

Investigation Report

Identification

Type of Occurrence:	Serious incident
Date:	14 May 2008
Location:	Zweibrücken
Aircraft:	1. Transport aircraft 2. Military transport aircraft
Manufacturer / Model:	1. Airbus Industry / A319-112 2. Transporter Allianz / C-160 Transall
Injuries to Persons:	None
Damage:	Aircraft not damaged
Other Damage:	None
Information Source:	Investigation by BFU
State File Number:	BFU 5X006-08

Factual Information

At 1556 hrs¹, an approximation between an Airbus A319 on take-off run and a C-160 Transall ready for take-off occurred on runway 03/21 of Zweibrücken Airfield.

History of the Flight

At 1547 hrs at the terminal the Airbus A319 was ready to depart to a flight in accordance with Instrument Flight Rules (IFR) from Zweibrücken to Berlin-Schönefeld with 132 passengers and five crew members aboard. Taxi clearance via taxiways G and C to runway 03 was issued. Prior to the aircraft lining up, the ATC controller completed the clearance with "German W... 8045², line up 03, backtrack approved". Then the Airbus lined up and taxied south to the take-off position of runway 03 (backtrack). Once there, the airplane turned 180° and was ready for take-off direction 03.

While the Airbus A319 was taxiing to runway 03 a C-160 Transall parked on the apron radioed the tower controller asking for clearance for a sky diving operations flight in accordance with Visual Flight Rules (VFR). During the day the military transport aircraft had already conducted four sky diving operations flights from Zweibrücken Airfield. These flights took off from runway 21 following consultation with the tower via the telephone. The tower controller answered the initial call with "German A... 173², Zweibrücken hello, again, ... wind 060 degrees, 6 knots, clouds and visibility o.k., temperature 25, dew point 06, QNH 1011, runway 03". The Transall crew read back: "Runway 03 and QNH, C-160, and requesting 21 for departure please". The controller acknowledged the requested runway with "21 approved".

At 1554 hrs the Transall crew requested taxi clearance which the controller acknowledged with: "German A... 173, taxi holding point runway, correction, taxi holding point Alpha, runway 21". The Transall crew read back: "Taxi runway holding point runway 21 via Alpha". About one minute later the Airbus A319 received the clearance: "A319, wind variable 1 knot, runway 03, cleared for take-off". As the Airbus A319 began the take-off run the tower controller realised the C-160 Transall

¹ All times local, unless otherwise stated.

² German W ... and German A ... are anonymised call signs

had lined up. The recordings of the radio communication show that at 1556 hrs he instructed: "German A... 173 hold position" and "8045, break up".

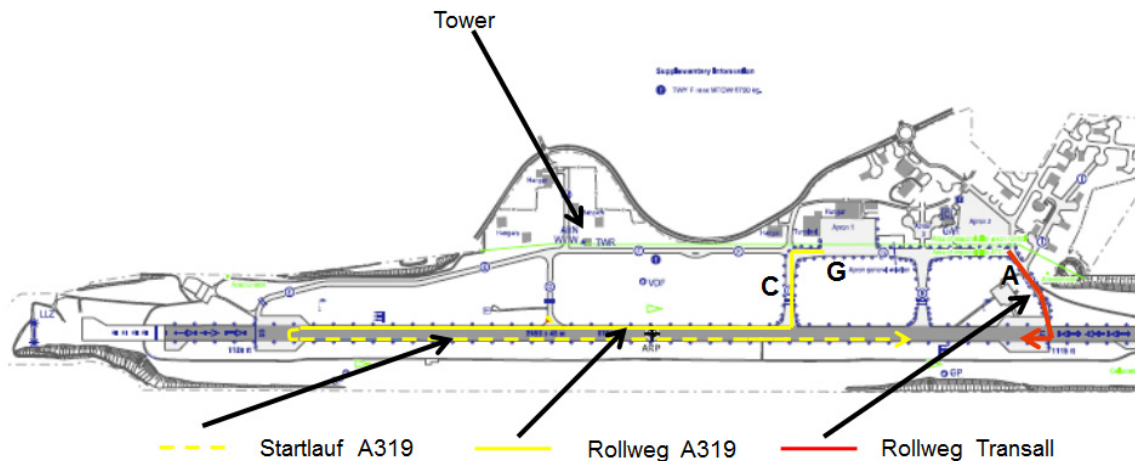
During the interview conducted by the BFU the Pilot in Command (PIC) of the Airbus A319 stated, initially he had not understood the instruction "... break up". At the time of the instruction "8045 break up" speed had exceeded V_1 and therefore a rejected take-off was no longer possible. The crew had then seen the C-160 Transall approaching from the opposite direction and continued the take-off run. The recorded radio communications contain a "say again" but due to interferences the source could not be determined.

