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TP 185E
Issue 4/2017

AVIATION SAFETY LETTER

In this issue...

Crew Resource Management

Flight Crew Fatigue Management

Mental Health in Aviation

You Have Control... or Do You?

TSB Final Reports

Learn from the mistakes of others;

You'll not live long enough to make them all yourself...



Canada

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Sécurité aérienne — Nouvelles est la version française de cette publication.

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ISSN: 0709-8103

TP 185E

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Guest Editorial

Surveillance is a key Transport Canada function, and we are updating our surveillance approach and our risk-based surveillance planning methodology. We are also introducing a quality management system and adopting a process to evaluate specific safety priorities through what we call *targeted inspections*.

Five years ago, TC adopted a risk-based approach to planning our surveillance activities. This has allowed us to concentrate our resources on higher risk sectors. Over the last year, we have identified opportunities to make this approach even better. For example, we now look at risk by sector (e.g. aerial work operators, airline operators, maintenance organizations approved to perform work on aircraft operated by airline operators). This means we will have yearly inspection plans that cover the full spectrum of the aviation industry versus simply the higher risk sectors.



Sean P. Borg

Our new quality management system will help us view inconsistencies in program delivery, identify opportunities for inspector training, and strengthen the surveillance program overall. As part of this, we will improve our inspector education and industry outreach on things like quality assurance and corrective action plans. The overall objective is to see an increase in national program standardization over time.

We see targeted inspections as an inspection campaign on a specific topic. For example, we may plan to inspect the carry-on baggage control procedures of airlines to better understand how they are complying with that regulation across the system and to verify if the requirement is effective in reducing risk. Our inspectors will all use the same targeted inspection worksheets, so they collect compliance data consistently. This evaluative approach to inspections will allow us to better understand system-level risks that may merit regulatory action.

Between April 2018 and March 2019, TC will conduct targeted inspections of heliports, aerial work operators, private operators and the general aviation community. The purpose of these targeted inspections is as follows:

Heliports	To provide compliance baseline data to feed future risk-based surveillance planning in these sectors.
Aerial work operators	
Private Operators	To evaluate the effectiveness of the newly introduced Part 6, subpart 4 of the <i>Canadian Aviation Regulations</i> (CAR 604).
General aviation	To provide baseline compliance data to support our plans to do more safety promotion and education with the general aviation community.

As we look to the future of the surveillance program, we expect to make better use of data to focus in on risk areas and plan surveillance activities. In other words, surveillance planning will be less about frequencies and much more about zeroing in on what the risk information is telling us. [△](#)

Sean P. Borg, Acting Chief
Technical Programs, Evaluation and Coordination Division
Standards Branch

Crew Resource Management

by Roger Gravel, Civil Aviation Safety Inspector, Commercial Flight Standards

Transport Canada (TC) has introduced Contemporary Crew Resource Management (CRM) Training Standard applicable to subparts 705, 704, 703 and 702 and the transition period for compliance will end January 31, 2019. Details on implementation are outlined in [AC 700-042](#).

The Transportation Safety Board (TSB) has acknowledged that human factors are the primary cause in a large percentage of aircraft fatalities, especially under subpart 703 and 704 operators.

Risks associated with human error are often resolved by effective CRM, which involves the utilization of all resources to achieve safe and efficient operations.

In light of this knowledge, the [TSB-issued recommendation A09-02](#), which stated that TC requires commercial air operators to provide contemporary CRM for *Canadian Aviation Regulations* (CARs) Subpart 703 air taxi and Subpart 704 commuter pilots.

In response to the recommendation, TC has replaced the current CRM Standard found in subsection 725.124(39) of the *Commercial Air Service Standards* (CASS); TC recommended that the same Standard apply to subparts 702 for Aerial Work, 703 for Air Taxi and 704 for Commuter Operations and that these air operators add a CRM program to their current training curriculum.

The latest iteration of CRM now includes the concept of Threat and Error Management (TEM). TEM advocates the careful analysis of potential hazards and taking the appropriate steps to avoid, trap, or mitigate threats and manage errors before they lead to an undesired aircraft state (UAS).



Components of TEM model are:

Threats: events or errors that occur beyond the influence of the flight crew, increase operational complexity, and which must be managed to maintain the margins of safety.

Errors: actions or inactions by the flight crew that lead to deviations from organizational or flight crew intentions or expectations.

UAS: Undesired aircraft states are defined as “flight crew-induced aircraft position or speed deviations, misapplication of flight controls, or incorrect systems configuration, associated with a reduction in margins of safety”. Undesired aircraft states that result from ineffective threat and/or error management may lead to compromising situations and reduce margins of safety in flight operations.

The goal of this is to improve the CRM knowledge and skills of commercial crew members engaged in a commercial air service, therein reducing the frequency and severity of crew-based errors. The expected reduction of the frequency of accidents and incidents within the scope of commercial flight operations will provide an enhanced level of aviation safety.

The proposed changes will also integrate CRM into aviation crew training programs and enhance the training standards into commercial aviation crew training programs.

CRM training should be an integral part of your company culture and appropriate to all operational personnel. Applying the “FIT” concept (below) will assist in achieving these goals:

Flexible: training is specific to either multi-crew or single-pilot operations.

Integrated: training should form part of the training curriculum.

Tailored: training program to match the size and scope of the operations.

For detailed guidance on implementing a Contemporary CRM training Standard, for which the transition period for compliance in your organization ends on January 31, 2019, please see [AC 700-042](#) and review your TC CRM guidance material. [△](#)

