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Aircraft Accident Investigation Bureau AAIB

# **Final Report No. 2048 by the Aircraft Accident Investigation Bureau**

concerning the accident

involving the Diamond DA 42 "Twin Star" aircraft, registration N321SV

on 2 July 2008

Paradiesgletscher, municipality of Hinterrhein/GR

30 km north of Bellinzona

**Ursachen**

Der Unfall ist darauf zurückzuführen, dass der Pilot das Flugzeug auf einer Höhe in ein enges Tal steuerte, die weder das sichere Überfliegen des niedrigsten Bergkammes noch eine Umkehrkurve erlaubte, so dass es zur Kollision mit dem Gelände kam.

## General information on this report

This report contains the AAIB's conclusions on the circumstances and causes of the accident which is the subject of the investigation.

In accordance with article 3.1 of the 9<sup>th</sup> edition of Annex 13, valid from 1 November 2001, of the Convention on International Civil Aviation of 7 December 1944 and article 24 of the Federal Air Navigation Act, 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 accident 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 definitive version of this report is the original in the German language.

All times in this report, unless otherwise indicated, are stated in local time (LT). At the time of the accident, Central European Summer Time (CEST) applied as local time in Switzerland. The relation between LT, CEST and UTC is:  $LT = CEST = UTC + 2 \text{ hours}$ .

## Final Report

<b>Aircraft type</b>	Diamond DA 42 "Twin Star"	Registration N321SV
<b>Operator</b>	A. V. Management B. V., Willemslaan 14, NL-1399 GK Muiderberg, Holland	
<b>Owner</b>	Aircraft Guaranty Title & Trust LLC Trustee, 515 N SAM Houston Pkwy E Ste 305, Houston TX 77060-4023, USA	

<b>Pilot</b>	Dutch citizen, born 1963			
<b>Licence</b>	Commercial pilot licence aeroplane – CPL(A), first issued by the Federal Aviation Authority (FAA) of the USA on 13 March 2005			
<b>Flying hours</b>	<b>total</b>	approx. 2500 hours	<b>during the last 90 days</b>	7:39 hours
	<b>on the accident type</b>	4:34 hours	<b>during the last 90 days</b>	4:34 hours

<b>Location</b>	Paradiesgletscher, municipality of Hinterrhein/GR		
<b>Coordinates</b>	723 700 / 149 200	<b>Elevation</b>	approx. 2900 m AMSL
	N 46° 28'57" E 009° 2'58"		approx. 9515 ft AMSL
<b>Date and time</b>	2 July 2008, 09:02 LT		

<b>Type of operation</b>	VFR private
<b>Flight phase</b>	Cruise
<b>Accident type</b>	Collision with the terrain

### Injuries to persons

Injuries	Crew	Passengers	Total number of occupants	Others
Fatal	---	---	---	---
Serious	1	1	2	---
Minor	---	---	---	---
None	---	---	---	Not applicable
<b>Total</b>	<b>1</b>	<b>1</b>	<b>2</b>	

<b>Damage to aircraft</b>	Destroyed
<b>Other damage</b>	Slight contamination of the terrain due to leaking fuel

## 1 Factual information

### 1.1 Pre-flight history and history of the flight

#### 1.1.1 General

The recordings of radiotelephony communications, data from the engine control's permanent memory, images taken by the passenger and statements by the pilot were used for the following description of the pre-flight history and history of the flight.

The flight took place under visual flight rules.

#### 1.1.2 Pre-flight history

On a flight on 28 June 2008, the pilot got familiarised with the aircraft type Diamond DA 42 "Twin Star". This flight, with a duration of 1:10 hours, took place in Holland, from Lelystad airport.

On 1 July 2008, the pilot, together with one passenger on board the DA 42, registered as N321SV, flew from Lelystad (NL) to St. Gallen-Altenrhein (CH) airport, where the aircraft arrived at approximately 15:30 LT.

On the morning of 2 July 2008, the pilot refuelled the aircraft with 163 l of Jet A-1 kerosene, completely filling the main tanks. He then prepared the planned visual flight from St. Gallen-Altenrhein to Ioannis Kapodistrias airport on the island of Corfu (Greece).

#### 1.1.3 History of the flight

All preparations were completed shortly after 08:00 LT and the pilot contacted St. Gallen-Altenrhein aerodrome control to request clearance to start the engines and subsequently reported that he was ready to taxi. Whilst taxiing, the pilot asked aerodrome control whether there was bad weather over the Alps. After a short pause, the air traffic control officer replied that according to the weather forecast, no bad weather over the Alps could be expected at that time. The pilot then replied that this confirmed the weather information in his flight preparations and thanked aerodrome control.

At 08:23 LT, N321SV received clearance for a take-off from runway 28 and then, after leaving the aerodrome circuit, flew towards Feldkirch, where the pilot signed off from St. Gallen-Altenrhein aerodrome control.

