

# Investigation Report

## Identification

Type of Occurrence:	Serious incident
Date:	25 April 2013
Location:	Near Regional Airport Frankfurt-Hahn
Aircraft:	1. Transport aircraft 2. Powered glider
Manufacturer / Model:	1. Boeing Company / B737-800 2. Alexander Schleicher GmbH & Co / ASH 25 Mi
Injuries to Persons:	None
Damage:	None
Other Damage:	None
State File Number:	BFU EX005-13

## Factual Information

At 1736:48 hrs<sup>1</sup> approximately 10 Nautical Miles (NM) east of the Regional Airport Frankfurt-Hahn an airprox involving a Boeing B737-800 and a powered glider (ASH 25) occurred in airspace E above 5,000 ft AMSL. The Boeing B737-800 was flying in accordance with Instrument Flight Rules (IFR) and the powered glider in accordance with Visual Flight Rules (VFR).

The read-out of the Quick Access Recorder (QAR) and the GPS device of the powered glider showed that the two aircraft passed each other in a distance of 0.19 NM and at an altitude difference of 161 ft.

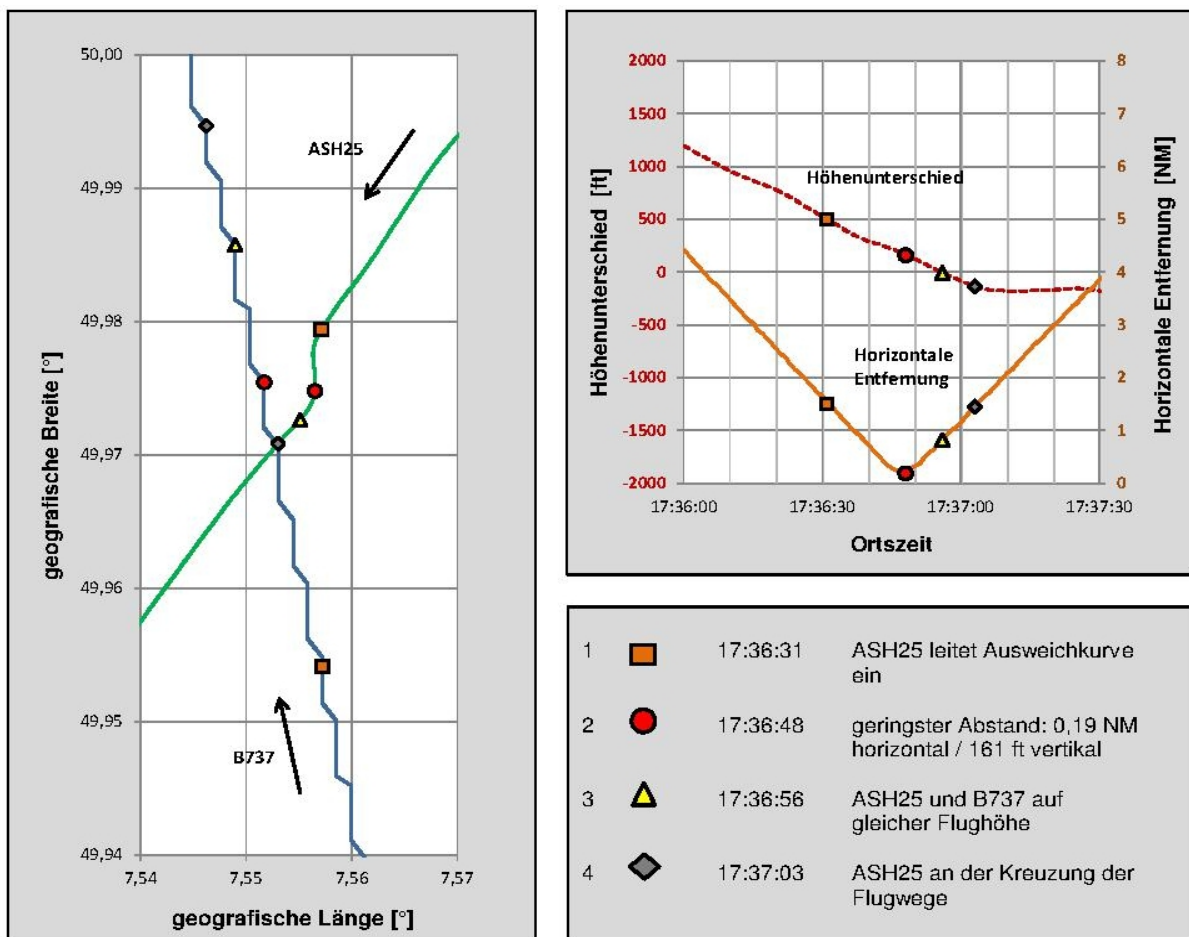


Image 1: Flight paths of the Boeing B737-800 and the powered glider

Source: QAR/GPS data, analysis BFU

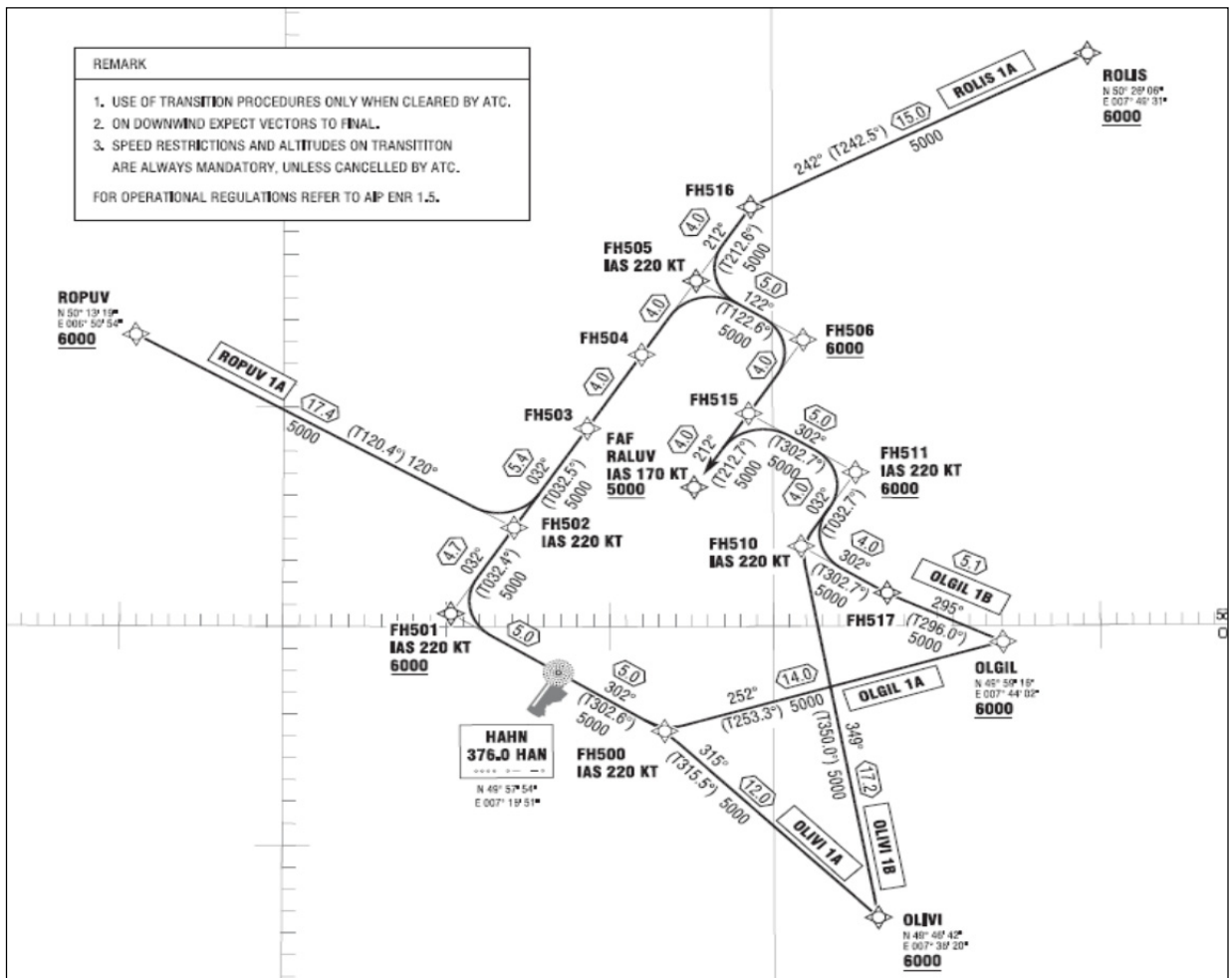
<sup>1</sup> All times local, unless otherwise stated.

## History of the Flight

The Boeing B737-800 was on a flight from Alghero, Sardinia, to Frankfurt-Hahn, Germany. On board the aircraft were 6 crew members and 108 passengers. The powered glider was on a triangular flight where Marpingen was the aerodrome of departure and arrival. On board were two persons.

