

# Investigation Report

## Identification

Type of Occurrence:	Serious incident
Date:	26 June 2017
Location:	Near Stuttgart
Aircraft:	<ul style="list-style-type: none"><li>1) Airplane</li><li>2) Ultralight aircraft</li></ul>
Manufacturer / Model:	<ul style="list-style-type: none"><li>1) Airbus Industry / A319-132</li><li>2) Aerospool / Dynamics WT-9</li></ul>
Injuries to Persons:	No injuries
Damage:	None
Other Damage:	None
State File Number:	BFU17-0804-5X

## Factual Information

The A319-132 took off from runway 07 of Stuttgart Airport. During climb at an altitude of about 1,200 ft AGL, the flight crew followed the descent instruction generated by the Traffic Collision Avoidance System (TCAS). An ultralight crossed the flight path of the Airbus. Shortly afterwards, the flight crew received the warning generated by the Enhanced Ground Proximity Warning System (EGPWS) not to descend.

## History of the Flight

On the day of the occurrence at 17:34:29 hrs<sup>1</sup>, the ultralight pilot established radio contact with the tower controller at Stuttgart Airport. He requested clearance to cross the control zone from the mandatory reporting point OSCAR and overflight of the airport. The tower controller issued the clearance with the words: “[...] frei zum Einflug in die Kontrollzone [...] dann fliegen Sie zu einer Position circa eine Meile südlich des Platzes und ich rufe zurück zum Überqueren (free to enter control zone then fly to the position about one mile south of the airport and I call you back for the overflight).“ At 1738:51 hrs, the ultralight pilot answered: “[...] fliege eine Meile südlich des, äh Platzes und ich rufe zurück zum Überqueren (flying one mile south of the airport and I call back for the overflight).“ The pilot stated that at the time of entry of the control zone the ultralight had been at 3,300 ft AMSL<sup>2</sup>.

At 1739:16 hrs the pilot in command (PIC) who was also Pilot Monitoring (PM) of the Airbus A319 established radio contact with the tower controller and received the clearance to roll on to runway 07. The flight was conducted under Instrument Flight Rules (IFR).

At 1740:20 hrs the tower controller advised the ultralight pilot: “[...] Airbus A319 in [...] -Bemalung des Luftfahrtunternehmens, steht am Anfang der Piste Null Sieben, melden Sie Verkehr in Sicht (Airbus A319 in [...] operator colours in sight is standing at the beginning of runway zero seven, report traffic in sight.)“ The ultralight pilot answered: “[...] Airbus in Sicht (Airbus in sight).”

At 1740:32 hrs the tower controller issued the clearance for the ultralight pilot to cross the airport after the Airbus A319 had started.

At 1740:41 hrs the tower controller issued take-off clearance for the A319 for runway 07. The PIC acknowledged the take-off clearance.

The PIC stated that during climb the flight crew had the ultralight in sight. They observed how it entered their flight path north of them.

At 1741 06 hrs, the tower controller asked the ultralight pilot whether he had the Airbus taking off in sight. The pilot answered: “[...] positive.“

Then the tower controller added: “[...] wie gesagt, die zieht unter Umständen steil hoch, also bitte dahinter überqueren (As I said it might pull up steeply, therefore

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

<sup>2</sup> Above Mean Sea Level

cross behind it).“ At 1741:18hrs, the ultralight pilot answered: “[...] verstanden, wilco (roger, wilco).“

Four seconds later the tower controller said: “[...] drehen Sie einmal nach rechts weg und danach Überqueren, das wird so nix (turn right once and then overflight this is not going to work).“ The ultralight pilot responded: “[...] drehe nach rechts weg (I am turning right).“

At 1741:40 hrs the tower controller gave the PIC of the Airbus A319 the traffic information about the ultralight in the departure sector: “[...] traffic is one o'clock half a mile 1 000 feet in right turn to avoid.” After about 9 s the PIC answered: “[...] wilco, traffic in sight.”

At 1741:53 hrs the tower controller radioed the ultralight pilot with the words: “[...] das wird so nix, jetzt äh beschleunigt Richtung Norden fliegen (this is not going to work, now fly speedily north).“ The ultralight pilot answered: “[...] wir fliegen [...] beschleunigt Richtung Norden (we are flying speedily north).“

At 1741:56 hrs at about 1,200 ft AGL, TCAS generated the Resolution Advisory (RA) to descend. The co-pilot as Pilot Flying (PF) initiated the descent. In his report the PIC stated the rate of descent resulting from the RA as minus 1 600 ft /min. Shortly afterwards the EGPWS<sup>3</sup> generated the warning: “Don't sink, Don't sink.“ The PIC decided that they should follow the TCAS RA up to 400 ft AGL and it had priority. At that time the tower frequency was busy and he could not report the TCAS RA.