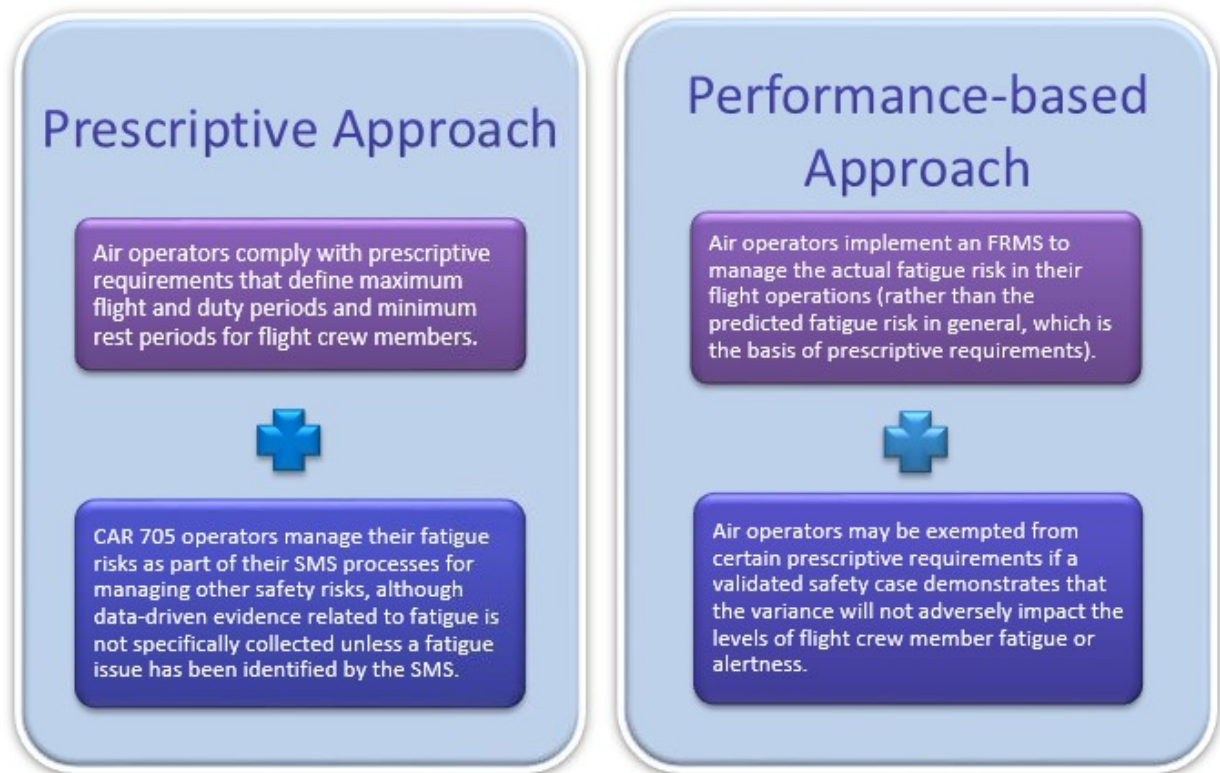
Flight Crew Fatigue Management

by Rosalie Kamp, Civil Aviation Safety Inspector, Technical Programs, Evaluation and Coordination Division, Standards

Flight crew fatigue is a hazard that can contribute to aviation accidents or incidents. Fatigue management refers to the methods by which air operators address the safety implications of flight crew fatigue.

Transport Canada (TC) recently published proposed new requirements for flight crew fatigue management. These proposed requirements include two approaches to flight crew fatigue: the prescriptive approach and the performance-based approach.

The prescriptive approach provides a one-size-fits-all approach to flight and duty time limitations and rest requirements. TC recognizes that this approach may not be the only way to effectively manage fatigue risks. Therefore, air operators have the option of implementing a fatigue risk management system (FRMS) as an alternate approach to managing fatigue risk, provided that varying from the prescriptive requirements does not adversely impact flight crew member fatigue. This performance-based approach uses fatigue modelling of work schedules as well as fatigue and alertness data collection to proactively identify and prevent fatigue risk.



An FRMS is used to:

- identify and minimize acute and chronic sources of work-related fatigue;
- mitigate and manage the potential risks associated with fatigue; and
- monitor effectiveness in preventing fatigue-related errors, incidents and accidents.

Using an FRMS to manage flight crew fatigue is voluntary. If an air operator can conduct their operations within the prescriptive requirements and fatigue-related risk is low, implementing an FRMS may not be practical.

For more information, please refer to the following advisory circulars (ACs):

- AC 700-047—Flight Crew Fatigue Management—Prescriptive Limitations
- AC 700-046—Fatigue Risk Management System Requirements
- AC 700-045—Fatigue Risk Management System Implementation Procedures

The above mentioned ACs are available on the following Web page:

<http://wwwapps.tc.gc.ca/Saf-Sec-Sur/2/npa-apm/actr.aspx?id=13&aType=1&lang=eng>. △

Invest a few minutes inspecting your first aid kit...

as per section 9, Schedule 2, Column 2 of the Aviation Occupational Health and Safety Regulations (SOR/2011-87) titled “[Contents of First Aids Kits](#)” for Privately Owned and Operated Aircraft.

Mental Health in Aviation

By Stuart McAulay, Aircraft Maintenance Engineer, RPM Mentoring, AME Association of Ontario

Our interpretation of mental health often references a vague understanding of only a few common forms of mental illness. We are familiar with the fact that people get stressed and suffer from acute forms of anxiety or are prone to depression and we have learned that about one in every five working Canadians is affected by some form of mental illness. With help from a growing number of media resources and notable advocates, we have been able to better interpret mental health as our overall state of mind and its ability to cope with the daily influences from everyday living. Awareness of our own mental condition can be identified through personal or professional assessment of that which



interferes with our cognitive abilities. Just as our mental capacity can be enhanced through positive assurances, it may also be conversely tested through daily stressors and hardened environments. Our response to these factors will tend to ebb and flow around a healthy baseline that we consider to be more or less normal. Routine stress overload, however, leads to mental distress in the form of fatigue, distraction and even burnout.

This analogy of mental health is no more specific to aviation than it is to other areas of industry since the influencing factors are unique to each person and their career situation. Aviation-related functions, however, come with great responsibility, especially in the positions of operating and maintaining aircraft. These positions require a high level of situational awareness, laser focus and the ability to make good decisions when required. Self-analysis of mental health concerns can be often elusive or even disregarded with the fear of the looming stigma and shame tainting both our personal and professional profiles. This social stigma continues to flourish as an unfortunate label that we carry as a trade-off for speaking up about how we really feel. This is a barrier to getting the help or resources needed to deal with the issues sooner than later. The ever increasing conversation surrounding mental health and stigmatized illnesses is a positive step forward and is critical to ensure more timely responses and assessments for anyone who needs them.