At 1724:28 hrs the Boeing crew had contacted Langen Radar and received gradual descent clearances to Flight Level (FL) 80.

At 1733:04 hrs the controller issued descent clearance to 5,000 ft AMSL with the words: “[...] descend altitude 5,000 feet, QNH 1,021.” At that time the Boeing B737-800 was cleared for transition OLIVI 1B (see Image 2).



**Image 2:** GPS/FMS RNAV Arrival Chart Transition to Final Approach (Overlay to Radar Vector Pattern) RWY 21

Source: AIP Germany

At 1733:33 hrs the crew received the clearance: “[...] after fox hotel 510 proceed inbound RALUV.” The point RALUV is the final approach fix for runway 21 of Regional Airport Frankfurt-Hahn. At 1734:17 hrs the crew received the clearance: “[...] descend altitude 4,000 feet and you are cleared for the ILS runway 21, report established next.” The Boeing flew with a computed airspeed of approximately 250 kt. At 1737:21 hrs the crew reported the airprox with the powered glider: “Langen Radar [...] eh just for your information, ah two miles ahead we had a close proximity glider, just two hundred away of us.”

Subsequently the Boeing B737-800 landed on runway 21.

The crew stated that only the co-pilot had had visual contact with the glider. This had occurred at the time the two aircraft had passed each other. At that time the Boeing had been descending through 6,500 ft AMSL. It had been a glider with a D-registration and orange stripes flying in an estimated altitude of 6,400 ft AMSL. The responsible controller stated that on his screen no radar target had been depicted in the flight path of the Boeing. Neither the radar recordings of the air traffic service provider, nor the radar data provided by the German Armed Forces showed the powered glider at the time of the airprox. The radar recordings of the air traffic service provider show individual primary targets (without altitude indications) which had been depicted at the time of the occurrence in the vicinity of the Boeing’s flight path.

The pilot in command of the ASH 25 stated that the powered glider had flown with a speed of approximately 110 km/h in slow gliding flight. At that time there was only slight thermal lift. The sky had been almost clear of clouds and only slight haze domes had built in 7,000 ft AMSL. Flight visibility had been about 30 km. At approximately 1730 hrs, at about 6,500 ft AMSL the collision warning system (TRX1090) had generated a warning. The equipment indicates whether the other object is higher or lower and in what distance it is flying. The direction is not indicated. The pilot and his wife had immediately started to search for the other plane in their own altitude and noticed a transport aircraft with illuminated landing lights ahead and to the left. The transport aircraft had been approximately 10 km away and at the same altitude. The ASH 25 pilot had initiated a left turn with a bank angle of about 45°. He then flew left in the opposite direction of the transport aircraft heading south (see Image 1 at: 1736:31 hrs). The powered glider had been in gliding flight with a sink rate of about 0.8 m/sec. The powered glider pilot stated that he had

decided to fly a parallel opposite course to the Boeing so that he could continuously observe it, and react to possible heading or altitude changes, if need be.

After about one minute the Boeing B737 had been approximately 150 m beside and about 50 m above the ASH 25 (see Image 1, at: 1736:48 hrs). Only at the last moment, while the two aircraft were passing each other, the Boeing B737 co-pilot had turned his head to the right.

The Boeing B737 had maintained heading and altitude. The powered glider pilot did not observe an avoidance manoeuvre.

Subsequently, he had returned to his original south-western heading and asked Langen Radar for clearance to 5,000 ft for glider sector Idar-Oberstein.

## Personnel Information

### Boeing B737-800

#### **Pilot in Command (PIC)**

The 39-year-old PIC held an Airline Transport Pilot's License (ATPL(A)) issued by the Irish Aviation Authority in accordance with ICAO and JAR-FCL; valid until 13 September 2016. He had a flying experience of more than 11,000 hours.

#### **Co-pilot**

The 23-year-old co-pilot held a Commercial Pilot's License (CPL(A)) issued by the Irish Aviation Authority in accordance with ICAO and JAR-FCL; valid until 2 July 2017. He had a flying experience of more than 1,450 hours.

### ASH 25 Mi

#### **Pilot in Command**

The 65-year-old PIC held a Private Pilot's License (PPL(A)) issued in accordance with ICAO and JAR-FCL German by the Ministerium für Wirtschaft und Arbeit des Saarlandes (Ministry for Economic Affairs and Employment of Saarland); valid until 19 October 2014. He also held an open-ended pilot's licence for gliders, issued in accordance with ICAO by the above-mentioned ministry. He had a flying experience of more than 8,000 hours.