At 1742:07 hrs the tower controller asked: “[...] traffic is now finally away confirm you can continue climb?“ The PIC answered: “[...] TCAS RA”. During the radio communication the EGPWS instruction “Don't sink, Don't sink“ could be heard twice in the background.

At 1742:14 hrs TCAS announced: “Clear of conflict“. The PIC transmitted the clear of conflict status to the tower controller.

The A319 lost approximately 150 ft altitude during the descent. According to the Quick Access Recorder data, the airplane was at about 1,050 ft AGL Radio Altitude (RA). Then the climb was continued.

The ultralight continued north.

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<sup>3</sup> Description in Chapter Additional Information

## Personnel Information

### Pilot in Command A319

The 39-year-old PIC held an Airline Transport Pilot's Licence (ATPL(A)) issued in accordance with Part-FCL (Flight Crew Licensing) by the Luftfahrt-Bundesamt (LBA, German civil aviation authority) on 23 January 2014. The licence listed the ratings for PIC on A320 in accordance with instrument flight rules (PIC IR). The licence was valid until 30 September 2017.

The BFU was provided with a class 1 medical certificate, valid until 18 September 2017.

The operator stated that the PIC had a total flying experience of approximately 12,244 hours, of which about 10,244 hours were flown on A319/A320/A321.

The operator supplied the mission schedule of the last 7 days. It showed that the PIC had conducted 3 flights prior to the occurrence.

### Co-pilot Airbus A319

The 33-year-old co-pilot held a Multi-Crew Pilot's Licence (MPL(A)) issued in accordance with Part-FCL by the LBA on 30 January 2014. The licence listed the ratings for co-pilot on A320 in accordance with instrument flight rules (COP IR). The licence was valid until 31 January 2018.

The BFU was provided with a class 1 medical certificate, valid until 03/09/2017.

The operator stated that the co-pilot had a total flying experience of approximately 2,079 hours, of which about 1,977 hours were flown on A319/A320/A321.

The operator supplied the mission schedule of the last 7 days. It showed that the co-pilot had conducted 4 flights prior to the occurrence.

### Pilot Dynamic WT9

The 65-year-old pilot held a licence for air sports equipment issued by the Deutsche Ultraleichtflugverband e.V. (German ultralight flying organisation). The licence listed the ratings for aerodynamically controlled ultralight aircraft and passenger transport. The licence was not limited.

The BFU was provided with a class 2 medical certificate with the restriction VML (correction for defective distant, intermediate and near vision) valid until 2 June 2018.

The pilot held a radio certificate (BZF II).

The pilot stated that he had a total flying experience of about 382 hours with powered aircraft; 83 hours of which on air sports equipment.

His pilot log book listed several familiarisation flights on single-engine aircraft of up to 2 t Maximum Take-Off Mass (MTOM) between 2000 and 2006.

## Aircraft Information

### Airbus A319-132

The A319-132 is a transport aircraft equipped with two fan jet engines. It is used as short and medium range aircraft.

Manufacturer	Airbus Industry
Year of manufacture:	2006
Manufacturer's serial number	2833
Operating Time	32,838
Landings	24,721
MTOM	68,000 kg
Engine type	IAE V2524A5

There were no entries of technical defects in the Techlog which could have influenced the flight.

## Dynamic WT 9

The Dynamic WT 9 is a single-engine, two-seat, and aerodynamically controlled ultralight aircraft. It is a low-wing fibre composite aircraft with fixed landing gear in nose-wheel configuration.

Manufacturer	Aerospool (Prievidza/Slowakei)
Manufacturer's Serial Number	DY 525
Year of manufacture:	2015
Maximum take-off mass	472.5 kg
Empty weight	279 kg
Wing Span	8.93 m
Length	6.46 m
Design manoeuvring speed ( $V_A$ )	160 km/h
Maximum speed ( $V_{NE}$ )	270 km/h
Engine Type	Rotax 912 ULS2

## Meteorological Information

At the time of the incident it was daylight. On 26 June 2017 sunset was at 2129 hrs in the Stuttgart region.