While mental health concerns are deeply personal in nature, their impact on the corporate stage can be far reaching. No pilot would be expected to fly an aircraft if they were in obvious physical pain just as a technician would not be expected to turn wrenches with a broken wrist. Mental illness is not a noticeable condition until it has already manifested itself as a toxic emotion or destructive addiction. Until then, it is cleverly hidden behind the mask that lets others know everything is just fine. Many professionals continue going about their business with this hidden impairment, refusing to confront their reality, because we cannot seem to accept the word “mental” in the context of an acceptable illness. The fear is real. The fear of being unfit for service, fear of your integrity being compromised, losing your status, your job, your friends. It's never an easy path but the conversation and mindset towards mental health must change at all levels even before we get to the root of the driving factors that brought us to this point. We must accept it for what it is and get the necessary supports in place.

The aviation sector has long championed the need for safety, quality, and human factor principles, which have been formally integrated and been proven to create more dynamic and confident work cultures. Mental health is surely the next realm of human involvement to be considered in this sobering context. Organizations must consider the role of peer support workers, assistance programs and intentional mentoring as the cornerstones of a healthy and profitable brand. We are all the face of mental health and our attitudes towards the well-being of ourselves and our peers speak directly to the proper nurturing of a psychologically safe workplace. [△](#)

Technical Standard Order (TSO) Workshop

by Craig Bloch-Hansen, Senior Engineer, Aircraft Design Standards, Standards

The TSO workshop is a yearly event hosted in rotation by the Federal Aviation Administration (FAA) in the United States, the European Aviation Safety Agency (EASA) in Europe, and Transport Canada (TC) in Canada. Canada hosted the 2017 conference in Ottawa at the Marriott hotel from September 13-14. The event was attended by 66 participants from across the Canadian, American, and European TSO industry including aircraft manufacturers, maintenance organizations, and TSO article manufacturers.

The workshop was opened by Denis Guindon, Director General, Transport Canada Civil Aviation, on Wednesday morning. Day one was focused on policy updates relating to the TSO programs from each authority and covered proposed TSOs in work for EASA and the FAA. The day culminated with a candid discussion between TSO stakeholders and the regulatory authorities regarding the on-going suitability of the TSO program as it relates to complex articles. The results of that discussion were sent to the quadrilateral (FAA, EASA, TCCA, ANAC) certification management team to help devise a joint plan to address any concerns.



The second day focused on updates from the technical side of TSOs. It began with an update from the TSO industry in form of a joint presentation from the General Aviation Manufacturers Association (GAMA) and the Aerospace and Defence Industries Association of Europe (ASD). After a lively discussion technical presentations on emergency locator transmitters, icing, small airplane seats, and TSO approval guidance provided a perspective on some of the current and upcoming technical challenges facing industry and regulators. The workshop closed with remarks from Robert Sincennes, Director, Standards.

Initial workshop feedback from both industry and authority participants has been positive. TC would like to thank all attendees of the workshop for their continuing support, and we look forward to seeing you again at the next TSO workshop hosted by EASA in Cologne, Germany September 19-20, 2018. [△](#)

TSB Final Report A15Q0126—Loss of Directional Control and Collision with Terrain

Summary

On September 2, 2015, the Bell 206B helicopter was flying from the airport at Sept-Îles, Que., with one pilot and four passengers on board. The purpose of the flight was to inspect a salmon pass approximately 20 NM north of Sept-Îles. During the final approach, a few feet from the ground, the helicopter began an uncommanded rotation to the right and, after turning a few times, crashed heavily into a rock on its front right side. The accident occurred at about 9:40 EDT. The male passenger occupying the front left seat and the female passenger occupying the rear central seat sustained fatal injuries. The pilot and the other two passengers, who occupied the left and right rear seats, sustained serious injuries. The 406-MHz emergency locator transmitter activated on impact. A fire started in the engine tailpipe but was immediately extinguished by persons on site.

