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Aviation Safety

Vortex

Learn from the mistakes of others; you'll not live long enough to make them all yourself . . . **Issue 1/2002**

Playing the Odds—The Art of the Pre-flight Inspection

With the morning coffee and pre-flight briefing out of the way, the instructor asked the 50-hr student to prepare his Bell 47 for the day's first flight. After completing the daily inspection and refuelling, the student summoned the instructor, who told him to go ahead and get the aircraft started and warmed up—he'd be along in a moment.

Shortly after the student had the ship running, the instructor headed across the tarmac and climbed in. They passed the next 15 min reviewing the details of the lesson and doing pre-flight checks, then departed the ramp into the clear sky. Two minutes into the flight, at approximately 700 ft AGL, the aircraft suddenly started a spin to the right, then pitched down and began a spiralling descent. Witnesses said that it appeared the pilot was unable to recover and control was lost. The 47 hit the ground in a steep nose-down attitude, and both occupants were fatally injured.

The afternoon before, a 100-hr inspection had been carried out on the ship by two of the company's maintenance personnel, a veteran aircraft maintenance engineer (AME) and a relatively experienced apprentice. The 100-hr inspection includes, among other things, the flushing and replenishing of the tail rotor gearbox oil. While the AME conducted other portions of the inspection, he assigned the oil change to the apprentice, who set out draining the gearbox and examining the oil for metal contamination. When all tasks on the 100-hr inspection check sheet had been initialled, the lead AME signed the inspection in the aircraft journey logbook. The check sheet item that called for draining and filling the tail rotor gearbox oil had been initialled by the apprentice as being complete.

The accident investigation revealed no evidence of oil in the tail rotor gearbox, and it was determined that it had overheated from lack of lubrication. The subsequent failure of the gears had caused the loss of tail rotor thrust and yaw control. The drain plug was still lock wired in place.

As with many accidents, this one wasn't caused by any one particular person or action, but a chain of unlikely events culminating in tragedy.

- The failure to refill the gearbox.
- The apprentice initialled the check sheet before the entire task was completed.
- The AME did not verify the work of the apprentice.
- A student pilot didn't check, or incorrectly read, the sight glass.
- The instructor, who had been notified of the previous day's maintenance action, elected to allow the student to perform the pre-flight, then joined him in the aircraft after it was running. Was it the school's policy to allow students to do the daily inspections by themselves following maintenance? What is your school's policy?

From a pilot's perspective, what can be learned from this accident? The most obvious lesson would be the value of a thorough pre-flight inspection.

Here are some other examples sharing this theme:

- A Bell 206B was coming out of maintenance, and a pilot was called in for a test flight. A few minutes into the flight, the main rotor departed the aircraft, and the crash killed them both. The mast nut had been removed for the maintenance action, but not re-installed.
- The Hughes 500 pilot was moving a diamond drill with a 100-ft longline and had landed at the camp for fuel. While refuelling, he was approached by two geologists with their packs who asked if he could drop them at the top of a nearby hill. The

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pilot was under pressure to get the move done, as several days of bad weather had put drilling behind schedule, but he told them to get aboard anyway. In his haste, he took off to drop the geologists and felt a tug at the helicopter. To his horror he immediately realized that the longline was still attached and was being dragged through the trees. Luckily, it didn't snag and he was able to learn a valuable lesson.