According to the aviation routine weather report (METAR) of Stuttgart Airport at 1720 hrs visibility was more than 10 km. Wind direction 250° at 7 kt. Cloud at 3,500 AGL 1/8 to 2/8, at 5,400 ft AGL 3/8 to 4/8, and at 7,600 ft AGL 5/8 to 7/8. The temperature was 19°C, dew point 12°C, and QNH 1,012 hPa.

## Aids to Navigation

The A319 crew followed the standard instrument departure route VESID 2H of runway 07 of Stuttgart Airport towards waypoint VESID.

Fig. 1 shows the standard instrument departure route including the area of approximation of the two aircraft. The chart is part of the LIDO (Lufthansa Systems GmbH & Co. KG) as of 18 May 2017.

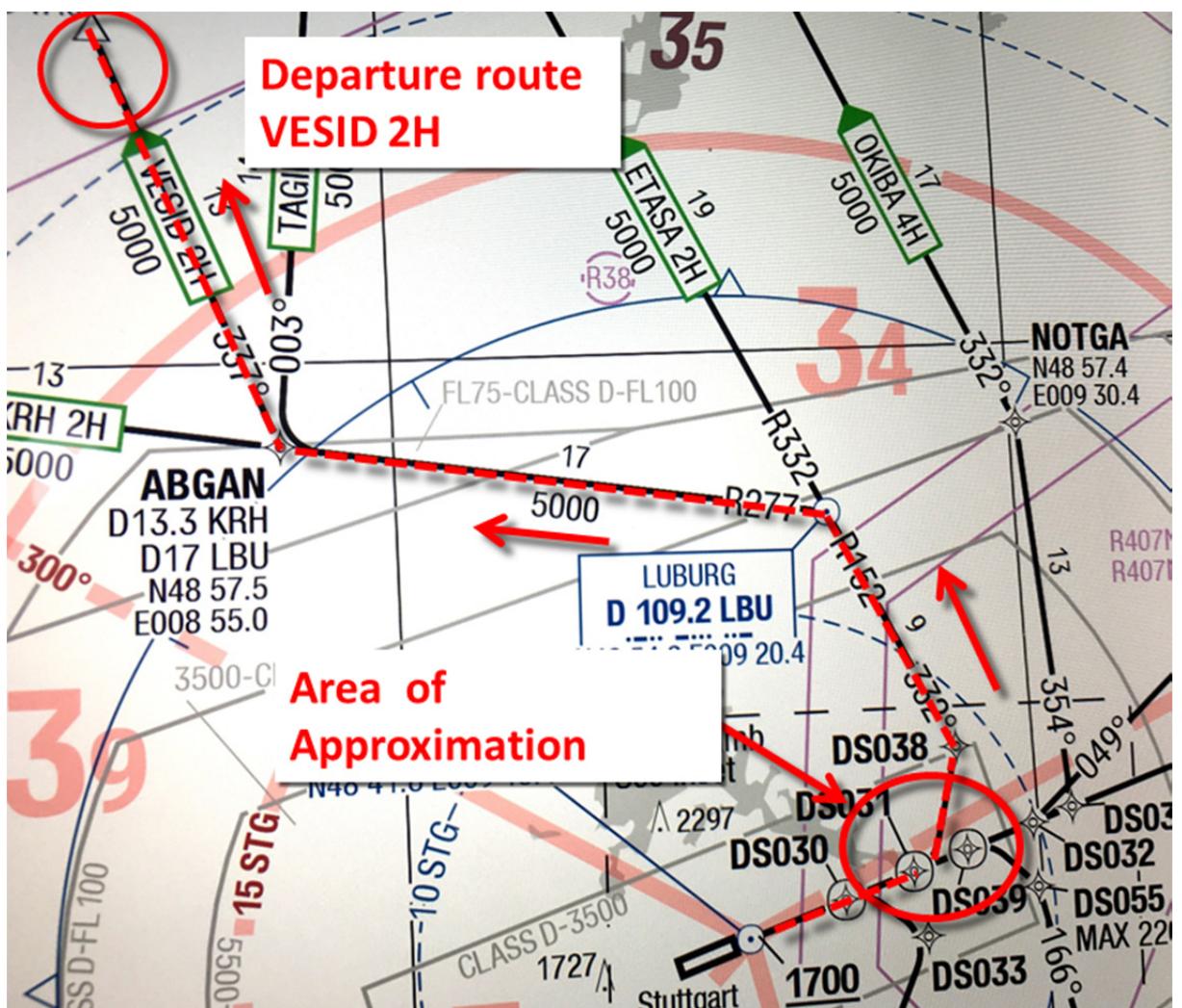


Fig. 1: Standard instrument departure route

Source: LIDO/BFU

## Radio Communications

Radio communications between the Airbus crew and the tower controller were held in English and recorded.