The commander of the C-160 Transall stated during the interview that he had received the take-off clearance for runway 21 and prior to reaching the take-off position at the south-end of the runway he had recognised the upper part of the vertical tail of the airplane approaching from the opposite direction. Almost at the same time the controller's instruction for a rejected take-off had come.

Both crew stated that the A319 had passed over the C-160 Transall with a vertical distance of about 400 ft.

After the C-160 Transall, which was still on the ground, had been passed by the Airbus A319 the Transall crew stated on enquiry by the ATC controller: "I read take a lining up and wait runway ...21". The ATC controller said: "You were cleared to holding point Alpha" which the Transall pilot acknowledged with: "O. k., sorry about that".

During the interview after the occurrence the C-160 Transall crew confirmed the commander's statement that a line up clearance had been issued.



Reconstruction of the taxi path

Source: AIP/BFU

Personnel Information

Flight Crew Airbus A319

The 30-year-old pilot held an Airline Transport Pilot's Licence (ATPL (A)) valid until 16 May 2009. He had a total flying experience of about 4,600 hours.

The 41-year-old co-pilot held a Commercial Pilot's Licence (CPL) valid until 23 November 2008. He had a total flying experience of about 492 hours.

Flight Crew C-160 Transall

The 59-year-old commander held a military licence, valid until 25 June 2008. He had a total flying experience of 8,638 hours.

The 31-year-old co-pilot held a military license, valid until 4 April 2009. He had a total flying experience of 512 hours.

The 38-year-old flight engineer held a military licence for flight engineers, valid until 4 August 2008. He had a total flying experience of 2,661 hours flown exclusively on the type Transall.

The 32-year-old aircraft loadmaster held a military licence, valid until 24 April 2009. He had a total flying experience of 573 hours flown exclusively on the type Transall.

Air Traffic Controller

The 30-year-old controller held the ratings for the workstations PL1 and PL2 for the control zone Zweibrücken.

Aircraft Information

Airbus A319

The Airbus A319 is a short and medium range transport aircraft. It has a maximum take-off mass of 68,000 kg and can seat up to 153 passengers.

C-160 Transall

The C-160 Transall is a medium range transport aircraft. It is used for military and humanitarian deployments.

It is equipped with two Rolls-Royce MK22 four-blade propeller engines and has a maximum take-off mass of 49,150 kg. It can transport a payload of 16,000 kg.

The crew consists of the commander, the co-pilot, the flight engineer and the loadmaster.

Meteorological Information

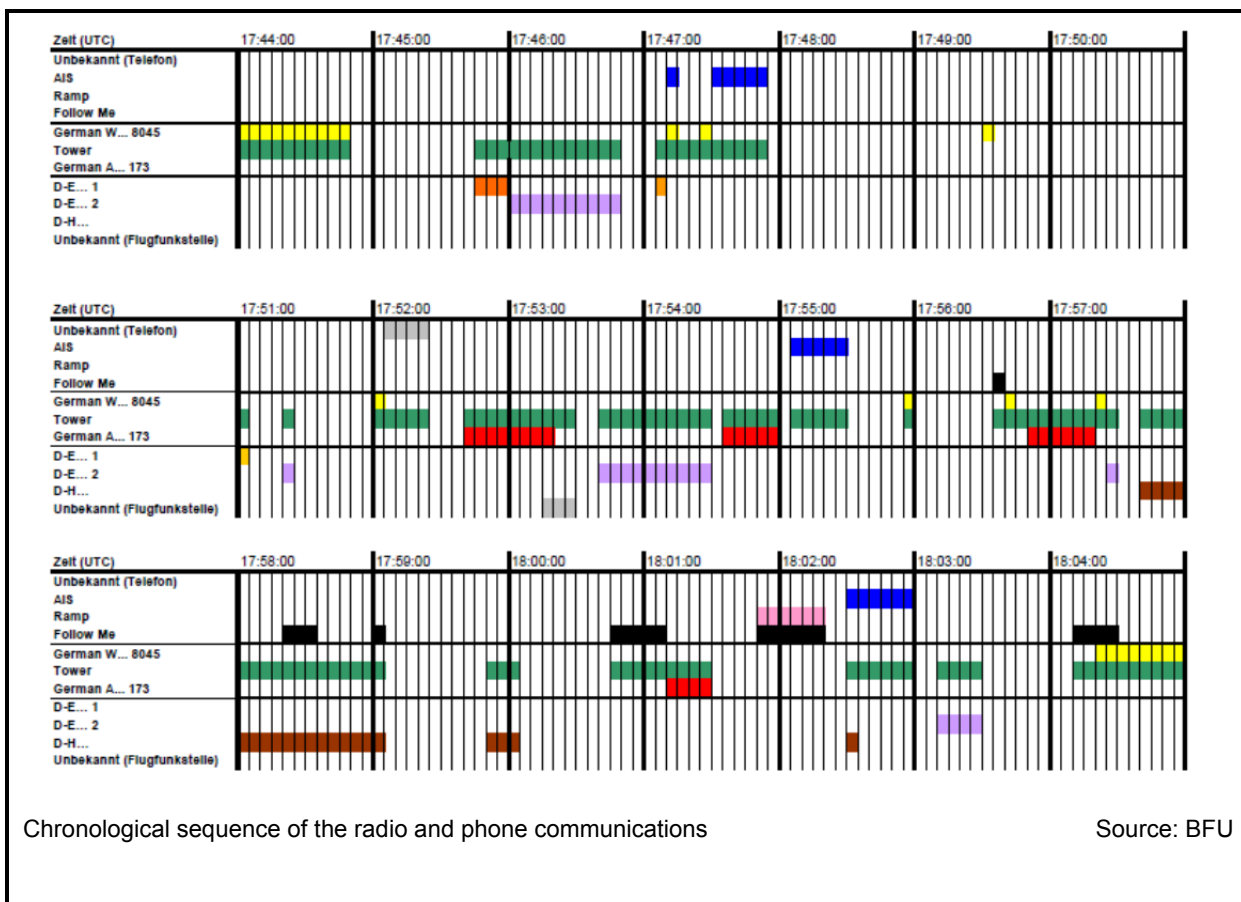
At Zweibrücken Airfield the following weather conditions prevailed:

