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Swiss Transportation Safety Investigation Board STSB

Status report by the Swiss Transportation Safety Investigation Board STSB

concerning the status of the investigation
into the accident involving the
Junkers Ju 52/3m g4e transport
aeroplane, HB-HOT,

operated by Ju-Air

on 4 August 2018

1.2 km south-west of Piz Segnas,
municipality of Flims (canton of Grisons)

Purpose of this status report

In accordance with Article 16 (7) of 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 repealing Directive 94/56/EC ((EU) No 996/2010), the Swiss Transportation Safety Investigation Board (STSB) is publishing a report describing the progress of the investigation on the anniversary of the accident.

As some of the necessary investigation activities have not yet been completed, no partial results will be published in this status report.

Synopsis

Summary

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|-------------------------|--|
| Owner | Swiss Air Force, Postfach 1072, 8600 Dübendorf, Switzerland |
| Operator | Ju-Air as part of Verein der Freunde der Schweizerischen Luftwaffe (Association of the Friends of the Swiss Air Force [VFL]), Überlandstrasse 271, 8600 Dübendorf, Switzerland |
| Manufacturer | Junkers Flugzeug- und Motorenwerke AG, Germany |
| Aircraft type | Ju 52/3m g4e |
| Country of registration | Switzerland |
| Registration | HB-HOT |
| Location | 1.2 km south-west of Piz Segnas, at 2480 m AMSL |
| Date and time | 4 August 2018, 16:56 local time |
| Type of operation | Commercial |
| Flight rules | Sichtflugregeln (Visual Flight Rules – VFR) |
| Starting point | Locarno (LSZL) |
| Destination | Dübendorf (LSMD) |
| Flight phase | Cruise |

Overview

On 4 August 2018, the historic Junkers Ju 52/3m g4e transport aeroplane, registration HB-HOT, operated by Ju-Air, took off from Locarno aerodrome at 16:10 local time for a flight to Dübendorf military aerodrome. Approximately 40 minutes later the aeroplane flew on a north-north-easterly track into the valley south-west of Piz Segnas. Towards the northern end of the valley, the aeroplane began a left turn, which developed into a downward spiral-shaped trajectory. Seconds later the aeroplane collided almost vertically with the terrain. All occupants of HB-HOT were fatally injured and the aircraft was destroyed.

Work at the site of the accident

The accident site was located in alpine terrain and was difficult to access. For the safety of salvage and investigation crews, it was necessary to stabilize the situation and control the danger of fire breaking out. In co-operation with the cantonal police of Grisons, officials of the Flims municipality, the fire brigade, the civil protection and the air force, it was possible to recover the bodies while also securing forensic evidence. The wreckage and its surroundings were captured using a three-dimensional laser scanning procedure and documented photographically as a basis for the subsequent reconstruction of the accident.

It soon became apparent that several people had observed and filmed some of the accident or had photographed the aeroplane during the flight. The fact that these eyewitnesses were at different locations made it possible to roughly reconstruct the flight path in the valley southwest of Piz Segnas for the first time.

Finally, the site of the accident was completely cleaned and soil contaminated with fuel and oil was removed.

Initial situation for further investigation activities

In most investigations into accidents involving large aircraft, extensive data from accident-resistant flight recorders are available shortly after the accident. This means that it is sometimes possible to describe the events with a high degree of precision just a few days after the accident. Often, initial conclusions regarding the primary causes of accidents can be drawn from these recordings and measures taken to improve safety. This is usually followed by a thorough technical examination of the wreckage and an in-depth systemic evaluation of the accident, which should also lead to safety recommendations in order to prevent similar accidents.

The historic Junkers Ju 52/3m g4e transport aeroplane involved in the accident was not equipped with any recording devices. Specifically, an accident-resistant flight data recorder (FDR) was not present. In the case of incidents involving large aircraft, these usually allow the reconstruction of the flight path, determination of the position of the aircraft in space and in relation to the airflow as well as the true airspeed and groundspeed of the aircraft. There was also no accident-resistant cockpit voice recorder (CVR) present. Such a device could provide information about the crew's discussions, the way they worked together and, if necessary, the nature of the problems that ultimately led to the accident.

In the accident, which is the subject of this investigation, all this data is missing, making the reconstruction of the flight path and the sequence of events extremely time-consuming and complex.

For this reason, it was necessary to adapt the safety investigation sequence described above: The investigation activities that serve to reconstruct the actual flight path and the sequence of events were started immediately and are still ongoing. At the same time, high priority was given to the evaluation of systemic aspects. Certain systemic safety deficits became apparent at an early stage during this investigation. The STSB therefore decided to publish an interim report on 20 November 2018 with a safety recommendation to the Federal Office of Civil Aviation (FOCA) and a safety advisory to the air operator in order to allow flight safety improvements in relation to equipment and engineering even before completion of the full investigation.

Technical investigations

The high degree of destruction of HB-HOT meant that the technical investigation was also complex. The lack of system status recordings on board the aircraft means that it was necessary to implement primarily forensic and metallurgical investigation methods. Examinations including those of the entire control surface system and their connections were therefore conducted at the site of the accident. It was subsequently possible to recover, clean, disinfect and sort the pieces of the wreckage according to assemblies. The entire wing assembly, including ailerons, flaps and their controls, was reconstructed and checked with regard to condition and function. Specific components of the wing assembly were subjected to metallurgical analysis and examined for corrosion.

The engines were cleaned in their found condition using a dry-ice blasting method and then completely dismantled. The individual components were visually inspected, identified and documented. Relevant components were then measured, classified and subjected to forensic and metallurgical analysis.