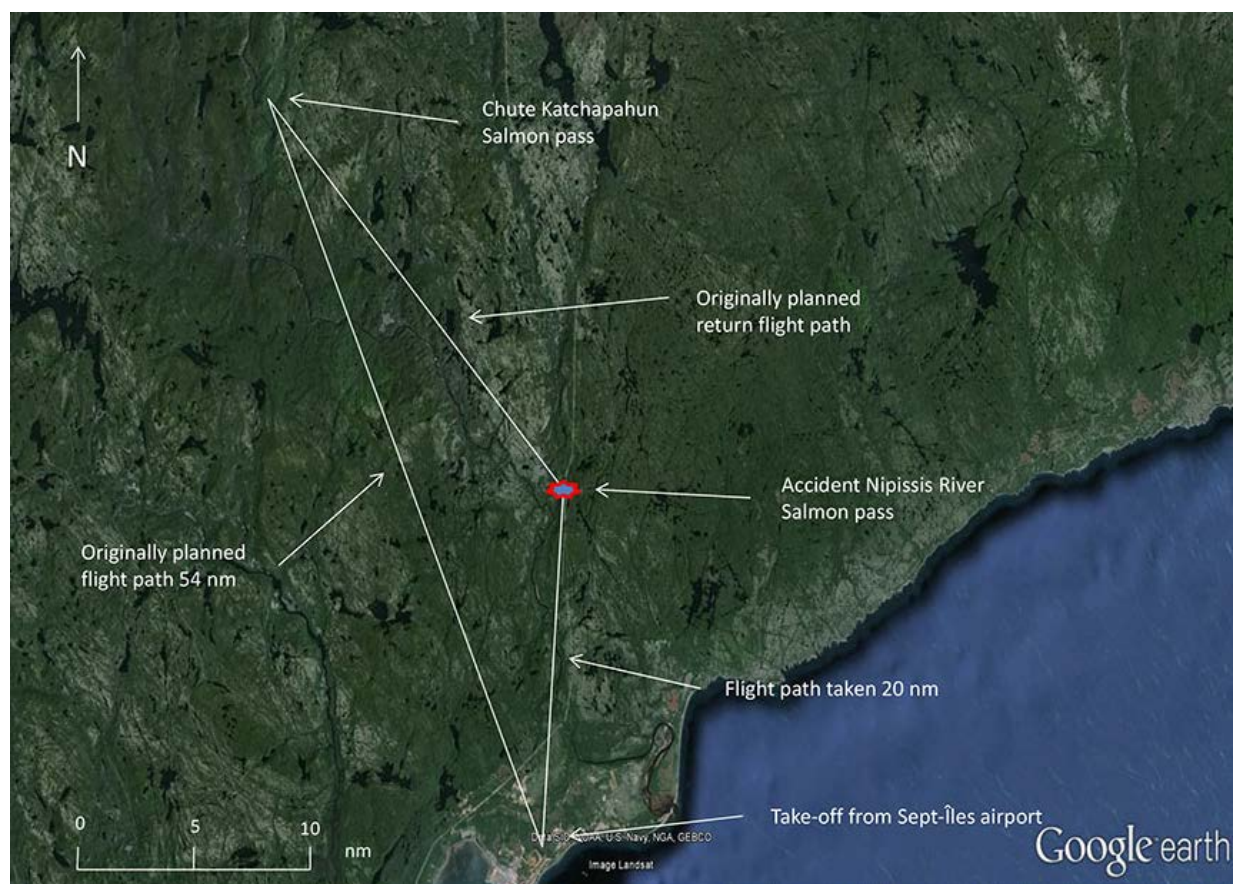


Figure 1. Flight path of helicopter (Source: Google Earth, with TSB annotations)

Factual information

History of the flight

On the morning of the flight, the pilot had agreed to meet the chief pilot at company facilities at the Sept-Îles airport (CYZV), Que. The flight was scheduled for around 8:30¹, and the pilot arrived at around 7:45. The contract

¹ All times are Eastern Daylight Time (UTC - 4)

specified that six passengers were to travel to two salmon passes on the Moisie and Nipissis rivers, which required the use of two helicopters. Each helicopter was to carry three passengers. The two aircraft were to go first to a salmon pass at Chute Katchapahun, Que., 54 NM north of Sept-Îles, and on the return journey land at a second salmon pass on the Nipissis River, 20 NM north of Sept-Îles.

With the agreement of the group, a passenger, who had to return to her work at the Nipissis River camp, was added, and she boarded the second helicopter. The flight itinerary was altered, and it was agreed to go first to the Nipissis River camp to drop her off.

It was agreed that the chief pilot would take off first and that the second helicopter would take off 10 min later. The chief pilot was to position himself at the landing site in order to guide the second helicopter in its approach and landing. The weather conditions were favourable for a visual flight rules flight.

The approach and touchdown of the first aircraft were normal. The wind was low and created no difficulty for control during touchdown.

The takeoff and the flight of the second helicopter to the site were without incident, and all aircraft parameters were normal. During the final turn leading to the landing site, the pilot saw the chief pilot, who was standing on a rock. The pilot could see the other aircraft parked. The pilot positioned the aircraft to face the place indicated, and during the final approach, noted that engine torque was at 110% and that the nose of the aircraft was turning to the right. The pilot then lowered the collective to reduce the torque while applying full left anti-torque pedal to counteract the yaw. However, the nose of the aircraft continued turning to the right and the helicopter kept losing altitude. The pilot again increased the torque by raising the collective to reduce the rate of descent. He pushed the cyclic to initiate a recovery and gain speed, but the yaw increased very quickly. Realizing that he had lost control of the aircraft, the pilot cut engine power to reduce the rate of yaw and prepare for the impact. The aircraft was in a nose-down attitude to the right before it crashed violently into the rock. According to available information, an alarm sounded in the aircraft shortly before the accident. However, it was not possible to determine which alarm sounded.

Damage to aircraft

The helicopter collided with the rock nose down and rotating to the right. The engine did not stop immediately, and a minor fire broke out in the tailpipe but it was immediately extinguished by persons on site. On impact, the tail boom detached and came to rest behind the aircraft. Severe damage to the skin on the rear of the right-hand side and the rear stabilizer was noted. Damage to the skids confirmed impact on the right side, with the nose of the aircraft pointing toward the ground. All damage resulted from the impact with the rock. The floor of the aircraft was severed at the rear of the cabin, causing the fuel tank to split.

Pilot experience and training

In June 2011, the pilot completed theoretical and practical aeronautical training. The pilot started work with the company in May 2015. He received ground training, which included a component on awareness of vortex ring state and loss of tail rotor effectiveness (LTE). LTE is discussed later in this report. The pilot received 4.1 hr of flight training. He also successfully completed a company-administered pilot proficiency check for the Bell 206B on July 5, 2015. At the time of the accident, the pilot had accumulated 263 hr of flight time, broken down as follows:

- 78 hr on a Sundowner, a single-engine aeroplane
- 135 hr on a Bell 206B, his training aircraft
- 35 hr on an Astar 350
- 15 hr on a Bell 206B with the company

Bell 206B characteristics

The first version of the Bell 206B entered the industry as the Bell 206B Jet Ranger II. The aircraft was equipped with an Allison 250-C20 engine, which produced 400 shaft horsepower (SHP), and a 62-in. tail rotor just like the aircraft involved in the accident.

In 1977, the Bell 206B Jet Ranger III model came onto the market. It had a more powerful Allison 250-C20B engine that produced 420 SHP, but the size of the tail rotor was still 62 in. Later, the manufacturer produced the Bell 206B3 Jet Ranger III, fitted with an Allison 250-C20J engine, which had a 65-in. tail rotor for greater effectiveness.

A modification can be made to install a longer, and thus more effective, tail rotor. This requires the installation of a more powerful engine. However, the aircraft involved in the accident was fitted with a 62-in. tail rotor, whereas several helicopters of the same model have a 65-in. tail rotor. It should be noted that the pilot was trained on aircraft that had 65-in. tail rotors, which are less sensitive to loss of rotor effectiveness.

Findings as to causes and contributing factors

1. The helicopter was operating in a flight regime that was conducive to either LTE or to the exceedance of the tail rotor's ability to supply the required power, which led to a loss of directional control at an altitude that precluded any recovery. Therefore, the aircraft collided with the terrain.
2. No in-flight training on LTE is provided on account of the risks this would entail. Consequently, the pilot was not familiar with the very precise skills required to control the aircraft when such a loss of effectiveness occurred close to the ground.
3. The pilot's lack of experience on a Bell 206B helicopter with a 62-in. tail rotor prevented him from recognizing LTE and counteracting it in a timely manner.
4. The female passenger sustained fatal abdominal injuries, possibly due to the fact that her lap belt was not fitted correctly.