- The pilot of a Britten-Norman Islander airplane was getting ready to head home with his passengers after an overnight stay in a coastal community. The passengers were very experienced flyers and always helped the pilot install and remove the winter covers and control locks, just like they did on this morning. When they finished, they got in the airplane and prepared to leave for home. As they left the runway, the airplane continued to pitch up and eventually stalled and crashed, resulting in one fatal and two serious injuries to the occupants. Investigation revealed one of the elevator control locks had been left installed.
- In the morning during his daily inspection (DI), the pilot of the Long Ranger noticed the engine bay drain was slow to empty when he bled his airframe fuel filter, indicating the drainpipe was clogged. Upon arriving back at base that evening, he reported the problem to maintenance personnel. The next day, it was raining hard while he did his pre-flight inspection, so he decided to forego draining the tank sumps into a clear pan as he usually did to inspect for water. After all, with all the rain the pan would already have water in it, so the test would be useless. Instead, he drained fuel on the ground for a while. He noticed the engine drain worked well, though—maintenance had obviously been good to their word. Soaking wet, he got in and started the ship normally. After a minute or so, the engine began to surge and flamed out. The aircraft was brought into the hangar, and four gallons of soapy water was drained from the fuel tanks. In the attempt to clear the drainpipe blockage, the AME had placed a high-pressure hose over what he thought was the engine drain, one of several drain and vent pipes located in that area. When the desired result wasn't achieved from that pipe, he eventually found the correct one and cleared the blockage. The first one was the fuel tank air vent.
- And how about this one: The 212 pilot noticed during his DI that the ship's large aluminum Mag-Light was missing from its usual hiding place. Assuming someone had used it and neglected to put it back, he carried on with the day's operations. During the pre-flight the following day, something about the main drive shaft troubled him; it looked "different" somehow, so he summoned the engineer for a closer look. The mechanic reached down, felt around for a while, and retrieved the flashlight that had disappeared the previous day, only now it had the paint worn off it from rubbing against the shaft.

All of these incidents were the result of human error, which will never be eliminated. All had, or carried the potential for, serious outcomes. Likewise, all could have been prevented by a good final look at the ship before flight. Most of the time everything is in order, but playing the odds in this game can have grave consequences, and eventually your luck will run out. It should be in-grained in all student pilots from the very beginning that a complete pre-flight is a must for the duration of their careers, and that a good walk-around is required before each and every flight. Maintenance action on the aircraft makes it even more imperative, and checking someone else's work is not only prudent but also necessary in the aviation business. While it is common, indeed at times *necessary*, to place our trust in others, mistakes are made everyday. At best they cause embarrassment, but all too often the results are tragic.

Looking for Your Input

The *Helicopter Flight Test Guide*, TP 3077E, is in the process of being rewritten to more accurately reflect the way flight tests are conducted. At the last Helicopter Instructor Refresher Course, held in Abbotsford in November, the subject of exercise 17, "Steep Turns," was discussed. The majority of Transport Canada (TC) inspectors present tested this exercise in conjunction with exercise 25, "Confined Areas." They preferred a practical test to asking for a canned demonstration of the exercise.

The course members and TC inspectors suggested that the exercise should continue to be taught as part of the course. However, they felt it should not be tested individually but as part of another exercise, such as the exercise on confined areas. I would like to know what the industry thinks about this, particularly the flight instructors. If there were general agreement, I would remove it from the flight test as a separate exercise and adjust the Flight Test Report accordingly.

Any responses to this proposal should be sent to:
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Back at Last!

It's been more than a year since the last issue of *Aviation Safety Vortex*, and we take great pleasure in finally introducing our new Editor, Mr. Brad Vardy.

Brad began flying in 1981 at Ocean Air Services in St. John's, Nfld., where he trained as a commercial helicopter pilot. His commercial career started with Viking Helicopters in Pasadena, Nfld., flying mainly in support of mining and mineral exploration. The purchase of Viking by Canadian Helicopter Corp. (CHC) in 1989 sent him to Goose Bay, where he stayed until 1996. During that time, he flew extensively in Labrador and the Arctic, toured internationally in support of CHC's United Nations contracts in Cambodia and Somalia, and was Project Manager of the giant Voisey Bay nickel discovery in northern Labrador.

Immediately before joining Transport Canada, Brad flew as a test pilot in the Engineering Division of Bell Helicopter Textron in Mirabel, Quebec, for five years.

He holds an instrument flight rules (IFR) rating and an airline transport pilot licence (ATPL) in Canada, a U.S. Commercial licence, and has experience in light, medium and heavy helicopters.

A Look Back

50 Years Ago:

Jan. 3, 1952 Bristol, England

The Bristol Aerospace Company Model 173—the first British twin-engine helicopter—flew for the first time. Test pilot "Sox" Hosegood said "I found it difficult to move in any direction except backwards!" The aircraft eventually became the Royal Air Force's (RAF) Belvedere.

July 31, 1952 Prestwick, Scotland

Two Sikorsky S-55s landed in Prestwick, setting the new world distance record and completing the first trans-Atlantic helicopter flight. The aircraft departed on July 13 from Westover, Massachusetts, and flew via Maine, Labrador, Greenland and Iceland in a total flying time of 42 hr 25 min.

