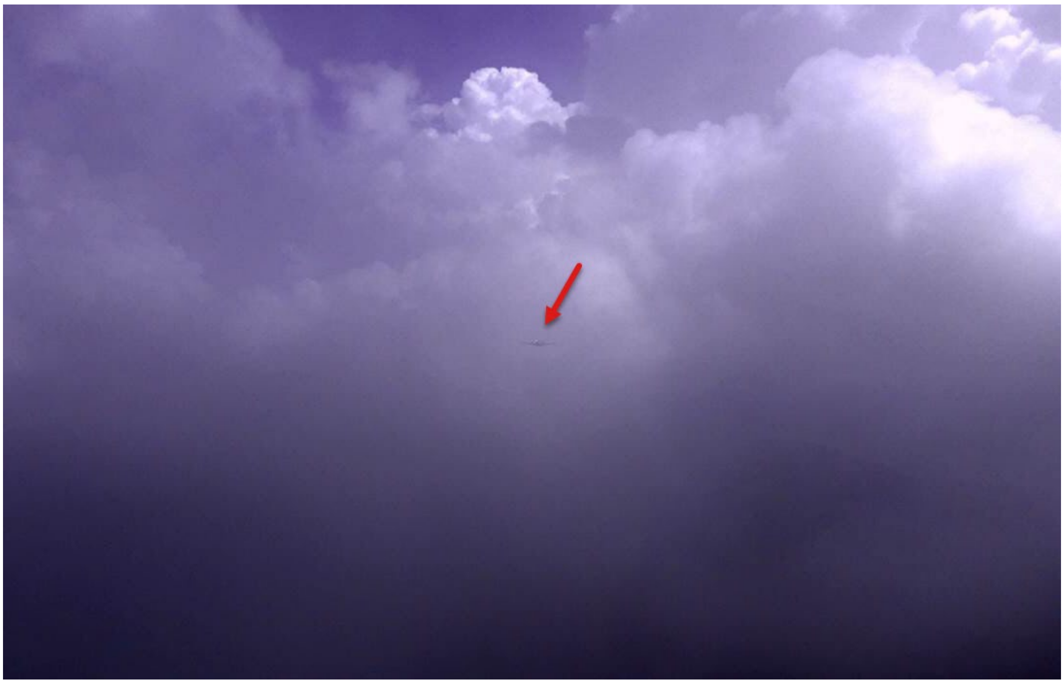

Figure 79: The faintly visible silhouette of an approaching Ju 52/3m g4e (red arrow) travelling towards Gross Mythen (image contrast increased). Footage provided by private individual.

Figure 80: The Ju 52/3m g4e flying past the summit cross is only faintly visible due to the weather conditions at Gross Mythen (image contrast increased). Footage provided by private individual.