Radio communications between the ultralight pilot and the tower controller were held in German and also recorded.

The air navigation services provider provided the BFU with audio recordings and transcripts.

## Aerodrome Information

Stuttgart Airport is located 13 km south of Stuttgart. Aerodrome elevation is 1,276 ft AMSL. It had one runway with the orientation 74° (07) and 254° (25). The control zone is active 24 hrs. The control zone extends from the ground up to 3,500 ft AMSL. The dimensions are described in the AIP<sup>4</sup> Chapter ENR 2.1 Airspace Class D.

## Flight Recorders

The operator provided the BFU with the Quick Access Recorder data.

The air navigation services provider provided the BFU with radar data. Fig. 2 depicts the flight paths of the ultralight, the Airbus A319, and the approximation area of the two aircraft in the departure sector. At the time of the closest proximity the two aircraft had a horizontal distance of about 0.213 NM and a vertical of 600 ft. The Airbus A319 had a ground speed of approximately 160 kt and the ultralight of about 110 kt.

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<sup>4</sup> Aeronautical Information Publication

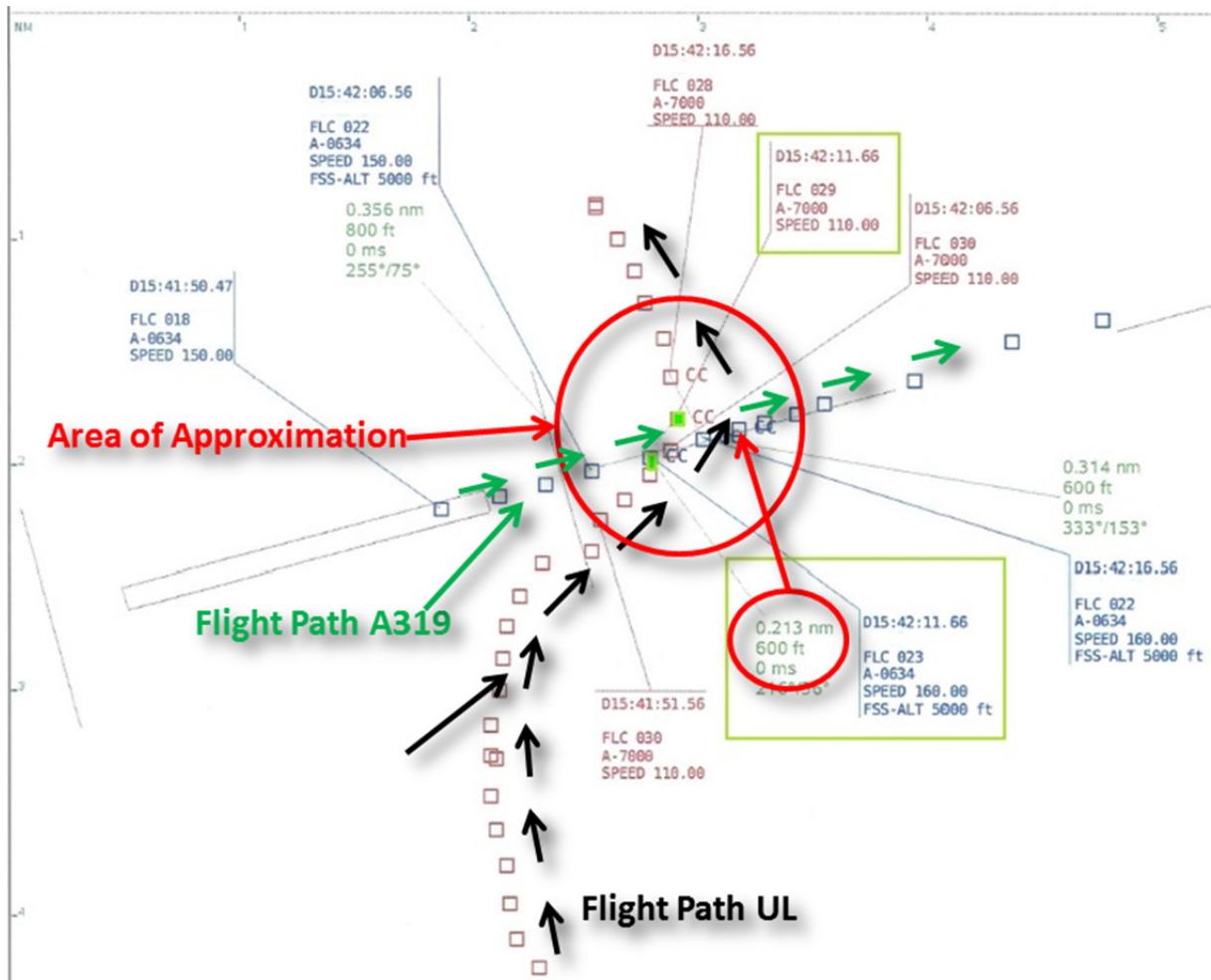


Fig. 2: Flight paths of both aircraft and approximation area

Source: Deutsche Flugsicherung/BFU

The following Fig. 3 and Fig. 4 are based on the Quick Access Recorder data of the A319. Fig. 4 shows the lateral view of the approximation of the two aircraft. Fig. 5 shows the diagramm compiled with the software Inflight of relevant parameters.

Heading in degrees; Pitch Angle in degrees; Computed Airspeed in kt; Altitude (1,013 HPa) in ft; A/P - Active/not Active; TCAS TA - Active/not Active; TCAS RA - Active/not Active