Shortly afterwards, he made contact with the "Zurich Information" flight information service. At this time the aircraft was flying at an altitude of 5200 ft QNH in the direction of Sargans. The flight path then took N321SV past Bad Ragaz, following the Rhine valley, via Landquart to Chur. There, at 08:46 LT, the pilot reported his position at an altitude of 5200 ft QNH.

Three minutes later, over the northern part of the Domleschg, the aircraft climbed to approximately 6000 ft QNH and headed for the Hinterrhein valley. Shortly before reaching Lake Sufner, another brief climb to 6300 ft QNH was performed. A picture which the passenger took in this region shows that the aircraft's navigation system registered a wind from the west at 7 kt at this time.

At 08:57 LT, N321SV flew over the village of Hinterrhein at an altitude of 6300 ft QNH. Engine power was then increased to 90% and in the following one and a half minutes the aircraft climbed about 600 ft. During this phase, the picture on the left of figure 1 was taken.

At approximately 08:59 LT, when the aircraft had reached around 7000 ft QNH, the engines were set to full power and the pilot increasingly reduced the speed towards the speed for the best rate of climb ( $V_y$ ).

At a rate of climb of approximately 1000 ft/min, which remained unchanged from the time power was increased, N321SV, following the Hinterrhein valley, finally flew into the caldera of the Paradiesgletscher which terminates the valley. The aircraft, climbing, finally came into contact with the highest part of the glacier, crossed the ridge of the glacier at low speed and dropped into a dip some 20 m deep to the south of the glacier, where it collided with a scree. The passenger and pilot were seriously injured.

Though the aircraft was destroyed, the radio's power supply continued to function. This is why the pilot was able to make an initial emergency call to "Zurich Information" at 09:06 LT. Since he was unable to provide any information on his location and since communication was difficult, the flight information service asked commercial aircraft to make contact with the injured crew on the emergency frequency and to act as a relay station. In this way it was possible a few minutes later to clarify the situation and a rescue helicopter was mobilised.

The emergency transmitter onboard N321SV was triggered by the impact and transmitted a signal which could be located. However, the pilot switched off the emergency transmitter before the rescue helicopter arrived because in his opinion transmission was generating too much noise.

Finally, it was possible to locate and rescue the occupants of the aircraft involved in the accident about half an hour after the accident.



**Figure 1:** Left: Picture taken by the passenger from N321SV at about 08:58 LT. At this time the aircraft was about 4 km west of the village of Hinterrhein at an altitude of approximately 6600 ft QNH. Right: Photo of traces on the glacier (green arrow) and of the wreckage (red arrow) at the foot of the glacier ridge.

## 1.2 Pilot's statements

After the accident the pilot stated that shortly before the accident he was flying at an altitude of 8000 to 10 000 ft QNH when he was caught by strong down-draughts. Despite increasing power to maximum and reducing speed to  $V_y$  he did not manage to stop the descent, leading to contact with the glacier.

The pilot also stated that he had great flying experience on different aircraft types and that he was acquainted with conditions in the Swiss Alps. However, he was unable to provide proof of these statements despite repeated requests.

## 1.3 Meteorological information

### 1.3.1 General

The information in chapters 1.3.2 to 1.3.4 was provided by MeteoSwiss.

The documentation used by the pilot for meteorological preparation was taken at 07:28 LT from the AMIE information system at St. Gallen-Altenrhein airport and corresponds with the data provided by MeteoSwiss after the accident.

### 1.3.2 General meteorological situation

Translated from German: *The flat high pressure area over central Europe continued to dissipate. An unstable air mass was making its way into Switzerland with a slightly increasing south-westerly current, ahead of a cold front over western France.*

### 1.3.3 Weather at the time and location of the accident

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

<i>Cloud</i>	<i>1-2/8 at 7500 ft AMSL, with isolated areas of cirrus above</i>	
<i>Weather</i>	<i>-</i>	
<i>Meteorological visibility</i>	<i>About 20 km</i>	
<i>Wind</i>	<i>Southerly wind at 5 to 8 kt, gusting to 10 - 15 kt</i>	
<i>Air temperature</i>	<i>6 °C</i>	
<i>Dew point</i>	<i>1 °C</i>	
<i>Atmospheric pressure</i>	<i>QNH Zurich LSZH 1015 hPa</i>	
	<i>QNH Lugano LSZA 1016 hPa</i>	
<i>Hazards</i>	<i>None detectable</i>	

### 1.3.4 Astronomical information

<i>Position of the sun</i>	<i>Azimuth: 92°</i>	<i>Elevation: 35°</i>
Natural light conditions	Daylight	

#### 1.4 Aircraft information

The Diamond DA 42 "Twin Star" is a twin-engined aircraft of composite construction. It has space for max. 4 people and is built as a cantilever low-wing aircraft with retractable landing gear. Power is provided by two Thielert TAE 125-01 Centurion 1.7 turbo charged diesel engines with a rated power of 99 kW or 135 PS<sup>1</sup>, each acting via a step-down transmission on a three-blade propeller. Both engines are equipped with a redundant full authority digital engine control (FADEC) system. These FADEC have a non-volatile memory (NVM) which record the pressure altitude as well as various engine parameters. It was possible to read out the N321SV's NVM after the accident which provided sound values indicating normal functioning of the engines up to the contact with the glacier.