25 Years Ago:

May 3, 1977 Arlington, Texas

The Bell XV-15 tilt-rotor, which had been under development since 1951, hovered for the first time.

In This Issue

You Have Control . . . or Do You?

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 can't 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?" and "What would I do now?"

Let's start with what happened to cause the problem. Since 1983, Bell Helicopters, the U.S. Army, the U.S. Navy, and the FAA, have been warning of the dangers of loss of tail rotor effectiveness (LTE). Bell published an Information Letter in 1984 stating the following:

. . . low speed flight characteristics . . . can result an unanticipated right yaw if appropriate attention is not paid to controlling the aircraft. These characteristics are present only at airspeeds less than 30 kts 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.

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

- 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.
- 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.

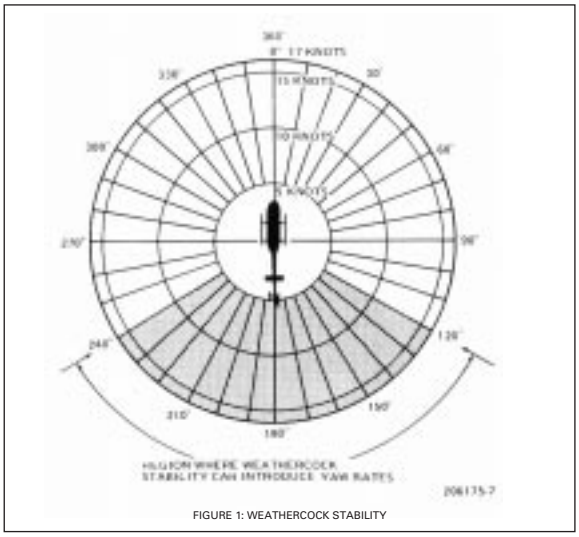
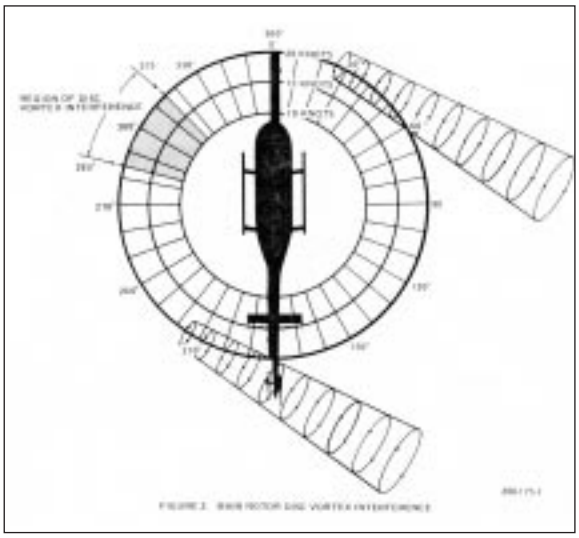


FIGURE 1: WEATHERCOCK STABILITY



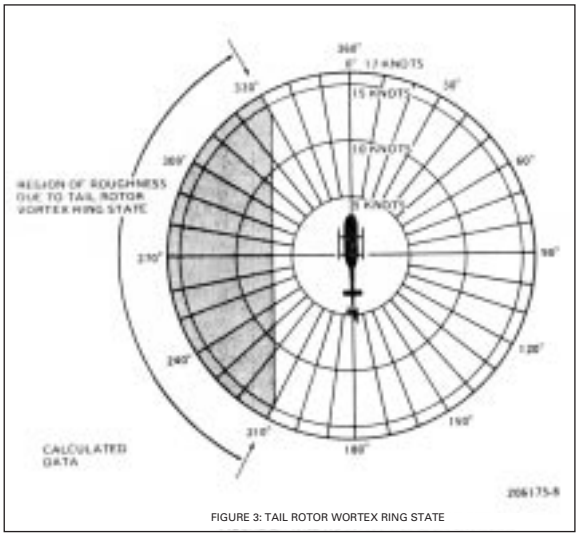


FIGURE 3: TAIL ROTOR WORTEX RING STATE

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've reprinted them here with the kind permission of Bell Helicopter Textron. —Ed.