Surface Wind:	060° / 06 kt
Clouds/Visibility:	CAVOK
Temperature:	25°C / 06°C
Air Pressure:	1,011 hPa

Communication

Radio communications between the aeronautical station Zweibrücken and the airplanes and the phone conversations were recorded. The recordings were made available to the BFU as .wav files.

For analysis purposes, the chronological sequence of the recorded radio and phone communications were illustrated graphically. A transcript of the conversations was prepared.



The recorded radio communications showed that during the time the Airbus A319 and the C-160 Transall were processed by ATC, two VFR flights and one helicopter were on the radio frequency. The IFR flights were coordinated by phone with Langen Radar. In addition, there were phone conversations with the Aviation Information Service (AIS).

Radio communications were only recorded during phases of speech. Whenever there was a break the device disengaged after a certain time.

Aerodrome Information

Zweibrücken Airfield has one runway oriented 03/21. It has a length of 2,950 m and a width of 45 m.

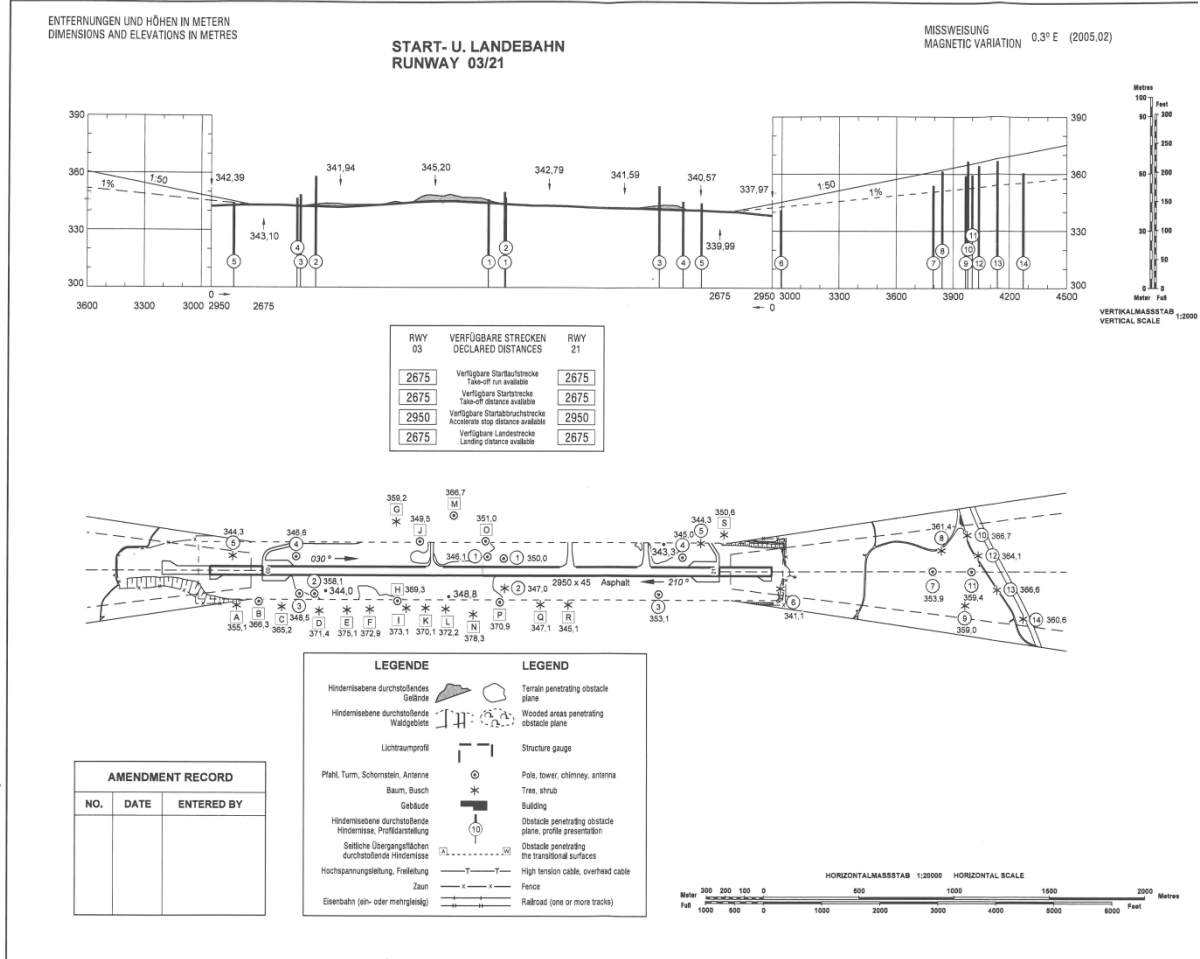
Runway elevation for runway 03 is 1,126 ft and for runway 21 1,115 ft. The middle runway section is about 10 ft higher than the threshold of runway 03 and about 20 ft higher than the threshold of runway 21.

