

OCCURRENCE REPORT: 70378

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FSIS 70378 30 OCT 1991 AIR ACCIDENT

Status: amended supplemental sent

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Unclassified

Refs:
AAIR 1010-130322 30 Oct 91

1. Injury Level: Black - Fatal
2. Aircraft/Operated By: CC130322
3. Aircraft Ownership: 435 SQN / 17 WING / 3435 /
4. A. Location: - 10.5 MILES SE OF ALERT -
4. B. Date/Time: 302130Z OCT 1991
4. C. Phase of Flight: LANDING - INITIAL APPROACH (IFR PROC & VISUAL CIRCUIT)

5. Damage Level: Destroyed / missing
6. Personnel Injured: , AIRCREW, Black - Fatal
, PASSENGER, Black - Fatal
, OTHER NON-MAINTENANCE TRADES, Black - Fatal
, PASSENGER, Black - Fatal
, PASSENGER, Yellow - Serious
, OTHER, Yellow - Serious
, OTHER, Yellow - Serious
, OTHER, Yellow - Serious
, OTHER, Yellow - Serious
, OTHER, Yellow - Serious
, OTHER, Yellow - Serious
, OTHER, Green - Minor
, OTHER, Green - Minor
, OTHER, Green - Minor
, OTHER, Green - Minor
, PASSENGER, Black - Fatal

7. Mission Type: TRANSPORT AND COMMUNICATIONS, TALEX (INCLUDES HELOS)

8. Description: Hercules CC130322, radio call-sign BOXTOP 22, was a scheduled resupply flight from Thule Air Base in Greenland to Canadian Forces station (CFS) Alert, an isolated station on the northern tip of Ellesmere Island. The flight departed Thule on 30 October 1991 at 2005Z (local time 1605), carrying five crew members and 13 passengers, and approximately 18,000 litres of arctic diesel fuel in a large cylindrical aluminum tank. The passengers were seated in a small area directly ahead of this bulk fuel delivery system (BFDS). BOXTOP 22 was the second of three aircraft bound for CFS Alert on the afternoon of 30 October. CAN FORCE (CF) 6185, a CC130 not associated with the BOXTOP operation, was approximately 10 minutes ahead of BOXTOP 22 and BOXTOP 21, another CC130, was approximately 20 minutes behind. The weather was reported as scattered cloud at 9,000 feet, a thin scattered layer at 18,000 feet and ten miles visibility in light snow. The visibility was such that the crew of BOXTOP 22 could observe the rotating beacon of CF6185 on the CFS Alert runway from approximately 25 miles away. The crew was communicating with the radar operator deployed at Alert for the Boxtop operation. The Aircraft Commander's (AC) original intention was to have the First Officer (FO) fly a Non-Directional Beacon (NDB) approach to runway 29. Believing that there was a potential conflict with the following aircraft, the AC elected, instead, to fly a visual approach to expedite his arrival. The aircraft crashed 10.5 miles southeast of the airport while manoeuvring for the approach. Poor weather, total darkness and rugged terrain were all factors in delaying the arrival of rescue personnel for approximately 32 hours. Four passengers died because of injuries suffered in the crash and the AC succumbed to hypothermia before rescue personnel could arrive on scene.

14. Light/Weather Conditions: DARK NIGHT

15. Lighting Conditions: UNPREPARED, SNOW COVERED/SNOW DRIFTS

16. Aircrew Information: ; Time on Duty Last 48 Hrs: hrs, Day of Occurrence: hrs; Flying Hours Last 48 hrs: hrs; Past 30 Days:

hrs; Total on Type: hrs; Grand total: hrs.