Other factors can affect the severity of LTE:

- 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 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.

Okay. We've looked at what happened and how to avoid it, but what do you do if you still run into the problem? The FAA Advisory Circular 90-95 addresses that by providing "Recommended Recovery Techniques."

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?

For related articles on LTE, check our Web site and follow the links or visit:
http://www.dynamicflight.com/aerodynamics/loss_tail_eff/
http://safecopter.arc.nasa.gov/Pages/Columns/RayProuty/html%20files/Downwind_Turn.html

LTE Accidents

Many of you have seen the literature on LTE before. Bell Helicopter and the United States Army have been aggressive in getting the message out for many years. Still, these accidents continue to occur, and many models are susceptible to this phenomenon (I've personally had it happen to me in a Hughes 500D, luckily without incident). Here's a brief sample from the archives. —Ed.

May 1994 **Hughes 300C**
The helicopter was being used to search for a missing person. The pilot turned the helicopter abruptly downwind to search down a river bank and lost tail rotor effectiveness. The helicopter rotated through 360° and descended rapidly toward a swamp. Despite the application of full power, the 300C landed heavily in swampy ground, breaking the skids.

July 1996 **Bell 206B**
As the 206 approached the pad at 7600 ft., it lost tail rotor effectiveness and spun through 360°, striking the pad heavily and damaging the skids, tail rotor and lower fin.

Oct. 1985 **Hughes 269A**
Tail rotor authority was lost and aircraft rotated into trees.

August 1988 **Bell 206B**
While looking for a remote site in mountainous terrain, a loss of tail rotor authority occurred. The helicopter struck the trees and came to rest about 6300 ft ASL.

Sept. 1994 **Bell 206B**
The pilot had just released a sling load and was preparing to land when he lost tail rotor authority and the helicopter began to rotate. The helicopter struck the ground and rolled over on its side, suffering substantial damage.

July 1993 **Enstrom 280**
Just after liftoff the pilot lost tail rotor authority, and the helicopter began spinning. After numerous 360° turns, the pilot rolled off the throttle and attempted a landing. On touchdown, the tail struck the ground and the tail rotor guard bent over, damaging the tail rotor and drive shaft.

From the Editor

Well, having enjoyed reading and learning from the *Aviation Safety Vortex* for over 20 years, it is a somewhat daunting pleasure to be editing it. It will certainly be a challenge to maintain the high standard of safety awareness for helicopter pilots that the Vortex has achieved over the years. The upside is having plenty of material, since I have personally made enough mistakes in my career to fill the newsletter until retirement, so here we go . . .

In autumn 2000, Transport Canada System Safety commissioned a complete review of their aviation safety newsletters. The results of that survey indicate that, overall, the readership of *Aviation Safety Vortex* is pleased with the content, but some very good comments and suggestions were made. With those in mind, the editors and production staff are currently meeting to develop improvements to all of our products, and we hope to implement them soon. In the Vortex for example, I hope to introduce recurring columns on technical and training issues as they relate to the safety of helicopter flying.

One of the immediate changes you'll notice in the Vortex is the new 12-page format rather than eight, which allows us more flexibility in both the variety of topics and the depth we can cover them in a single issue. We will also be publishing quarterly, and stagger distribution with the *Aviation Safety Letter* and *A.I.P. Canada* package.

Many of you indicated in the survey that you'd like more detailed analysis of accidents in our Occurrence Synopsis. While this is possible, it would mean a much longer delay, sometimes years, between the incident and its appearance in the Vortex. The Synopsis is intended to be a preliminary notification of incidents and is most often published while TSB investigations are in their very early stages when little information is available. With the larger format, however, I intend to profile more accidents that we could in the past, and I hope this will satisfy the desire for better coverage. Incidentally, once TSB reports are completed, they're available as a matter of public record at: *www.tsb.gc.ca/ENG/reports/air/RptAvi_Indx.html*, or by following the links at *www.tsb.gc.ca*.

In this issue, the Occurrence Synopsis is basically a year in review of incidents involving damage or injury in 2001. Because of the sheer number involved, the accompanying descriptions are very brief, but we felt it was important to get a good idea of what a year's worth of incidents looks like. You'll also notice the format of the narrative has changed in a couple of ways. First, using two columns makes more efficient use of space, opening up more room in the publication for articles. Secondly, the aircraft registration will no longer be included because of issues raised with respect to privacy.