Loss of directional control

During this occurrence, the aircraft experienced a loss of directional control near the ground, without any mechanical failure. Two conditions can cause a loss of directional control:

- an increase of engine torque beyond limits
- LTE



Figure 2. Aircraft wreckage



Figure 3. Torque effect

Increase of engine torque beyond limits

Available information indicates that the pilot noted that engine torque was at 110%; however, the exact moment at which this was done or for how long is not known. It is also not known whether the torque could have exceeded 110% without the pilot noticing it. When the collective is raised beyond the limit of 110%, the pitch of the main rotor blades increases and the engine must produce sufficient power to compensate for the very large and rapid increase of main rotor drag. As a result, there is a decrease of main rotor revolutions per minute, which affects the tail rotor proportionally. According to the aircraft manufacturer, the tail rotor can compensate for the loss of directional control up to the limit of 110% of engine torque for a maximum of five seconds. Beyond this limit, the tail rotor's ability to supply the required thrust is exceeded with a resulting loss of directional control similar to an LTE.

Insufficient tail rotor thrust, which can be identified by a yaw to the right, can be countered in two ways:

1. apply full left anti-torque pedal and move the cyclic control stick forward; and
2. if altitude is sufficient, reduce power.

For more information about LTE, read “You Have Control . . . or Do You?,” which is reprinted on page 13 in this edition of the ASL. [△](#)

You Have Control... or Do You?

This article was originally published in the Aviation Safety Vortex, Issue 1/2002 and written by Fred Johnson, Regional System Safety Officer, Transport Canada

Imagine that you have logged a couple of thousand hours, about half of them flying Jet Rangers. You are an experienced line pilot and instructor. You have been dispatched, along with a paramedic, to perform a routine MEDEVAC flight on a clear summer day. Winds are light and variable at your destination.

You have been given a description of the vehicle that you are to rendezvous with, and just ahead you see what appears to be your objective. Many vehicles match the description you have been given, so you do a slow, low pass to see if this is indeed the object of your search. On the first couple of runs, you still cannot be certain, so you slow to a hover for a third circuit.

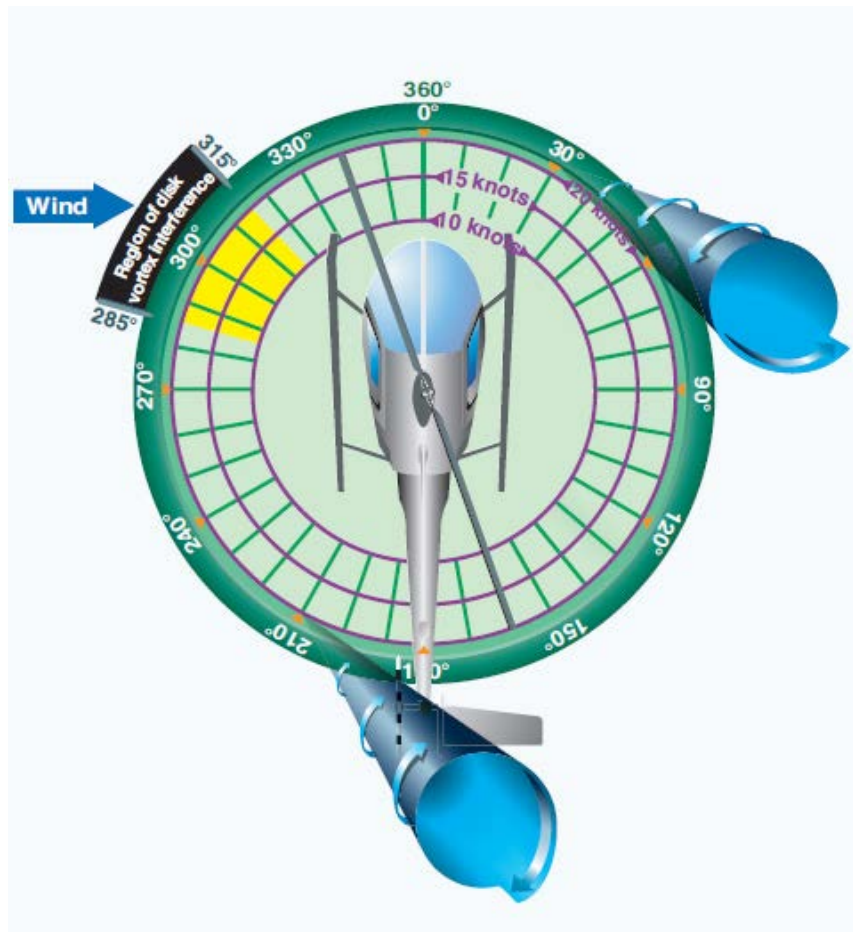
You determine that this is not the vehicle you are seeking and apply power and collective inputs to climb out and away. Suddenly the aircraft yaws to the right, and no matter how much left pedal you apply, it continues to yaw, culminating in a spin.

No, this is not an imaginary exercise. This is a summary of the start of an actual accident sequence that took place in Alberta in July 1998. The questions you should have in mind at this point are:

- What happened to cause this?
- How do I avoid situations like this?
- What would I do now?

Let us start with what happened to cause the problem. Since 1983, Bell Helicopters, the U.S. Army, the U.S. Navy, and the Federal Aviation Administration (FAA) have been warning of the dangers of loss of tail rotor effectiveness (LTE). Bell published an information letter in 1984 stating that "... low speed flight characteristics ... can result in an unanticipated right yaw if appropriate attention is not paid to controlling the aircraft. These characteristics are present only at airspeeds less than 30 knots and apply to all single rotor helicopters."

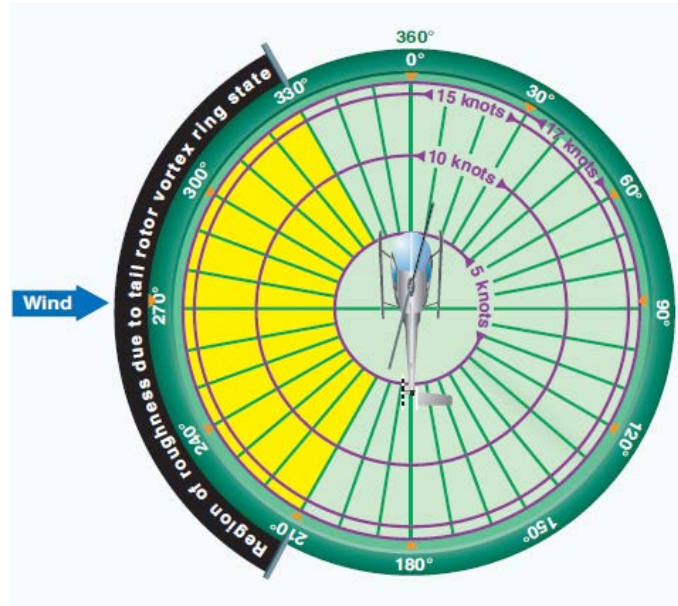
Unanticipated right yaw is the occurrence of an uncommanded right yaw rate that does not subside of its own accord and that, if not corrected, can result in the loss of aircraft control.