At the same time, the technical files of HB-HOT were reviewed and compared with the actual condition of the aircraft. As part of this, it was necessary to clarify in detail the work that had been conducted on the aircraft involved in the accident over the previous 40 years. In order to be able to track the maintenance work, the companies entrusted with this work are assessed with regard to their work processes, equipment and organisation.

Human factors

Since no recordings from a cockpit voice recorder are available from the accident flight, the co-operation of the two pilots during the flight can only be analysed based on the general characteristics of the two individuals. For this reason, the crew's pre-flight history will be reconstructed, whereby data from earlier areas of activity will also be used. The usual inquiries will also be made into the immediate pre-flight history, flight preparations and health status of the crew.

Organisational factors in relation to operation and oversight

In order to understand accidents in a systemic context, it is essential to analyse the company's operating principles, the crews' training and the management tools available for flight operations. It is also necessary to examine oversight of the company by the authority to evaluate whether it had any influence on the genesis of the accident.

Because the operator used its aircraft until the accident without making use of a flight data monitoring system, it was necessary to adopt unusual methods to investigate actual flight operations. The STSB has made several appeals to the public, asking for photographs and video footage, flight path recordings and descriptions of previous flights. These appeals have been met with a good response: more than 200 reports regarding the flight involved in the accident and previous flights are currently available to the investigation. The Swiss Transportation Safety Investigation Board would like to take this opportunity to thank everyone who has supported the investigation.

Furthermore, radar data of 218 flights of Ju 52 aeroplanes operated by Ju-Air, which took place between April and August 2018, have been secured. This corresponds to approximately half of the flights operated during this period. This radar data will be corrected using the pressure and temperature conditions prevailing at the time of each flight in order to reconstruct the flight paths and analyse them with regard to flying tactics.

Together with the quality management and safety management of the operator, the performance and oversight activities will also be documented and examined in terms of effectiveness.

Reconstruction of the accident flight

In addition to the evidence from the wreckage and at the site of the accident it is possible to use radar data, still images and video footage, and personal electronic components found at the site of the accident (e.g. passengers' digital cameras) in order to reconstruct the sequence of events and the flight path of the accident flight.

A total of over 40 mobile phones, digital cameras, memory cards and other components with possible data storage were secured at the site of the accident. Most of the found electronic components were heavily damaged and could not be read directly. In the case of some of the damaged components, elaborate procedures made it possible to obtain video and audio recordings of the accident flight and the flight of the day before. The STSB is able to rely on the experience of the French safety investigation authority, the *Bureau d'Enquêtes et d'Analyses pour la sécurité de l'aviation civile* (BEA) to reconstruct severely damaged components. The BEA has been very helpful in preparing and reading devices with data storage owned by passengers and members of the crew, which were secured at the site of the accident. Attempts to reconstruct some of the severely damaged units are still ongoing.

It is possible to reconstruct the entire history of the flight based on the various data storage devices, using the following high-precision method for the last minutes of the flight: The valley south-west of Piz Segnas was captured using a three-dimensional laser scan and combined with the three-dimensional terrain model from the Federal Office of Topography. A laser scan of a sister aircraft of HB-HOT was taken and a three-dimensional model of the aeroplane was created. This means that images of the accident aircraft taken from the ground during the flight

can now be positioned and analysed with regard to the terrain. This model can also be used to evaluate images from inside the aircraft to determine the flight path. The existing still images and video material should make it possible to determine the positions of the accident aircraft in space, its attitude relative to the terrain and its speed relative to the ground for the critical phase of the accident flight.

At the same time, the audio tracks from the existing video material will be analysed. Spectral analysis of the audio recordings may make it possible to determine the revolutions per minute of the engines and draw conclusions about the condition of the engines during the course of the accident. This work is ongoing, and the STSB is receiving support from the French safety investigation authority, the BEA.

Furthermore, the mass of the aircraft and the position of the centre of gravity are being determined in order to determine their influence on flight performance.

In order to reconstruct the flight characteristics and the aerodynamic parameters prevailing during the course of the accident (e.g. attitude and true airspeed), it is necessary to know the small-scale movements of the air masses in the valley south-west of Piz Segnas. For this purpose, the wind flows in this valley will be simulated using a sophisticated model, with the real wind and temperature data being incorporated as boundary values. In order to validate and quantify the regularity and extent of the effects calculated during this simulation, for several weeks this year, measurements will be conducted in the area of the accident. A traditional weather station will determine the wind, atmospheric pressure, temperature and humidity on the ridge next to the Segnas Pass. A lidar system¹ will be used to record the three-dimensional flow conditions in the area of the flight path shortly before the beginning of the spiral-shaped flight path. The technical and logistical challenges mean that the success of these measurements cannot be guaranteed. In particular, for the measurements being helpful for explaining the accident of HB-HOT, weather conditions comparable to those on the day of the accident must occur during the midsummer measuring period.

Outlook

In summary, the safety investigation has already revealed important safety deficits, which, although not directly related to the accident, should be mitigated with regard to the future operation of historic aircraft.

Provided that the remaining inquiries are completed as planned, the final report on this accident should be available in the first quarter of next year, following the usual quality assurance process.

Bern, 2 August 2019

Swiss Transportation Safety Investigation Board

¹ Lidar: Laser Detection and Ranging - a measuring system that emits laser pulses and evaluates the backscattered light from the atmosphere, in this case with regard to the Doppler Effect. In the present case, it is used for three-dimensional measurement of wind above the site.