SUMMARY

The accident occurred on 8 January 2016 during a commercial cargo flight from Oslo/Gardermoen Airport (ENGM) to Tromsø/Langnes Airport (ENTC) and involved an aeroplane of the model CL-600-2B19, manufactured by Bombardier Inc. The aeroplane was operated by West Atlantic Sweden AB and had the registration SE-DUX.

The flight was uneventful until the start of the event, which occurred during the approach briefing in level flight at FL 330. The event started at 00:19:20 hrs during darkness without moonlight, clouds or turbulence. The lack of external visual references meant that the pilots were totally dependent on their instruments which, inter alia consisted of three independent attitude indicators.

According to recorded data and simulations a very fast increase in pitch was displayed on the left attitude indicator. The pilot in command, who was the pilot flying and seated in the left seat exclaimed a strong expression. The displayed pitch change meant that the pilot in command was subjected to a surprise effect and a degradation of spatial orientation The autopilot was, most probably, disconnected automatically, a "cavalry charge" aural warning and a single chime was heard, the latter most likely as a result of miscompare between the left and right pilots' flying displays (PFD).

Both elevators moved towards nose down and nose down stabilizer trim was gradually activated from the left control wheel trim switch. The aeroplane started to descend, the angle of attack and G-loads became negative. Both pilots exclaimed strong expressions and the co-pilot said "come up".

About 13 seconds after the start of the event the crew were presented with two contradictory attitude indicators with red chevrons pointing in opposite directions. At the same time none of the instruments displayed any comparator caution due to the PFDs declutter function in unusual attitude.

Bank angle warnings were heard and the maximum operating speed and Mach number were exceeded 17 seconds after the start of the event, which activated the overspeed warning.

The speed continued to increase, a distress call was transmitted and acknowledged by the air traffic control and the engine thrust was reduced to flight idle.

The crew was active during the entire event. The dialogue between the pilots consisted mainly of different perceptions regarding turn directions. They also expressed the need to climb. At this stage, the pilots were probably subjected to spatial disorientation. The aircraft collided with the ground one minute and twenty seconds after the initial height loss.

The two pilots were fatally injured and the aeroplane was destroyed.

SHK has investigated the alerting and rescue services that were performed. There is a potential for improvement of procedures, training and exercises that could shorten the alerting time, improve the situational awareness of relevant rescue authorities and increase the ability to carry out a rescue operation in the mountains.

The accident site and the wreckage did not show any evidence of an inflight break-up.

The flight recorders were recovered and readout. Calculations and simulations were performed to reconstruct the event and showed that the aeroplane's flight control system operated normally.

The erroneous attitude indication on PFD 1 was caused by a malfunction of the Inertial Reference Unit (IRU 1). The pitch and roll comparator indications of the PFDs were removed when the attitude indicators displayed unusual attitudes. In the simulator, in which the crew had trained, the corresponding indications were not removed. During the event the pilots initially became communicatively isolated from each other.

The current flight operational system lacked essential elements which are necessary. In this occurrence a system for efficient communication was not in place. SHK considers that a general system of initial standard calls for the handling of abnormal and emergency procedures and also for unusual and unexpected situations should be incorporated in commercial aviation.

The accident was caused by insufficient operational prerequisites for the management of a failure in a redundant system.

Contributing factors were:

- The absence of an effective system for communication in abnormal and emergency situations.
- The flight instrument system provided insufficient guidance about malfunctions that occurred.
- The initial manoeuver that resulted in negative G-loads probably affected the pilots' ability to manage the situation in a rational manner.

Safety recommendations

ICAO is recommended to:

- Ensure that a general system of initial standard calls for the handling of abnormal and emergency procedures and also for unusual and unexpected situations is implemented throughout the commercial air transport industry. *(RL 2016:11 R1)*

EASA is recommended to:

- Ensure that a general system of initial standard calls for the handling of abnormal and emergency procedures and also for unusual and unexpected situations is implemented throughout the commercial air transport industry. *(RL 2016:11 R2)*
- Ensure that the design criteria of PFD units are improved in such a way that pertinent cautions are not removed during unusual attitude or declutter modes. *(RL 2016:11 R3)*

Transport Canada is recommended to:

- Ensure that a general system of initial standard calls for the handling of abnormal and emergency procedures and also for unusual and unexpected situations is implemented throughout the commercial air transport industry. *(RL 2016:11 R4)*

- Ensure that the design criteria of PFD units are improved in such a way that pertinent cautions are not removed during unusual attitude or declutter modes. *(RL 2016:11 R5)*

FAA is recommended to:

- Ensure that a general system of initial standard calls for the handling of abnormal and emergency procedures and also for unusual and unexpected situations is implemented throughout the commercial air transport industry. *(RL 2016:11 R6)*

- Ensure that the design criteria of PFD units are improved in such a way that pertinent cautions are not removed during unusual attitude or declutter modes. *(RL 2016:11 R7)*

The Swedish Transport Agency is recommended to:

- Ensure that providers of air traffic control units guarantee procedures to enable an alerting message about a critical situation to be submitted immediately to the air rescue centre concerned. *(RL 2016:11 R8)*

- Ensure that providers of air traffic control units train and exercise relevant personnel so that they can assist the air rescue centre in accordance with current regulations. *(RL 2016:11 R9)*

- Ensure that the Maritime Administration secures that all crews maintaining preparedness for SAR missions in mountainous areas fulfil the requirements on capability to perform appropriate search tasks. *(RL 2016:11 R10)*

The Swedish Maritime Administration is recommended to:

- Develop the coordination between the sea and air rescue coordination centre (JRCC) and concerned air traffic control units (including ATCC) so that air traffic control units' staff becomes familiar with which facts and other information they may need to assist JRCC. *(RL 2016:11 R11)*

- Ensure that rescue commanders and assistant rescue commanders are given regular training and exercising in staff work with collaborators from other authorities responsible for rescue services and organisations in JRCC. *(RL 2016:11 R12)*

- Produce a basis for, and perform, training and exercising in searching in a mountainous environment for SAR crews maintaining preparedness in a mountainous environment in both daylight and darkness. *(RL 2016:11 R13)*

- Review procedures so as to minimise the time for preparations ahead of take-offs with SAR helicopters. *(RL 2016:11 R14)*