The controller stated that the C-160 Transall was not always in his field of vision during taxiing from the parking position towards runway 21 because taxiway Alpha is partially behind a rise in the terrain.

Only airplanes with a maximum take-off mass of up to 5.7 t are allowed to use taxiway F. Airplanes with a higher maximum take-off mass had to backtrack to the threshold of runway 03.

Airspace D is established for approaching and departing air traffic.

At the time of the occurrence runway 03 was in service.



Aerodrome obstacle chart including runway elevations of runway 03/21

Source: AIP

Flight Recorder

The Airbus A319 was equipped with a Cockpit Voice Recorder (CVR) and a Flight Data Recorder (FDR).

The C-160 Transall was equipped with a CVR.

Due to the delayed report of the occurrence the recordings were not available for the investigation.

Organisations and their Procedures

The Airbus A319 had a German certificate of registration and was operated by a German operator in accordance with EU OPS.

The C-160 Transall had a German Armed Forces certificate of registration and was deployed as military transport aircraft.

At Zweibrücken Airfield an air traffic service provider certified by the responsible supervisory authority conducted all ATC operations within the control zone.

Additional Information

The occurrence happened on 14 May 2008 at 1556 hrs and on 15 May 2008 at 1520 hrs General Flugsicherheit der Bundeswehr (General Air Safety of the German Armed Forces) informed the BFU of the occurrence. In the following days the BFU became aware of the severity of the occurrence after several phone conversations with the air traffic service provider, the Armed Forces and the operator.

Analysis

The Serious Incident involving the Airbus A319 and the C-160 Transall on 14 May 2008 at Zweibrücken Airfield meets the ICAO definitions for runway incursions³. One airplane was on runway 21 for take-off even though another airplane was on take-off run on runway 03. A high collision risk existed. A collision was prevented by a close call.

The investigation into the Serious Incident determined no evidence of any malfunction of a technical system aboard the airplanes, at the airport or the air traffic service provider.

Key areas during the analysis of the occurrence were the following questions:

1. Why did the error or misunderstanding in the communication or the execution of the taxi instruction occur?
2. Why was this error not recognised earlier?

The possibilities of an extended human performance analysis were limited because the CVR recordings were no longer available.

Operational Aspects

The transport aircraft Airbus A319 and the military transport aircraft C-160 Transall were involved in the runway incursion. Both airplanes were under control of the controller of the control zone Zweibrücken.

The taxi clearance for the Airbus A319 via taxiways G and C to runway 03 corresponded with the stipulated phraseology. Adding "German W ... 8045, line up 03, backtrack approved" also corresponded with the stipulated procedures. The Airbus A319 crew correctly read back the instructions and then carried them out.