### Air Traffic Control

The 25-year-old controller held an air traffic controller licence (approach and sector control including FIS) issued in accordance with ICAO by the Federal Supervisory Authority for Air Navigation Services; valid until 13 July 2013.

## Aircraft Information

### Boeing B737-800

The aircraft type is a twin-engine low-wing aircraft which is mainly used for short and medium range flights. It has a seating capacity of 189 passengers.

The aircraft had a valid Irish certificate of registration and was operated by an Irish operator.

### ASH 25 Mi

The powered glider is a two-seat self-launch powered glider with retractable power plant. It has a wing span of 26 metres. The aircraft involved was equipped with a transponder, a FLARM, and a collision warning system (TRX1090).

The TRX1090 system was installed between the FLARM and the display unit. Therefore the display indicated FLARM targets and airplanes, which broadcasted their positions via the Mode-S transponder (ADS-B out). The approach of airplanes equipped with a transponder without ADS-B out could also be identified and were indicated on the display including airprox warning with altitude information (Source: garrecht.com).

## Meteorological Information

The Regional Airport Frankfurt-Hahn, located about 20 NM north-west of the incident site, reported in the aviation routine weather report (METAR) of 1730 hrs CAVOK conditions, which means:

- Horizontal ground visibility of 10 km or more
- No clouds below 5,000 ft AMSL
- No significant weather phenomena
- No storm clouds

At the time of the occurrence the sun was in the direction of 260° and 25° above the horizon.

The Boeing B737-800 crew stated that visibility was about 50 km. The ASH 25 pilot described visibilities of 30 km.

## Radio Communications

The responsible air traffic service provider recorded radio communications and made them available as transcripts for investigation purposes.

## Flight Recorders

The Flight Data Recorder (FDR) of the Boeing B737 and the IGC file of the flight of the ASH 25 were available for the investigation of the occurrence. The radar data of the air traffic service provider and the German Armed Forces were available for the investigation.

## Airspace

Airspace E is a controlled airspace in which flights in accordance with Instrument Flight Rules (IFR) and flights in accordance with Visual Flight Rules (VFR) take place. IFR flights are separated to each other, but not to VFR flights. As far as it is possible for the air traffic personnel, IFR flights receive traffic information regarding VFR flights. VFR flights also receive traffic information, as far as possible.

In addition, for VFR flights the following is required: A flight visibility of 8 km, distance from clouds 1.5 km horizontally and 1,000 ft vertically. Powered aircraft have to engage a transponder above 5,000 ft AMSL.

## Additional Information

Because the powered glider flew with disengaged engine at the time of the occurrence it was just a glider. Therefore it was not required to activate the transponder. In airspace E this is only mandatory for powered aircraft flying above 5,000 ft AMSL or 3,500 ft GND.

## Analysis

All persons involved were appropriately licensed. There were no weather related visibility limitations. Due to the determined position of the sun at the time of the occurrence glaring can be ruled out.

The pilot of the powered glider stated that he had been informed of the impending conflict by the on-board collision warning system. The size of the Boeing and the already illuminated landing lights made it easier for the pilot of the powered glider to observe the other aircraft. Had he not realized the danger so early he might have initiated the left-hand turn later or possibly not at all. This would have at least resulted in a significantly smaller horizontal separation. However, due to the slow speed of the powered glider the distance between the two aircraft was still relatively short. The decision of the pilot to remain on opposite course is to be considered correct due to the different speeds.

The Boeing crew did not have the advantage of early recognition. The powered glider flew without activated transponder and was therefore not indicated on the Boeing's TCAS. The timely visual observation of the powered glider by the Boeing crew was negatively influenced by: its small size, its linear flight except for the left-hand turn, its missing lighting, and the high speed of the Boeing. Under these circumstances a timely initiation of an avoidance manoeuvre was almost impossible.

Due to the inactive transponder of the powered glider, the controller did not have any definite information about it on his monitor. He therefore had no chance of giving the Boeing crew concrete traffic information and, if necessary, an adequate avoidance recommendation. The radar recordings of the air traffic service provider show individual primary targets (without altitude indications) which, at the time of the occurrence, had been depicted in the vicinity of the Boeing. However, the described airprox was not visible. Due to the irregular and recurrent primary targets with spatial connection the controller had information about possible aircraft which could be close to the Boeing's flight path. These primary targets were indicated right and left of the Boeing's flight path. The controller would have had the option to inform the Boeing crew about both possible threats. It cannot be ruled out, that in addition to the reported airprox right of the flight path there was another on the left. A traffic warning regarding possible glider traffic with direction information might have supported the Boeing crew with the timely recognition of the powered glider.