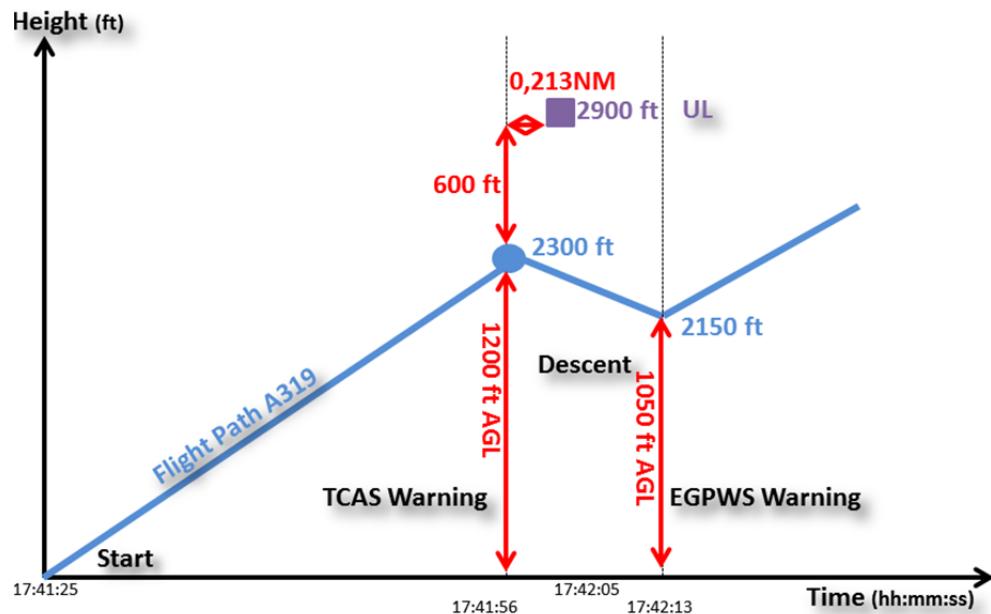


Fig. 3: Flight paths of both aircraft

Source: BFU

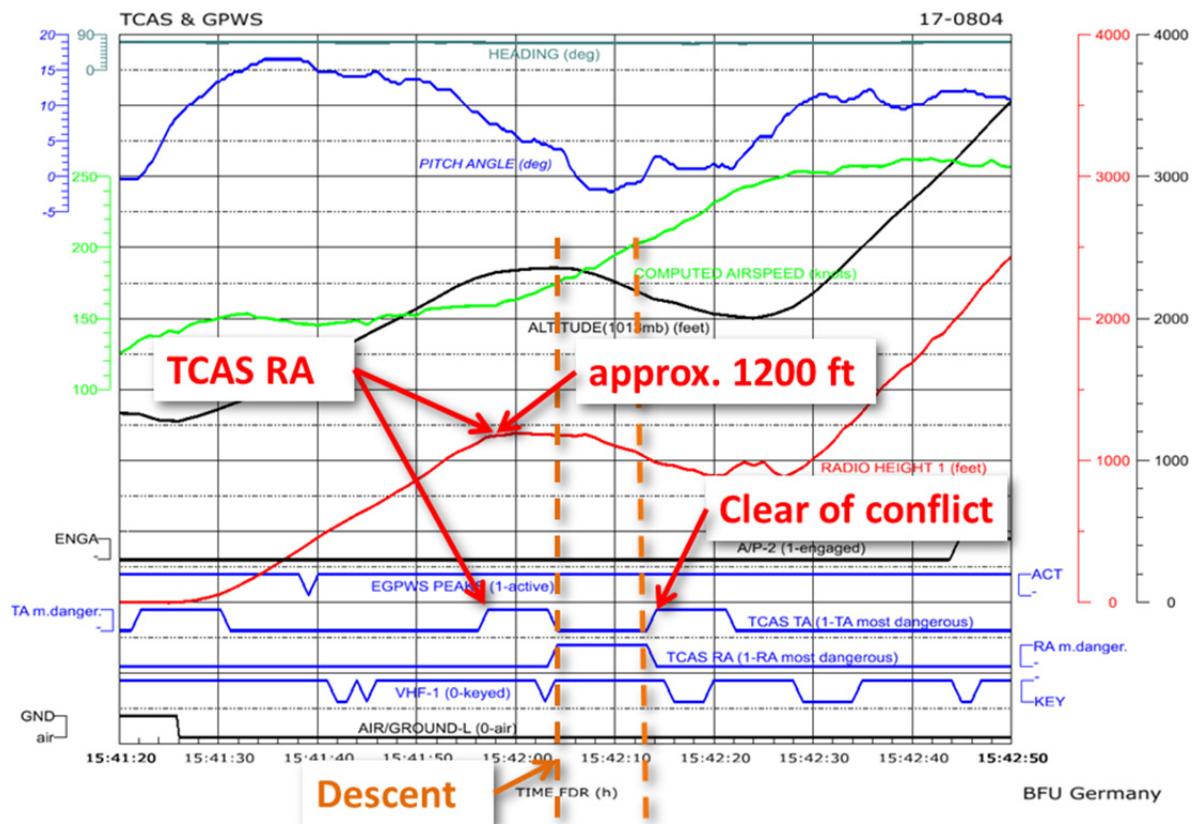


Fig. 4: Parameters of the Quick Access Recorder

Source: BFU

## Organisational and Management Information

### Traffic Resolution Advisory Procedure

The operator's Operations Manual Part-B and the Flight Crew Training Manual, as of 20 December 2017 described the following procedures for pilots:

*Resolution Advisory: All „Climb“ and „Descend“ or „Maintain Vertical Speed Maintain“ Adjust Vertical Speed Adjust“ or „Monitor Vertical Speed“ type Messages:*

*AP<sup>5</sup> (if engaged)* OFF

*Both FD<sup>6</sup>s* OFF

*Respond promptly and smoothly to a RA by adjusting or maintaining the vertical speed, as required, to reach the green area and/or avoid the red area of the vertical speed scale.*

*Note: Avoid excessive maneuvers while aiming to keep the vertical speed just outside the red area of the VSI<sup>7</sup> and within the green area. If necessary, use the full speed range between V<sub>MIN</sub> max and V<sub>MAX</sub>.*

*Respect Stall, GPWS or Windshear Warning. Notify ATC<sup>8</sup>. When „Clear of conflict“ is announced: Resume normal navigation in accordance with ATC clearance, AP/FD can be re-engaged as desired.*

## Additional Information

### Traffic Collision and Avoidance System

The description of TCAS was part of the BFU report AX001-1-2/02 of May 2004. Excerpt from the report.

*[...] TCAS is a warning system which functions independently of ground equipment, of the aircraft navigation equipment and of the pilots. TCAS uses the transponder (Mode C or S) of other airplanes as a source of information, it possesses its own transmitter/receiver/locator systems and computers for the fast determination of flight paths and the generation of advisories for the pilots.*

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<sup>5</sup> Autopilot

<sup>6</sup> Flight Director

<sup>7</sup> Vertical Speed Indicator

<sup>8</sup> Air Traffic Control

Only one TCAS device is installed aboard a transport category airplane, i.e. there is no redundancy for fail-safe operation. It is permitted according to the MEL (Minimum Equipment List) to continue to operate an aircraft for up to 10 days in case of TCAS failure. [...]

The information is displayed either on navigation displays, or on additionally installed instruments or a combination thereof instead of classical flight instruments. Fig. 5 shows both variants. The display of both instruments depicts the air traffic in the airspace monitored by TCAS. The pilots can observe the relative position, the relative flight altitude, and the trend of the relative flight altitude of other aircraft.