Main rotor disk vortex interference

How do you avoid situations that could induce this problem? Well, being able to recognize the conditions elemental to occurrence could help to reduce the danger. The conditions under which LTE may occur are as follows:

- Any manoeuvre that requires the pilot to operate in a high-power, low airspeed environment with a left crosswind or tailwind;
- There is a greater susceptibility for LTE in right turns, especially at low airspeeds;
- If there are delays in reversing the pedal control position when proceeding from a left crosswind situation (needing a lot of right pedal) to downwind, the aircraft could rotate through more than 360° before stopping.



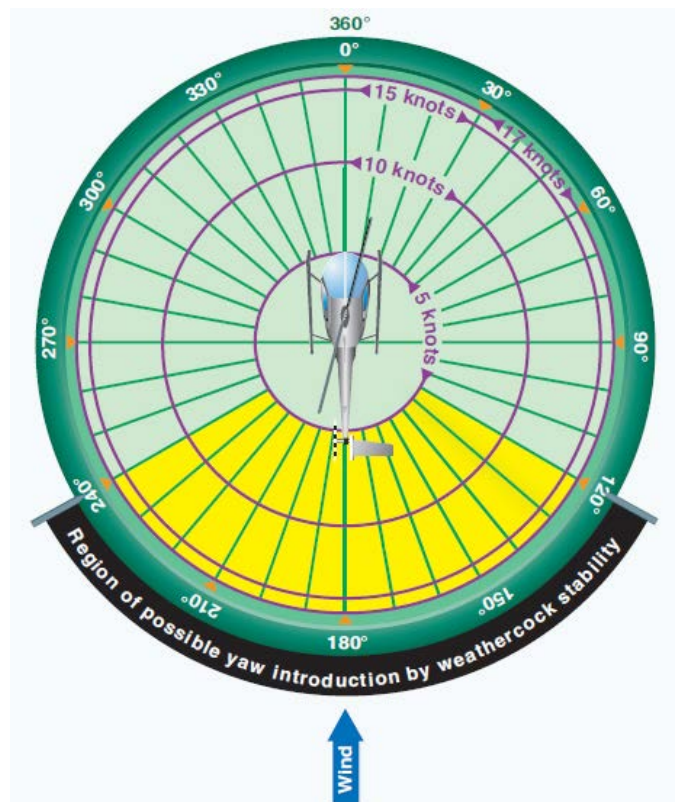
Tail rotor vortex ring state

Other factors can affect the severity of LTE include the following:

- The higher the gross weight and/or density altitude, the lower the margin between the maximum power available and the power required to hover;
- At airspeeds below translation, the tail rotor provides almost all of the directional control;
- Rapid power inputs can cause rotor droop, which, in turn, decreases the tail rotor thrust, diminishing tail rotor effectiveness.

In order to reduce the onset of LTE, ensure the tail rotor is properly rigged and maintain maximum power-on rotor revolutions per minute (RPM) at low airspeeds. When manoeuvring between a hover and 30 kt:

- avoid tailwinds;
- avoid out of ground effect hover/high power demand situations;
- be aware of wind direction and velocity when hovering in winds of about 8–12 kt;
- be aware that if you already have considerable left pedal input, little may be left to control a right yaw; and
- be alert to changes in the aircraft flight and wind conditions.



Weathercock stability

This discussion does not replace the critical relative wind azimuth chart, or data contained in the performance section of the flight manual. The information letter referred to by the author contains three figures, which illustrate relative wind azimuths and velocities which may contribute to unanticipated right yaw. I have reprinted them here with the kind permission of Federal Aviation Administration. —Ed.

We have looked at what happened and how to avoid it, but what do you do if you still run into the problem? FAA Advisory Circular 90-95 addresses that by providing recommended recovery techniques (see below).

1. If a sudden unanticipated right yaw occurs, the pilot should perform the following:
 - Apply full left pedal. Simultaneously move cyclic forward to increase speed. If altitude permits, reduce power.
 - As recovery is effected, adjust controls for normal forward flight.
2. Collective pitch reduction will aid in arresting the yaw rate but may cause an increase in the rate of descent. Any large, rapid increase in collective to prevent ground or obstacle contact may further increase the yaw rate and decrease rotor RPM.
3. The amount of collective reduction should be based on the height above obstructions or surface, gross weight of the aircraft, and the existing atmospheric conditions.
4. If the rotation cannot be stopped and ground contact is imminent, an autorotation may be the best course of action. The pilot should maintain full left pedal until rotation stops and then adjust to maintain heading.

In the example used to start this story, the pilot correctly assessed the situation and concluded with an autorotation. Although the aircraft was damaged, no one was hurt. It would be nice if this situation never again occurred, but if it does—and you are flying—what will you do?△

TSB Final Report A15O0188—Collision with Terrain Cessna 182H

Summary

On November 9, 2015, a privately-registered Cessna 182H, with one pilot and one passenger on board, departed from the Parry Sound Area Municipal Airport (CNK4), Ont., at 19:17 EST under night visual flight rules (VFR) for a flight to Tillsonburg Airport (CYTB), Ont. Once airborne, the aircraft immediately started a right climbing turn for approximately 90° of heading, and then continued its turn for an additional 180° while descending before colliding with the terrain. The aircraft clipped trees in a nose-down attitude with a significant angle of bank to the right before striking the ground on a rocky downward slope. The two occupants were fatally injured and a post-impact fire destroyed most of the aircraft. The aircraft was equipped with an emergency locator transmitter (ELT), but it was not activated by impact forces. The accident occurred during the hours of darkness.

Factual information

History of the flight

On November 9, 2015, the pilot and his wife were returning home in a Cessna 182H after a weekend at their cottage near Parry Sound, Ont.