Up and Coming

In an effort to make you a bigger part of *Vortex*, I'm hoping to add some new features over the next few issues (you don't expect *me* to write it all, do you?)

- *Letters to the Editor* will return on a limited scale.
- *Tips and Tails* is a forum for you to share information with your fellow pilots. We're looking for those little tricks you use to deal with a specific challenge, or more elaborate tales of how a lesson was learned.
- *. . . But Were Afraid to Ask* is where you can write in with your questions, and our distinguished panel of industry wizards will endeavour to answer them. Preference will be given to topics which, through better understanding, will contribute to safety through enhanced knowledge.

Here in Canada we have a wealth of talent and experience, accustomed to operating helicopters to their maximum potential in extremely harsh environments. Don't be shy — let's get the dialogue going and spread the knowledge around. We all have things to learn from each other, no matter what your experience level.

Check the editorial/credit panel on page 3 for details on how to contact us.

If you haven't already been there in your head, don't go there in your helicopter.

Occurrence Synopsis

The following information may change as investigations progress.

01 Jan. 2001 **R22 Beta**
85N Fort St. John, B.C.
TSB Occurrence No. A01W0001
Left unattended with the rotor turning, the helicopter lifted off, spun around twice and landed on its side. Substantial damage, no injuries.

04 Jan. 2001 **B206B**
Westlock, Alta.
TSB Occurrence No. A01W0003
Aircraft was approaching to land when engine over-sped. The pilot completed a successful autorotation with no damage.

15 Jan. 2001 **SK61N**
Porteau Cove, B.C.
TSB Occurrence No. A01P0003
The helicopter was climbing to pick up logs on the side of a hill when it experienced a loss of power and decay in main rotor RPM. The aircraft descended into the trees, seriously injuring both crewmembers.

18 Jan. 2001 **B205A1**
Revelstoke, B.C.
Main rotor strike while landing.

21 Jan. 2001 **B205A1**
Near Longview, Alta.
TSB Occurrence No. A01W0011
While the helicopter was manoeuvring to land on a seismic line, the tail rotor struck a post. The helicopter rapidly turned 180º and landed hard. Substantial damage, but no injuries.

25 Jan. 2001 **R22 Beta**
Newmarket, Ont.
TSB Occurrence No. A01O0022
Dynamic rollover occurred during confined area practice. Solo student was not injured.

01 Feb. 2001 **MD530F**
1NW Cheadle, Alta.
TSB Occurrence No. A01W0032
While departing into sun's glare in gusty winds, the sling load of seismic bags contacted and brought down four spans of wire from a high voltage power line. Pilot was able to release the load without damage to the aircraft.

13 Feb. 2001 **AS350B2**
5SE Elk Point, Alta.
TSB Occurrence No. A01W0046
Longline and carousel dropped in uncommanded hook release. The manual release cable was found to be misrigged.

27 Feb. 2001 **AS350B2**
Powder River, Montana U.S.A.
TSB Occurrence No. A01F0023
The helicopter slipped while at idle on an icy surface. Lower vertical fin contacted a metal bin.

27 Feb. 2001 **B206L1**
Kennedy Lake, N.W.T.
TSB Occurrence No. A01W0070
The helicopter landed hard following an engine failure.

02 Mar. 2001 **B205A1**
5N Revelstoke, B.C.
TSB Occurrence No. A01P0031
Aircraft landed hard while dropping off skiers. No injuries, minor damage

03 Mar. 2001 **R22 Beta**
8W Pitt Meadows, B.C. (Douglas Is)
TSB Occurrence No. A01P0033
Tail strike on landing which resulted in the tailboom being cut off.

15 Mar. 2001 **B212**
Stewart Lake, N.W.T.
TSB Occurrence No. A01P0065
Following a flameout, the pilot secured No. 2 engine, jettisoned the empty sling gear and performed a successful single engine landing back at camp.

16 Mar. 2001 **H269B**
Victoria, B.C.
TSB Occurrence No. A01P0047
Tail rotor malfunction caused uncontrollable right yaw. Landed hard with substantial damage but no injury.