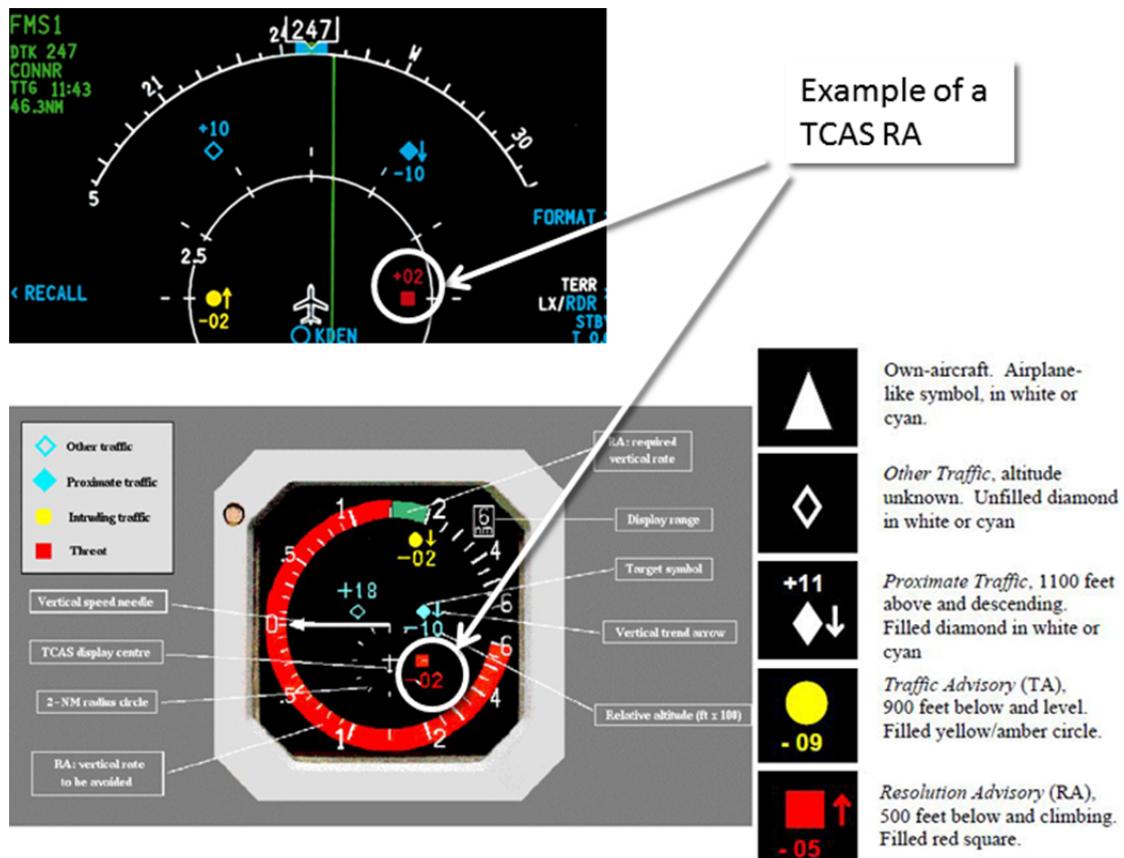


Fig. 5: Various instrument options of TCAS RA depiction

Source: FAA; Rockwell Collins/BFU

## Enhanced Ground Proximity Warning Systems

The aircraft position is determined using GPS data. The EGPWS computer receives the current position, the altitude, the heading, and the ground speed, among other things. The navigation display depicts the flight path in relation to the terrain. The indication makes the flight crew aware of potential conflicts with terrain or obstacles. Conflicts are identified if the terrain or obstacle is within a specific calculated upper limit within the intended flight path. Based on the type of conflict optical and aural warnings and alarms are generated.

In the present case, Mode 3 Descent After Take-off was triggered. This generated the warning for significant loss of altitude after take-off or low altitudes during go-around if landing gears or flaps are not in landing configuration. This protection is active until the EGPWS determines that the aircraft has gained sufficient altitude and is therefore no longer in the take-off phase. Significant loss of altitude after take-off or during low go-around generates the aural warning: "Don't sink, don't sink".<sup>9</sup>

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<sup>9</sup> System description Honeywell MK VI and MK VIII, Rev. C, May 2004

## Analysis

At 1740 hrs the Airbus A319 took off from runway 07 at Stuttgart Airport. During climb, at an altitude of about 1,200 ft AGL, the ultralight Dynamic WT9 entered the departure route of the Airbus A319. The A319 flight crew followed the TCAS instruction and shortly afterwards the EGPWS generated a warning.