The TCAS of the Boeing would have been able to process the transponder data of the powered glider, inform the crew, and generate an avoidance recommendation, if the transponder had been activated. Since this was not the case, the Boeing crew saw the powered glider at a time when it was already too late for an avoidance manoeuvre.

The project “Erkennbarkeit von Segelflugzeugen und kleinen motorisierten Luftfahrzeugen“ (BEKLAS, 2004 (recognisability of gliders and small powered aircraft)) on behalf of the Bundesministeriums für Verkehr, Bau- und Wohnungswesen (Federal Ministry of Transport and Urban Affairs) had thoroughly examined the problem of recognition of gliders and small powered aircraft. The project’s final report states: *Air traffic is based on the principle “See and Avoid” [...]. Although it originated from the early days of air traffic the concept is still valid today. As the name implies, it is essential to see other traffic and to be seen by other traffic to avoid collisions. Key element therefore is the capability of a pilot to notice other airplanes, estimate course and speed, and deduce the right action for the situation.”*

The principle “See and Avoid” as collision avoidance strategy is subject to limitations due to physiological capabilities. In airspace E flights in accordance with instrument flight rules with speeds up to 250 kt (under certain circumstances military aircraft are allowed to fly even faster) and flights in accordance with visual flight rules take place. Due to their construction and size it is not possible to detect gliders early. *“Gliders can best be seen, when the rudder with the fuselage, or, with commensurate bank angles, the wing depth reflects the sun light and impresses by their size. However, during stationary circling flight this is almost never the case. Due to a circle time of approximately 20-30 seconds there are only less than five seconds per perspective. If the mean fuselage width is 62.4 cm, the distance is more than 3.2 km, and the point vision sharpness is 1.5, the fuselage cannot be recognised, only the wing depth (The mean wing depth at the root is 92 cm for nine different synthetic single-seater.). If distance is increasing to more than 4.7 km the wing depth also disappears. Then only the flashing of the wing in the sun can be observed as above-threshold impulse (Similar to a cobweb which can only be recognised by the reflection otherwise remains invisible.). These reflections are not present in shadow or below a cloud.”* (BEKLAS) Assuming a speed of 250 kt IAS, the crew of a transport aircraft has about 37 seconds to prevent a collision. But since a glider presents such an optimum only for a brief period the time span can be considerably shorter.

Due to technical progress different systems are available which pilots can use to support them with the recognition of impending collisions.

The consequent use of the already available technical means would minimise the collision risk considerably in airspaces where controlled IFR traffic and uncontrolled VFR traffic occur at the same time.

The two aircraft passed each other at almost parallel opposite courses in a horizontal distance of less than 0.2 NM. The pilot of the powered glider stated that he had continuously observed the flight path of the Boeing. But a course change of the Boeing to the right at an unfavourable moment in combination with an increase in rate of descent could have quickly resulted in a collision.

After the two aircraft had passed each other, the powered glider returned to its original course. The powered glider crossed the flight path of the Boeing 19 seconds after the B737-800 had been at that particular point and about 300 ft below its original altitude (see Image 1, at: 1737:03 hrs). Depending on the atmospheric situation and the profile of the aircraft, the wake vortexes it generates descend with a rate of 300-800 ft/min. The powered glider was in immediate proximity to the wake vortex of the Boeing B737-800. Had the powered glider flown into it, the worst case scenario would have been a crash.

## Conclusions

The Serious Incident was caused by the following:

- The Boeing 737 crew did not have any information regarding the powered glider and did not see it until it was too late for an avoidance manoeuvre.
- The air traffic service provider could not provide the Boeing crew with any meaningful traffic information, because there was no transponder signal from the powered glider. Therefore, active contribution to the collision avoidance was not possible.

Investigator in charge: Blanke

Assistance: Himmler

Braunschweig: 26/02/2016

This investigation was conducted in accordance with the regulation (EU) No. 996/2010 of the European Parliament and of the Council of 20 October 2010 on the investigation and prevention of accidents and incidents in civil aviation and the Federal German Law relating to the investigation of accidents and incidents associated with the operation of civil aircraft (*Flugunfall-Untersuchungs-Gesetz - FIUUG*) of 26 August 1998.

The sole objective of the investigation is to prevent future accidents and incidents. The investigation does not seek to ascertain blame or apportion legal liability for any claims that may arise.

This document is a translation of the German Investigation Report. Although every effort was made for the translation to be accurate, in the event of any discrepancies the original German document is the authentic version.

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