The C-160 Transall crew had requested take-off direction 21 because several sky diving operation flights were scheduled for the day and this afforded the Transall a significantly shorter taxi distance between the terminal and the take-off position. The wind conditions and the flight performance of the C-160 Transall allowed this decision. For this day, the airfield operator had defined the runway operating direction for general flight operations. The German Armed Forces and the tower

³ ICAO Doc 9870; Runway Incursion: Any occurrence at an aerodrome involving the incorrect presence of an aircraft, vehicle or person on the protected area of a surface designated for the landing and take-off of aircraft.

controller had agreed by telephone that the take-off direction for the Transall would be opposite to the one for the general air traffic and everyone involved knew about the agreement. This procedure had already been carried out four times that day without incident.

The take-off information requested with "Zweibrücken Tower, German A... 173, hello again, request your latest" was answered by the tower with "German A... 173, Zweibrücken hello, again, ... wind 060 degrees, 6 knots, clouds and visibility o.k., temperature 25, dew point 06, QNH 1,011, runway 03" and initially gave operating direction 03. While reading back the information the C-160 Transall crew explicitly requested take-off direction 21 which the tower controller acknowledged with the words "21 approved". Thus, the take-off information was corrected and the requested take-off direction acknowledged.

About two minutes later, taxi clearance was given with the words "German A... 173, taxi holding point runway, correction, taxi holding point Alpha, runway 21" and therefore a clearance to taxi to the holding point runway 21. From the controller's point of view the mistake "taxi holding position runway" was thus corrected. In accordance with the standardised phraseology the correct wording should have been "Taxi holding point runway 21 via Alpha". The correct line-up clearance should have been "Line up runway 21". It cannot be ruled out that the corrected take-off direction in combination with the corrected taxi clearance was the beginning of confusion. The C-160 Transall crew carried out the clearance as line-up clearance. The instruction and the acknowledgement were not in complete agreement with the stipulated phraseology.

The subsequent take-off clearance for the Airbus A319 was consistent with the rules. The crew read back the clearance and therefore acknowledged it.

With the instruction "172 hold position" and "8045, break up" the controller intended to stop both airplanes 44 seconds after the take-off clearance to the Airbus A319. Both instructions immediately followed one another because he had realised that the C-160 Transall had lined up on runway 21 and the Airbus A319 had already begun its take-off run from the opposite direction.

The Airbus A319 pilot asked again because he had not understood the instruction "8045, break up". The wording "break up" is insofar unclear because one cannot necessarily deduce to reject take-off. The correct phraseology would have been "stop

immediately". The Airbus A319 continued the take-off run also due to the speed reached.

The tower controller answered the enquiry with "Danke" (Thank you) because meanwhile the Airbus A319 had overflown the C-160 Transall which was still on the ground.

A rejected take-off could have resulted in a collision or a runway excursion because the speed of the Airbus A319 had already been above V_1 as the PIC stated.

Specific Conditions (Infrastructure)

The length and width of runway 03/21 was sufficient for the safe operation of the airplanes involved in the runway incursion.

Since taxiway F was only certified for airplanes up to 5.7 t maximum take-off mass due to limited bearing capacity, it was a regular procedure for the Airbus A319 to cross the runway to get to take-off point 03 when the take-off direction was 03. This procedure did not have any direct influence on the subsequent runway incursion.

The elevation profile of the runway was of importance. Because the middle runway section was about 10 ft higher than threshold 03 and about 20 ft higher than threshold 21 the crews of the airplanes could only see each other to a limited extent. Neither crew had an unobstructed view to check whether the runway was free.

Such an elevation difference between the middle runway section and the two thresholds is rather rare but the crews involved and the tower controller knew about it.

There were no stopbars or runway guard lights.

No weather-related visibility limitation, which could have contributed to the occurrence, existed.

The camouflage painting of the C-160 Transall may have influenced the visual recognition of it.

Human Factors

In general, runway incursions are the result of a chain of events underlain by certain basic conditions and causes. The interaction of the people involved plays a special

role. During the analysis of the runway incursion at Zweibrücken Airfield one of the key aspects was the interaction between the tower controller and the two airplane crews as well as the two airplane crews among each other. The other airplanes which were either in the traffic circuit or on the ground had only an indirect influence.

An error analysis of the actions of everyone involved showed that the C-160 crew lined up on runway 21 after they had received the clearance "German A... 173, taxi holding point runway, correction, taxi holding point Alpha, runway 21". This was a so-called pilot deviation, i.e. a flight crew did not adhere to an instruction or deviated from the stipulated procedure.

In order to deduce suitable actions to prevent similar occurrences in the future, the question has to be answered why this error occurred and was not recognised by other persons involved in time.