17. Non Aircrew Pers Info: PASSENGER, Time on Duty Last 48 Hrs: hrs, Day of occur: hrs

OTHER NON-MAINTENANCE TRADES, Time on Duty Last 48 Hrs: hrs, Day of occur: hrs

PASSENGER, Time on Duty Last 48 Hrs: hrs, Day of occur: hrs

PASSENGER, Time on Duty Last 48 Hrs: hrs, Day of occur: hrs

OTHER, Time on Duty Last 48 Hrs: hrs, Day of occur: hrs

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OTHER, Time on Duty Last 48 Hrs: hrs, Day of occur: hrs

PASSENGER, Time on Duty Last 48 Hrs: hrs, Day of occur: hrs

22. A. Investigation: This was the crew's first flight of the day in the ongoing BOXTOP operation. The pilots' log books reflect that both had flown into Alert before, but that their experience in operating in the CFS Alert area was extremely limited. The flight on the day of this accident was the crew's first attempted night visual approach into CFS Alert. The CFS Alert airstrip is located on the Arctic coast. There are two published instrument approaches to runway 29 as well as a radar approach capability, available only during the BOXTOP operation when a portable radar is deployed. Due to rapidly rising terrain to the south of the airfield, all instrument approach procedures require aircrew to maintain 3,900 feet above sea level (ASL) until crossing the coastline outbound before commencing the descent over the ocean. The airfield has a TACAN facility which is oriented on Grid North and a NDB. A number of crew procedures and phenomena peculiar to operations in the Arctic could have had a bearing on this accident. These include grid navigation, radar reversal, and crew drills, all of which are explained further in the paragraphs that follow.

Grid navigation procedures were developed and are practised to avoid the problems associated with the rapidly converging lines of longitude in the high northern latitudes. The use of grid navigation is complicated, and aircrew who are not intimately aware of the theory and practical applications of its use can become confused. For example, the track direction from Thule to Alert is 011 degrees True but 076 degrees Grid. The published radial from the Alert TACAN to begin descent from 3,900 feet ASL is the 170 degree radial (Grid) which is 108 degrees True. If a pilot approaching Alert from the south quickly scanned the approach chart and mistook the 170 Grid radial reference for a True direction of 170 degrees, a premature descent from 3,900 feet could result, particularly if the coastline was not visible. Evidence presented to the Board of Inquiry showed that conditions on the day of the crash were such that a phenomenon called "radar reversal" could occur. In radar reversal the radar returns from the land appear to be water and the returns from the ocean can appear as land. This phenomenon sometimes occurs because the land contours are partially masked by hard packed, drifted snow while the water returns are enhanced by very sharp, jagged ice formations. As BOXTOP 22 crossed the 35 nautical mile arc of the Alert TACAN at 10,000 feet ASL and began a descent to 3,900 feet ASL, the crew advised the radar approach personnel that a visual approach was planned. Since airspace around CFS Alert is designated as Class E or uncontrolled airspace, the decision of the AC to "cancel IFR" informed the radar controller that the pilot would align the aircraft with the runway visually and that he would not expect radar assistance. The aircraft did level off from the descent, momentarily, at 3,900 feet ASL but then the AC began a further descent without discussion. His call for concurrence that 1,500 feet ASL was an acceptable altitude was made after the aircraft had already descended to almost 2,600 feet. The positive response from the NAV was surprisingly quick, because a cursory glance at the radar, even in conditions of radar reversal, should have cued him to the other positional references available and should have indicated a problem with the AC's plans. The FO, though uneasy with the descent to 1,500 feet ASL, did not voice his doubts and deferred to the AC and NAV. The AC levelled the aircraft at approximately 1,300 feet ASL. Although the aircraft remained at or below this altitude (approximately 250 feet above ground level) for almost one minute, no one on the flight deck questioned or observed upon the altitude. Seconds before the crash, the aircraft entered a gentle turn to the left. From testimony and the cockpit voice recorder, it was clear that the crew was completely unaware of any danger until the aircraft struck the ground. Testimony also revealed that the AC and NAV, due to position errors and a lack of situational awareness, perceived the aircraft position to be in a safe area over the arctic sea ice. The lights at the CFS Alert complex are the only permanent source of illumination within several hundred miles and are concentrated in a relatively small area. During the left turn the lights of CFS Alert would have been obscured to the crew by the attendant position of the wing and engine nacelles. Once sight of the CFS Alert complex lights was lost, the crew would have been unable to maintain spatial position by Visual Flight Rules (VFR) means. At the outset of the approach to CFS Alert, the AC intended to expedite the aircraft arrival time, but the flight path that was flown would not have saved a great deal of time when compared to a radar directed visual approach. The descent profile chosen was premature, even without considering the elevation of the Winchester Hills south of the airfield. The aircraft struck the terrain while in a gentle descent and shallow left bank at 160 knots Indicated Airspeed (IAS). Major structural damage occurred immediately on contact. The wreckage trail was approximately 1,600 feet long with the aircraft coming to rest in three separate segments. The cockpit and the entire wing structure were near each other, while the tail section was abeam and approximately 100 feet behind the main wreckage. The cockpit survived the impact relatively intact and the crew escaped with only minor injuries. A post impact fire, fed by a severed oxygen line, destroyed the cockpit shortly thereafter. Most of the passengers were relatively close to the main wreckage. Two passengers were given shelter and comfort in situ due to suspected spinal injuries while two