During the previous summer, the couple had often commuted to their cottage using this aircraft, which was equipped with floats at the time. Two weeks before the accident, the floats had been removed and the aircraft reconfigured as a landplane.



Figure 1. Flight path using recovered GPS data (Source: Google Earth, with TSB annotations)

On this day, the aircraft departed from Parry Sound (CNK4) at 19:17 EST under night VFR for a flight to Tillsonburg (CYTB), Ont. The pilot did not file a flight plan prior to the flight, and there is no record of him requesting a weather briefing from NAV CANADA. Data recovered from an onboard portable global positioning system (GPS) showed the aircraft taxied on Runway 35 before it took off from Runway 17. The aircraft became airborne just prior to the mid-point of the runway at 19:25:15.²

As soon as the aircraft became airborne, it started a climbing right turn for approximately 90° of the heading. At 19:26:02, the aircraft began to descend while continuing the right turn for an additional 180°. At 19:26:05, the GPS stopped recording and, shortly afterward, the aircraft collided with the terrain. The aircraft clipped trees in a nose-down attitude with a significant angle of bank to the right before striking the ground on a rocky downward slope.

Severe impact forces and a post-impact fire destroyed the aircraft. The remaining wreckage, which was not consumed by the fire, was examined; however, this examination did not identify any pre-impact failure or system malfunctions, which would have contributed to this accident.

Weather

The closest available weather reporting service to CNK4 is the automated weather observing system at Muskoka Airport, Ont., located approximately 39 SM to the southeast. The 19:00 aerodrome routine meteorological report (METAR) reported winds at 120° true (T) at a speed of 2 kt, temperature and dew point of -5°C, and a visibility of 9 SM. This METAR was consistent with weather conditions observed at CNK4 at that time.

² All times are Eastern Standard Time (UTC - 5).



Figure 2. Departure airport and surrounding area (Source: Google Earth, with TSB annotations)

Visual cues in the vicinity of the departure airport

The accident took place in visual meteorological conditions (VMC) with clear skies. Since evening civil twilight had ended at 17:27, the flight was initiated during the hours of darkness.

In the vicinity of CNK4, pilots can use airport lighting, cultural lighting, and ambient illumination as visual cues during night operations.

The airport lighting at CNK4 consists of runway threshold lights, runway end lights, and medium-intensity runway edge lights. The airport beacon and all runway lights are controlled by a Type J aircraft radio control of aerodrome lighting (ARCAL) system.³

The pilot could expect some cultural lighting (e.g. cottages, traffic on Highway 400) to the south of the airport, but the availability of cultural lighting was limited to the west of Highway 400, which is the direction the aircraft turned after takeoff.

There would have been limited ambient illumination available from the waning crescent moon, with less than four percent of the moon's visible disc illuminated. The new moon took place on November 11, 2015, two days after the occurrence. Other pilots operating in the vicinity of CNK4 that evening reported that there was no discernable horizon when looking to the west.

Pilot training and experience

The pilot completed his private pilot licence in late 2013, and he completed a night rating approximately 18 months before the accident. His category 3 aviation medical certificate was valid at the time of the occurrence.

³ Type J ARCAL systems require pilots to key the microphone five times within five seconds to operate all aerodrome lighting for a duration of approximately 15 min.

The investigation determined that there was nothing to indicate that the pilot's performance was degraded by physiological factors.

The pilot purchased the occurrence aircraft in the summer of 2015 and had operated it on floats until converting it to wheels two weeks before the accident.

The pilot's logbook was destroyed in the occurrence; however, the recent completion of his private pilot licence training, combined with the flight hours logged in the aircraft airframe logbook suggest that his total flying experience would have been less than 220 hr. The investigation could not determine the pilot's total night flying or instrument flying experience but because regulations prohibit takeoff and landing on water at night, the pilot would not have used the occurrence aeroplane for night flying while it was on floats. In addition, the pilot was not instrument rated, and it is not known if he had undergone any recent instrument flying training.

Spatial disorientation

The *Transport Canada Aeronautical Information Manual* (TC AIM) describes the potential for disorientation. It refers to vision as the strongest orienting sense and stresses that when in whiteout or cloud this sense is not available, which increases the likelihood of disorientation. It says:

“For example, once a turn has been entered and is being maintained at a steady rate, the sensation of turning will disappear. Upon recovering from the turn, pilots may feel as though they are turning in the opposite direction and erroneously re-enter the turn, even causing the aircraft to enter into a spin.”⁴

While the conditions mentioned are whiteout and cloud, a similar lack of external visual cues and resulting disorientation can occur in areas of darkness.

Night flying involves numerous risks owing to poor visual cues, especially on takeoff and landing. Few or no visual references at night can lead to various illusions that cause spatial disorientation because of the lack of discernible horizon. Night flying in, out of, or over featureless terrain such as bodies of water or wooded areas—called black hole conditions—is particularly difficult.

Night flying—Visual reference to the surface

The principle behind VFR flight is that the pilot uses visual cues (e.g. visual horizon, ground references) outside the aircraft to determine the aircraft's attitude. Therefore, some basic requirements must be met when conducting VFR flight—day or night.

According to *Canadian Aviation Regulation* (CAR) 602.114 and CAR 602.115, the aircraft must be "operated with visual reference to the surface" regardless of whether it is operated in controlled or uncontrolled airspace. The CARs define surface as "any ground or water, including the frozen surface thereof." However, the CARs do not define "visual reference to the surface," which has been widely interpreted by the industry as meaning VMC.

Therefore, a flight conducted over an area away from cultural lighting and where there is inadequate ambient illumination to clearly discern a horizon would not meet the requirements for operation under VFR (i.e. to continue flight solely by reference to the surface). Instead, such a flight would require the pilot to rely on their flight instruments to ensure safe operation of the aircraft.

Analysis

There were no indications that an aircraft system malfunction contributed to this accident. This analysis focuses on the operational factors that contributed to the accident and on the current regulatory environment.

⁴ Transport Canada Aeronautical Information Manual (TC AIM), AIR 3.7 (March 31, 2016).

Departure assessment

Night departures from aerodromes with limited cultural and ambient lighting sources present several hazards to pilots, especially to those without an instrument rating or current night flight experience.