The BFU is of the opinion that the following aspects arose from this question:

1. The C-160 Transall crew had already conducted four take-offs that day with the take-off direction 21. For the C-160 Transall crew, the deviation from the operating direction 03 had already become routine in a certain way and was therefore no longer recognised as deviation from a standard procedure. During the planning phase this take-off direction had already been agreed on by telephone with the ATC controller.
2. The tower controller had formally given the correct instructions but had to correct himself regarding the take-off direction. Even though the take-off direction 21 had been agreed on beforehand, the deviation from the stipulated take-off direction for that day in combination with the work load caused by other airplanes resulted in the slip of tongue.
3. There was a slip of tongue during taxi clearance. The instruction "German A... 173, taxi holding point runway, correction, taxi holding point Alpha, runway 21" was read back by the C-160 Transall co-pilot in the corrected form "Taxi runway holding point runway 21 via Alpha".
4. The Airbus A319 with the callsign "German W ... 8045" received a taxi clearance including backtrack for the take-off direction 03. Since here the line-up was part of the clearance and the callsign of the C-160 Transall "German A ... 173" was very similar, it is possible that the Transall crew became confused regarding the content of the clearance. The word "German" was emphasised in both callsigns. Confusions and

misunderstandings caused by similar callsigns or content of clearances are error situations which occur in aviation and which should be recognised by established safety mechanisms or redundant information.

5. The tower controller did not recognise in time that the C-160 Transall crew carried out the taxi clearance not in accordance with his instruction. The duty description of an ATC controller includes the observation of the implementation of issued clearances and instructions. Due to temporary overwork and the specific conditions, such as the limited view because of the elevation profile and the deviation from the standard phraseology, the controller could only execute his supervision to a limited extent.
6. The instruction "8045, break up" the Airbus A319 received from the controller was not understood because it did not correspond with the standard phraseology. At the time, the Airbus A319 crew concentrated on the take-off run and, therefore, attentiveness to non-standardised information and procedures was not there. The instruction "173 hold position" was in agreement with the stipulated phraseology. The C-160 Transall crew understood and carried out the instruction.

The BFU is of the opinion that vagueness in the communication prompted the C-160 Transall crew to line up. It was not a single error but small inadequacies which added up. The BFU is of the opinion that loss of orientation, e.g. holding point Alpha was not found, is rather improbable.

Considering all facts determined during the investigation the BFU does not assume that the line-up clearance for the C-160 Transall was really issued. The experiences made during the analysis of CVR and radio communication recordings in the scope of accident investigation in the past show that a few days after the occurrence persons involved in the occurrence create a mental scenario which can deviate from the actual situation. This does not mean it is a conscious or deliberate false testimony.

However, indefeasible proof was not given due to the recording procedure of the radio communications. The digital recording procedure with so-called .wav files was not consecutive but was stopped when no-one was speaking. During read-out and copying of the .wav files individual files were generated depending on the length of the communication. The individual files carried a time stamp but proof of the integrity

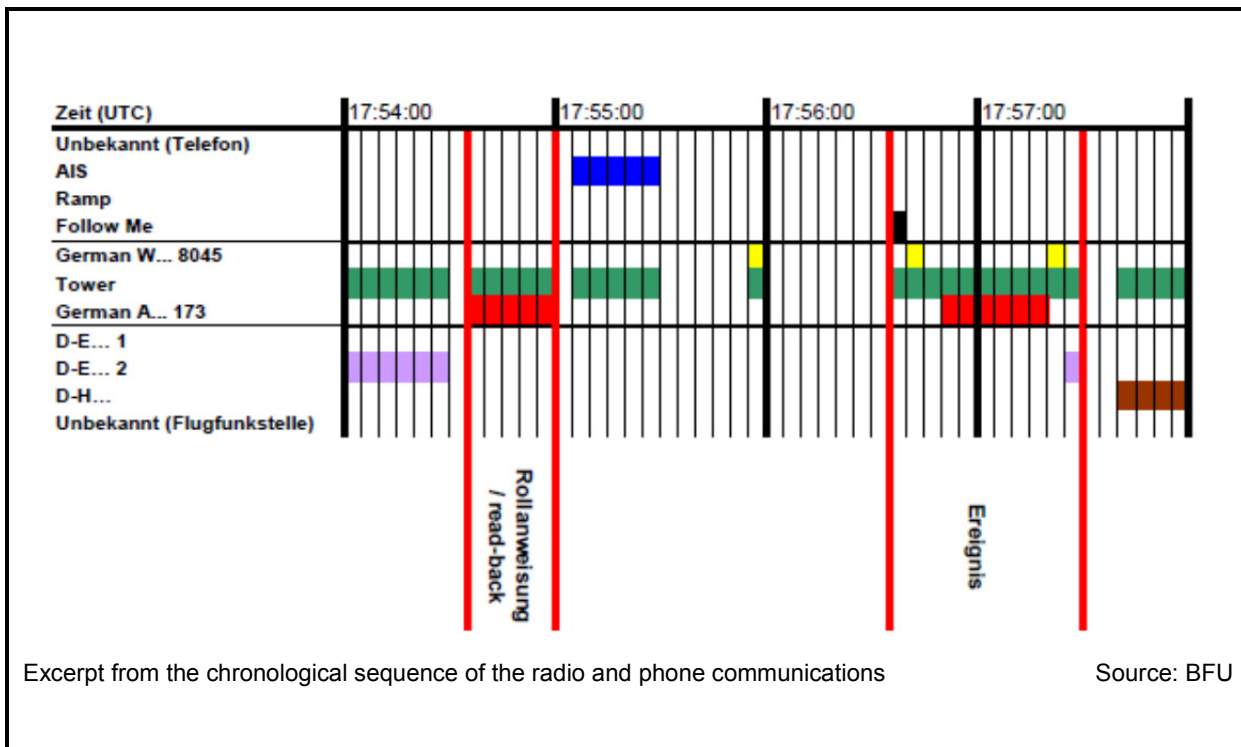
was not given. Therefore, the BFU could not prove beyond doubt the integrity of the recordings.