For general conditions like those prevailing at the time of the accident, the aircraft flight manual for the Diamond DA 42 "Twin Star" specifies that the type is capable of a rate of climb of approximately 1000 ft/min at altitudes between 6000 and 10 000 ft. For steep climbs, the speed for best rate of climb ( $V_y$ ) is recommended, not the speed for best angle of climb ( $V_x$ ), as  $V_x$  is lower than the minimum speed for safe control of the aircraft in single-engine operation.

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<sup>1</sup> PS – *Pferdestärke* (horse power): historic non-SI unit, 1 PS = 0.736 kW



## **2 Analysis**

### **2.1 Technical aspects**

There are no indications that technical defects or limitations existed which might have influenced or caused the accident.

### **2.2 Human and operational aspects**

The pilot informed himself extensively about the weather conditions on the section of the route over the Alps. According to the weather forecast available to him and the information provided to him during taxiing by St. Gallen-Altentrhein aerodrome control, he could expect unproblematic conditions for an Alpine crossing.

After leaving the control area of St. Gallen-Altentrhein airport, the pilot chose a cruising altitude of 5200 ft QNH, which he maintained on the subsequent flight path as far as the Domleschg region. Subsequently a climb to 6300 ft QNH followed, after which the altitude remained stable until the aircraft was over the village of Hinterrhein. This low altitude would not have permitted a flight over the San Bernardino Pass, leading to the south. Nor is there any indication that the pilot intended to fly over this pass.

It is not comprehensible why the pilot flew into the westernmost part of the Hinterrhein valley at an altitude of approximately 1900 m AMSL (6300 ft AMSL), as this contradicted the elementary rules of mountain flying tactics, which envisage height reserves over passes to be crossed and sufficient space to perform a 180° turn. The section of the valley into which the pilot then flew is surrounded by mountain ridges with an elevation of 2900 (9515 ft AMSL) to 3400 m AMSL (11 155 ft AMSL) and, because of its narrowness, would not allow a 180° turn to be made, at least on the flight path adopted by N321SV. Even if an immediate climb at maximum power had been initiated after passing the village of Hinterrhein, it would have been possible to fly over the lowest ridges only with very little clearance. The fact that the pilot was initially climbing at only slightly increased power west of the village of Hinterrhein, permits the conclusion, that he was not aware of the impending hazardous situation. Although he eventually set the engines to full power and adopted an optimal climbing speed, the accident could no longer be prevented.

The rate of climb which N321SV attained during the last two and a half minutes of its flight corresponds to the values which are to be expected for these conditions according to the aircraft flight manual. This fact allows the conclusion that downdraughts did not affect the flight path, contrary to the pilot's statements. On the basis of the existing photographic material and the data read out from the FADEC, there is no evidence of the aircraft attaining the altitude of 8000 to 10 000 ft, the altitude at which the pilot stated he was flying immediately before the accident.

However, it can be stated that the pilot maintained the aircraft in a controlled flight attitude up to the unavoidable contact with the glacier. The aircraft finally slid over the topmost part of the glacier and dropped into a dip, leading to the injuries to the occupants and the destruction of the aircraft.

After the accident, the pilot, with the aid of a radio which was still functioning, made contact with the flight information service and was able to ask for help. This behaviour was appropriate. However, switching off the activated emergency transmitter before the arrival of the rescue services, merely because the sound the device was emitting was annoying the pilot, was less prudent.

### 3 Conclusions

#### 3.1 Findings

- The pilot was in possession of the necessary licences.
- There is no indication that the state of health or capabilities of the pilot were in any way impaired during the flight involved in the accident.
- The aircraft, registered as N321SV, exhibited no technical defects or restrictions which could have had an effect on, or could have caused the accident.
- The mass and centre of gravity of the aircraft were within the permitted limits.
- The aircraft flew over the village of Hinterrhein at an altitude of 6300 ft QNH. Engine power was then increased to 90% and in the subsequent one and a half minutes the aircraft climbed some 600 ft.
- At an altitude of approximately 7000 ft QNH, the engines were set to full power and the pilot increasingly reduced the speed towards the speed for the best rate of climb ( $V_y$ ).
- After selecting maximum power, the aircraft climbed at a constant rate of approximately 1000 ft/min until it came into contact with the glacier.
- The emergency transmitter was triggered by the impact. The device was subsequently switched off by the pilot.
- After the accident, the pilot was able to contact the flight information service and initiate the rescue of the occupants of the aircraft.
- The weather conditions had no influence on the accident.

#### 3.2 Causes

The accident is attributable to the fact that the pilot flew the aircraft into a narrow valley at an altitude which allowed neither safe overflying of the lowest mountain ridge nor a 180° turn, resulting in the collision with the terrain.

Payerne, 6 October 2009

Aircraft Accident Investigation Bureau

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