other passengers were found in the mangled fuselage and were pulled out by the crew. BOXTOP 22's disappearance from the radar scope was noted within minutes and the fact that a crash had occurred was confirmed shortly thereafter by BOXTOP 21. An international Search and Rescue (SAR) operation was launched but the initial ground rescue attempt was thwarted by the terrain between the station and the crash site. When the first dedicated rescue aircraft arrived overhead approximately 10 hours later, the weather had deteriorated to blizzard conditions of snow and blowing snow. The ground rescue team, in these blizzard conditions and total darkness, pursued the only accessible land route along the coast to cross the Sheridan River at its delta. The first rescue personnel arrived at the crash site just over 32 hours after the accident. In addition to their crash related injuries, all of the survivors were suffering from hypothermia. Repeated attempts by the surviving crew and passengers of BOXTOP 22 to recover all possible clothing and emergency supplies were ineffective due to the combination of crash damage, poor weather and arctic winter darkness. The standard issue kit bag and the designated survival kit bags were almost identical in appearance, particularly in the dark. The crew made several forage trips through the wreckage in search of survival gear or supplies, but the majority of the equipment found was from the sea survival equipment and several personal kit bags which proved to be of little value.

DFS Comments

BOXTOP 22 was flown by a well-rested, motivated and relatively experienced crew. The last minutes of this flight have been well documented from the Flight Data Recorder (FDR) and CVR, the wreckage trail and witness testimony. The enigma is why a crew of this calibre allowed such a situation to develop.

Two major areas of concern are highlighted by this accident. The first is the lack of crew coordination and situational awareness demonstrated during the last five minutes of this flight. The second is that this accident was the third in less than two years where a serviceable aircraft has been flown into terrain under night VFR.

Visual flight at night presents special challenges and dangers. This is acknowledged in Canadian Forces Flying Orders with the requirement for specific IFR instrumentation before night VFR is allowed. The isolation of many arctic and sub-arctic locations adds to this dangerous environment, especially if aircrew rely totally on outside visual references for safety of flight. At night, the emphasis must be placed on using aircraft instrumentation as the primary source of reference and outside visual reference only as a backup. In a multiple crew aircraft, the pilot not at the controls should be specifically designated to maintain a complete instrument scan. The pilot flying should use both visual and instrument information to manoeuvre safely.

The availability of survival gear and crew survival training has generated considerable discussion. The crew had hung their parkas on the cargo compartment side of the flight station 245 bulkhead. This bulkhead separates the flight deck and cargo compartment and was the location of a fracture in the fuselage structure. All the parkas were lost or destroyed during the crash sequence and fire. Each crew member also carried an additional bag of survival equipment commonly referred to as a "B25 kit". The aircraft survival kit bags were stored in similar bags and stored along the right side of the fuselage. Most of this equipment was destroyed during the crash. A summer visit to the site by an accident investigator and a salvage team failed to find any useful survival equipment that had been overlooked by the crew. Considering the total darkness, it would appear that the crew salvaged as much survival gear as possible.