Work Load

The work load of the involved airplane crews was not unusually high. Both crews were not under any particular pressure for time. They were familiar with the local conditions of the airfield. The traffic and passenger volume of airports was more familiar to the Airbus A319 crew than that of an airfield. The crew of the military transport aircraft was familiar with the operation of civil and civil-military airfields but more used to military airports due to their usual deployment. Because flight operations were mostly conducted in accordance with ICAO regulations there were no significant uncertainties for everyone involved which would have resulted in any special work load.

For a short time, the controller had a higher work load. Compared to the altogether low traffic volume at Zweibrücken Airfield the controller had a traffic peak of about 20 minutes where he had to deal with the transport aircraft, the military transport aircraft, two VFR flights and one helicopter. During this time period he had to conduct coordination calls via the telephone with the Aviation Information Service (AIS) and radio communications with the follow-me vehicle. The analysis of the work load with the help of graphs of the radio and telephone communications determined that several times for short periods of time the controller had to handle parallel activities. While the controller had to simultaneously deal with a VFR flight and conduct a coordination call with AIS, the slip of tongue during the taxi clearance for the C-160 Transall occurred. At the time as both airplanes were on the runway, the controller had to communicate with the Airbus A319, the C-160 Transall and the follow-me vehicle. For the BFU it became quite apparent that in this phase the controller hardly had any free capacities for the supervision of the implementation of his instructions.

The BFU is of the opinion that this work load of a controller was not unusual or generally unsafe. But the analysis showed quite clearly that in this situation a deviation from or an exception to the stipulated operating direction 03 was not appropriate. The BFU is of the opinion that the conscious deviation from the operating direction 03 was a deviation from standard operating procedures which resulted in a risk situation.



The BFU assumes that the C-160 Transall crew did not mentally register the Airbus A319 cleared for take-off and taxiing to take-off point runway 03. A human factors analysis of the event sequence revealed that the Airbus had initially been in the area of the terminal, then received taxi instructions and clearances via radio and been visually detectable except for one part of runway 03. It is improbable that the airplane was confused with another transport aircraft because there was none this large. Presumably, neither member of the C-160 Transall crew did recognise the Airbus because of a feeling to be the only ones using the airfield and thinking oneself safe because the tower controller had everything under control.

Defences

Defences are measures to protect a system from the consequences of technical or human failure. The BFU is of the opinion that one mechanism which would have prevented the runway incursion is the adherence to Standard Operating Procedures (SOP). The following SOPs would have been of importance:

Adherence to the Runway Operating Direction

The airfield operator and the air traffic service provider had agreed on operating direction 03; it therefore constituted a SOP. The take-offs of the C-160 Transall were a conscious deviation from the SOPs. The C-160 Transall crew had requested the opposite take-off direction because the distance between terminal and take-off position was shorter and saved ground time. In terms of service orientation the controller accepted the deviation from the SOP valid for that afternoon. The deviation from the SOP did not occur in an ad hoc situation but was prearranged.

Without this exception the C-160 Transall would have to taxi to runway 03 via taxiway C. It can be assumed that the C-160 Transall would have seen the Airbus A319 and would not have lined up.