In light of his limited night flying experience, and because the weather in the area at the time of departure was VMC, it is highly likely that the occurrence pilot felt that the conditions satisfied the requirements for a night VFR flight, even though it is unlikely that visual reference to the surface could have been maintained. Given the pilot's total flight time, training, and limited night flying experience, it is likely that he did not adequately assess the hazards associated with a night VFR departure from an aerodrome with limited ambient and cultural lighting.

Loss of control

After takeoff, the airport lighting would have dropped from the pilot's field of view, first below the aircraft and then behind it. At that time, the pilot would have needed to rely on ambient illumination or cultural lighting to provide sufficient outside visual references to control the aircraft, or he would have had to transition to cockpit flight instruments.

Once the airport lighting was lost from view, there would have been few visual cues available outside the aircraft. There were not many lit ground features on the flight path, particularly to the west of the airport in the direction of the turn, and limited ambient illumination would have been available from the waning crescent moon. After takeoff, visual references would have been greatly reduced, and the pilot would have found himself in a black hole situation.

It is not known whether the turn after takeoff was intentional or inadvertent, but it is clear that the increasing angle of bank and subsequent descent were either not detected or not corrected in time to prevent the collision with the ground. The pilot, who was probably not proficient at flying with reference to the instruments, may have become spatially disoriented after losing visual reference to the surface off the departure end of the runway and lost control of the aircraft.

Findings as to causes and contributing factors

1. Given the pilot's total flight time, training, and limited night flying experience, it is likely that he did not adequately assess the hazards associated with a night VFR departure from an aerodrome with limited ambient and cultural lighting.
2. The pilot, who was probably not proficient at flying with reference to the instruments, may have become spatially disoriented after losing visual reference to the surface off the departure end of the runway and lost control of the aircraft.

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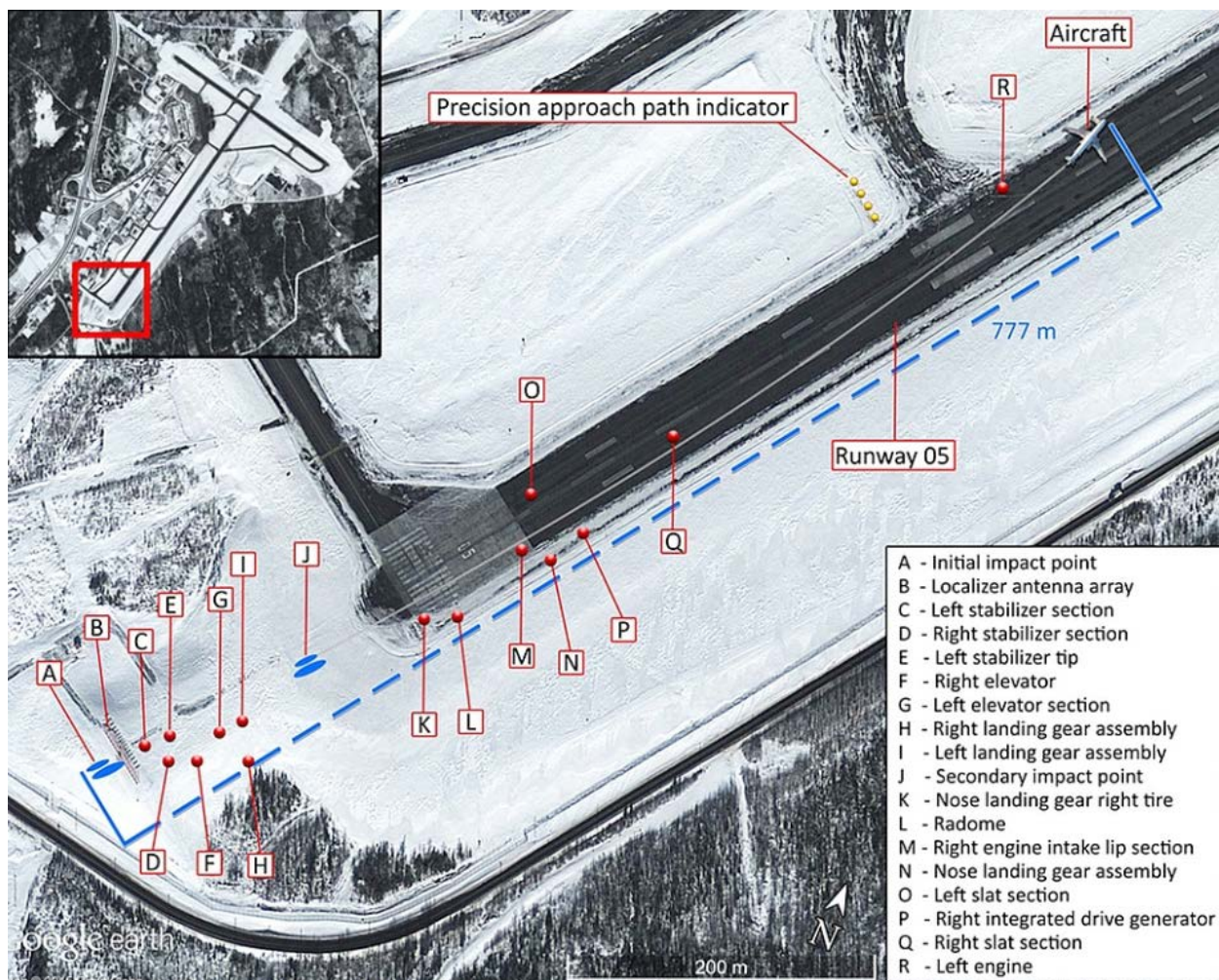


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TSB Final Report A15H0002—Collision with Terrain Airbus Industrie A320-211

On March 29, 2015, an Airbus Industrie A320-211 was on a scheduled flight from Toronto/Lester B. Pearson International Airport, Ont., to Halifax/Stanfield International Airport, N.S., with 133 passengers and five crew members on board. At approximately 00:30 ADT, while conducting a non-precision approach to Runway 05, the aircraft severed power lines, and then struck the snow-covered ground about 740 ft before the runway threshold. The aircraft continued airborne through the localizer antenna array, and then struck the ground twice more before sliding along the runway. It came to rest on the left side of the runway, about 1 900 ft beyond the threshold. The aircraft was evacuated; 25 people sustained injuries and were taken to local hospitals. The aircraft was destroyed. There was no post-impact fire. The emergency locator transmitter was not activated. The accident occurred during the hours of darkness.



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