### Ratings of the Persons Involved

The A319 flight crew held the required licences and ratings and had to be viewed as experienced due to the flying experience the operator reported.

The Dynamic WT9 pilot had the required licences and ratings for the operation of the aircraft. The BFU is of the opinion that based on his total and type flying experience the pilot has to be viewed as experienced as well. The entries in his pilot log book showed that he had been flying single-engine aircraft up to 2 t MTOM for years. He also held a BZFII which allowed him to enter the control zone at airports and conduct radio communications in German. The BFU estimates that he was familiar with radio communications phraseology at airports.

### Technical Condition of the Airplanes

Based on the A319 documentation and the statement of the ultralight pilot the two aircraft did not have any technical defects. TCAS and EGPWS of the A319 functioned properly. Therefore, the acting persons were not distracted by technical limitations.

### Weather and Visual Meteorological Conditions

At the time of the occurrence, it was daylight and the cloud cover was 1/8 to 2/8 at 3,500 ft AGL. Visibility was more than 10 km. Both airplanes were below the cloud and reported to the tower controller that they had the other aircraft in sight. The A319 crew was conducting an IFR flight. The ultralight pilot was flying VFR. The BFU is of the opinion that due to the reported visibility and the cloud base weather conditions did not influence the course of events.

### Airbus A319 Crew

The workload of a flight crew at the beginning of the climb consists of changes in aircraft configuration, general system monitoring, radio communications, radio frequency changes, and flight path monitoring, among other things. In this phase,

airspace monitoring can be limited due to the workload in combination with the high pitch angle.

Prior to take-off, the crew received traffic information regarding the ultralight. The PIC acknowledged that they had the ultralight in sight. After take-off, at approximately 1,200 ft AGL, TCAS generated a RA. The co-pilot initiated an immediate descent. At the time, the rate of descent was minus 1 600 ft/min. The airplane lost about 150 ft of altitude. At the time and in low altitude, the rate of descent was high. TCAS calculated a flight path and indicated it on the Primary Flight Display<sup>10</sup>. The calculated flight path prevented a collision with the other airplane. Subsequently, the co-pilot followed the EGPWS instruction.

The crew acted in accordance with the procedures of the Operation Manual Part-B Chapter Abnormal and Emergency Procedures R34, as of 20/ December 2017, and the Flight Crew Training Manual.

### Ultralight Pilot

The crossing of the control zone of Stuttgart Airport was demanding for the UL pilot in regard to the observation of the airspace. The willingness to listen and strictly adhere to the instructions of the tower controller is essential. As a rule, ultralight pilots are not familiar with the air traffic and radio communications procedures at airports, in spite of radio certificates (BZF II).

According to the documentation, the ultralight pilot fully acknowledged the instructions of the tower controller. He wanted to cross the airport with a northern heading. Initially, he was asked to fly a holding pattern south of the airport and then cross the airport after the Airbus A319 had departed. The ultralight pilot acknowledged that he had the A319 on the runway in sight. He did not comply with the instruction of the tower controller, left the holding position, and flew north directly into the departure sector of the Airbus taking off. This manoeuvre caused the airprox.

The BFU estimates that the stress level of the ultralight pilot had increased due to the high airspeed, the radio communications with the tower controller, the flight control including navigation, and the observation of the airspace.

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<sup>10</sup> Primary Flight Display including flight attitude

## Tower Controller

The tower controller gave the A319 crew and the ultralight pilot traffic information. Therefore, all pilots received information regarding the other airplane. The tower controller issued the instruction to the ultralight pilot to cross the control zone after the A319 had departed. The ultralight pilot did not react according to the instruction.

The flight path of the ultralight was unpredictable for the tower controller. He reacted with corresponding radio instructions in an attempt to prevent the airprox of the two aircraft.

## Conclusions

The airprox of the two aircraft in the departure sector of Stuttgart Airport was caused by the ultralight pilot not following the radio instructions of the tower controller even though he had acknowledged them.

The A319 flight crew deliberately accepted the Enhanced Ground Proximity warning during the avoidance manoeuvre.

Investigator in charge: Norman Kretschmer

Assistance: Hans-Werner Hempelmann

Braunschweig, 6 January 2020

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.

## Published by:

Bundesstelle für  
Flugunfalluntersuchung  
Hermann-Blenk-Str. 16  
38108 Braunschweig

Phone            +49 531 35 48 - 0  
Fax            +49 531 35 48 - 246

Mail            [box@bfu-web.de](mailto:box@bfu-web.de)  
Internet        [www.bfu-web.de](http://www.bfu-web.de)