The BFU is of the opinion that due to the runway's geographical position and the resulting elevation profile, operation on opposing runways should in general be avoided at this airfield. The safety problem was caused by the fact that airplanes standing at opposing runway ends cannot see each other or only to a limited extent depending on their size.

Adherence to Standard Phraseology

Prior to the runway incursion radio communications were conducted in accordance with standard phraseology for taxi and take-off clearances. The wording "runway 03" during take-off information and the clearance "... taxi holding point runway" were slips of tongue which the controller recognised and consciously corrected. The not precise adherence to standard phraseology and the correction have possibly contributed to the C-160 Transall crew's misinterpretation of the implementation of the clearance.

The instruction "8045, break up" was not in accordance with the standard phraseology. "Stop immediately" would have been the standard instruction the controller would have had to use in the abnormal situation which suddenly occurred when the two airplanes were on the runway at the same time. Due to the lack of FDR data it is not possible to objectively analyse whether a rejected take-off was still possible at that time and with the speed the aircraft had reached. The explanation of the Airbus A319 PIC was plausible, however.

Read-back / Hear-back Procedure

In principle, the procedure was adhered to. Unclear wordings and smaller mistakes were not noticed by the persons involved, however. According to the radio communications recordings other crew members did not intervene.

Signs, Markings and Technical Equipment

At the time, Zweibrücken Airfield was not equipped with stopbars on the taxiways or other markings or signs which help preventing runway incursions. The BFU is nevertheless of the opinion that in this case such markings or signs would not have prevented the runway incursion because the C-160 Transall crew acted on the assumption of a line-up clearance.

A radar monitoring system with the function "Runway Incursion Monitoring", as airports have, might have alerted the controller sooner. However, the traffic volume on an airfield, such as Zweibrücken, does not justify the expense for the installation and operation of such a safety system.

Crew Resource Management (CRM)

Three crew members were aboard the C-160 Transall. Due to the lack of CVR recordings the details of the communication in the cockpit are not available but it is to be assumed that no crew member has recognised the content of the clearance and has developed a situational awareness of the Airbus A319 on take-off run. Thus, the safety elements intended by the implementation of Crew Resource Management, e.g. calling someone's attention to a crew member's error, cannot come into effect.

Organisational Aspects

Reportable Events

The operator operating the Airbus A319, the German Armed Forces as operator of the C-160 Transall and the air traffic service provider had in-house occurrence reporting systems in place.

Even though the in-house reporting system was adhered to by the German Armed Forces, there was a delay which resulted in the CVR data already being overwritten by the time the BFU was informed of the occurrence.

Take-off from an occupied runway is listed as example for Serious Incidents in the German Law Relating to the Investigation into Accidents and Incidents Associated with the Operation of Civil Aircraft (FIUUG) and are reportable events according to the German Air Traffic Order (Luft VO) para 5. Therefore, the PICs, the operators and the air traffic services providers would have had to report to the BFU immediately.

According to the information the BFU could determine the occurrence was communicated either incompletely or with a delay within the operator and the air traffic service provider. The BFU is of the opinion that the reporting system should be improved and the necessary safety culture be assisted. The operator stated that the reporting systems and decision criteria in regard to the prompt notification of the BFU were revised in August 2010.

Risk Assessment

According to the information provided to the BFU, the decision to take-off opposite to the operating direction of the runway was agreed on by the operator of the C-160 Transall and the air traffic service provider while planning the flights. Regarding the deviation from any SOP it would have been appropriate to assess the possible risks. The possible risk potential due to the elevation profile of the runway would have become clear prior to the decision.

Conclusions

The runway incursion occurred because a C-160 Transall did not stop at the holding point 21 but lined up on runway 21 due to misinterpreting the taxi clearance.

Contributing factors were the deviations from standard operating procedures. These were:

- The take-off direction intended for and used by the C-160 Transall was opposite to the operating direction of the runway for all other take-offs and landings that day.
- The standardised phraseology for radio communications was not consequently adhered to.
- The read-back-hear-back procedure was not consequently adhered to.

The wrong line-up could not be detected by the crews of the airplanes involved. Due to the elevation profile of the runway, the opposite airplane could not be seen or only to a limited extent.

The controller, too, could not see every airplane on the ground at all times due to the elevation profile of the runway.

Safety Recommendation

The BFU intends to publish the following safety recommendation:

Safety Recommendation 12/2013

The Federal Supervisory Authority for Air Navigation Services (BAF) should inspect the recording systems for the radio communications of certified air traffic service providers in regard to verifiable and complete recordings and, if appropriate, require probative recording procedures.

Investigator in charge: Johann Reuss

Braunschweig,
10 December 2013

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
Internet www.bfu-web.de