It has been noted that none of the aircrew had completed an arctic survival course. This was not deemed a major factor since there was neither enough snow to build proper snow shelters nor the proper tools to do so. The crew performed well in the post-crash scenario and climatic conditions. This does not preclude, however, a re-assessment of our survival training course content and availability of the courses for all those engaged in winter arctic flying operations.

I support the recommendation to re-examine the applicability of all equipment currently carried in transport survival kits. We are very fortunate with the timing of this rescue. The effects of hypothermia due to the lack of suitable shelter remain a major area of concern. We must continue our efforts to improve survival equipment and SAR response times, using the lessons learned in this accident.

23. Cause Factors: PERSONNEL PILOT (32A) JUDGEMENT The pilot chose to continue a visual approach after he had lost sight of the airfield complex lighting and when insufficient visual cues existed to confirm safe terrain clearance.

PERSONNEL PILOT (32A) TECHNIQUE The pilot failed to maintain the briefed altitude.

PERSONNEL CO-PILOT/FIRST OFFICER JUDGEMENT The Co-pilot failed to inform the Pilot that he was not completely satisfied with the decision to descend to 1,500 feet. In addition, although both the Co-pilot and the Flight Engineer were aware that the Pilot had descended at least 100 feet below his briefed level off altitude, they failed to advise him of the error.

PERSONNEL NAVIGATOR TECHNIQUE Despite the multiple aids available to him, the Navigator for reasons unknown, misidentified the aircraft position and confirmed an incorrect safety altitude.

24. Preventive Measures: (SEE DETAILED DESCRIPTION) A COMPLETE REVIEW IS BEING CONDUCTED OF SURVIVAL EQUIPMENT AVAILABLE FOR TRANSPORT AIRCRAFT TO ENSURE THAT EQUIPMENT IS BOTH "USER FRIENDLY" AND STURDY ENOUGH TO WITHSTAND "SURVIVABLE" CRASH FORCES.

(SEE DETAILED DESCRIPTION - 1) A REVIEW IS BEING CONDUCTED OF THE PRESENT SURVIVAL TRAINING PROGRAM TO ANALYZE COURSE CONTENT AND AVAILABILITY WITH RECOMMENDATIONS, IF REQUIRED, FOR IMPROVEMENTS. NOTE: AIR COMMAND ORDER 9-9 ISSUED IN DEC 92 DIRECTS THAT AIRCREW WHO ROUTINELY OPERATE IN THE ARCTIC SHALL COMPLETE THE ARCTIC SURVIVAL COURSE.

(SEE DETAILED DESCRIPTION - 2) A TWO DAY AIRCREW COORDINATION TRAINING/COCKPIT RESOURCE MANAGEMENT COURSE WAS IMPLEMENTED FOR INITIAL C130 COURSE CANDIDATES IN MAR 93. 426 SQN WILL IMPLEMENT A TWO DAY CONTINUATION COURSE FOR ALL CREWS COMPLETING PROFICIENCY SIMULATOR TRAINING.

(SEE DETAILED DESCRIPTION - 3) A Ground Proximity Warning System is now being installed on CC130 tanker aircraft. Fleet fitment is planned during the avionics upgrade program scheduled for FY 1994-1995

(SEE DETAILED DESCRIPTION - 4) The amount, type, location and marking of survival gear in the C130 was questioned. All survival kits have now been modified to include fluorescent striping to make them more visible in the darkness and to distinguish

them from personal issue kit bags. The placement of additional survival equipment is under review. New equipment purchase trials are under way to replace some items with products that are more survivor friendly. A mix of mummy type and zippered blanket sleeping bags will be included in the basic aircraft kits. In addition, some items are now pre-assembled to simplify cold weather use.

25. Comments: DFS: DFS Comments added to Investative Narrative field due to their length.