19 Mar. 2001 **AS350B**
Fort St. John, B.C.
Pilot advised flight service station (FSS) of a hydraulic failure. Aircraft landed safely.

23 Mar. 2001 **B206B**
Akimiski Is. (James Bay) Ont.
TSB Occurrence No. A01O0097
On final to a fuel cache, the engine flamed out due to fuel exhaustion. The hard landing caused extensive damage to the helicopter, but no injuries to the three occupants.

25 Mar. 2001 **MD500D**
Near Rivers Inlet, B.C.
TSB Occurrence No. A01P0061
Pilot landed safely following in-flight main rotor vibration. One blade found with cracks.

27 Mar. 2001 **B206L1**
Kennedy Lake, N.W.T.
TSB Occurrence No. A01W0070
Engine failure in flight with three on board. Landed hard with no injuries.

28 Mar 2001 **SK61N**
Port Hardy, B.C.
Crew shut down engine after N1 surging. Aircraft landed safely.

04 Apr. 2001 **R22 Beta**
Near Buttonville, Ont.
TSB Occurrence No. A01O0099
The helicopter contacted the ground during a training exercise and rolled over. No injuries to the student or instructor.

05 Apr. 2001 **AS332L**
190SE St. John's, Nfld.
TSB Occurrence No. A01A0029
One engine failed while en route to the Henry Goodrich oil rig. The crew diverted and conducted a successful single-engine landing on the Hibernia platform.

06 Apr. 2001 **SK76A**
Timmins, Ont.
TSB Occurrence No. A01O0100
Crew shut down one engine due to low oil pressure, then landed in Timmins without further incident.

06 Apr. 2001 **SK76A**
10S Owen Sound, Ont.
TSB Occurrence No. A01O0102
On an IFR flight from Owen Sound to London, the crew shut down one engine following a significant power loss. The flight continued under instrumental flight rules (IFR) to London where it ended uneventfully.

13 Apr. 2001 **R44**
60N Fort St. John, B.C.
TSB Occurrence No. A01W0084
On takeoff from a gas pipeline, the main rotor struck a metal vent pipe on the gas plant building. The helicopter came to rest on its side with substantial damage. Two passengers received minor injuries, another pilot and one passenger were uninjured.

17 Apr. 2001 **AS350B3**
Near Tafraout, Morocco
While engaged in survey operations (bird towing), the longline contacted an unmarked hydro wire suspended across a valley (neither the poles nor wires were visible against the horizon in the rough, mountainous terrain). The pilot saw the wire at the last moment but was unable to avoid contacting it.

22 Apr. 2001 **B212**
30NW Golden, B.C.
TSB Occurrence No. A01P0077
Main rotor contacted a rock face. Aircraft remained upright, and there were no injuries.

29 Apr. 2001 **MD500E**
26N Baker Lake, Nunavut
TSB Occurrence No. A01C0064
Pilot heard a loud bang followed by a vibration. During the precautionary landing on rough terrain in blowing snow, the aircraft came to rest on its side resulting in substantial damage. The pilot was the lone occupant and escaped injury.

02 May 2001 **R22 Beta**
70N Peace River, Alta.
TSB Occurrence No. A01W0100
Autorotation to soft ground in a pipeline right of way resulted in severing of the tail boom by the main rotor. The pilot was uninjured.

06 May 2001 **B206B**
7 SE Ekati, N.W.T.
TSB Occurrence No. A01W0102
While conducting longline operations on a frozen lake under a uniform overcast sky, visual reference was lost in the downwash. The aircraft subsequently descended and contacted the lake causing substantial damage. The pilot was taken to a nursing station but was released without injury.

16 May 2001 **B206B**
Portage La Prairie, Man.
Precautionary landing after striking an unidentified bird during night training. No injuries, but a pitch link was bent by the impact.

16 May 2001 **R22 Beta**
10E Abbotsford, B.C.
TSB Occurrence No. A01P0100
Aircraft was seen to break up in flight. The instructor and student were fatally injured.

20 May 2001 **B212**
20S Lethbridge, Alta.
TSB Occurrence No. A01W0116
Pilot observed a transmission pressure warning light and landed short of destination with no damage to the aircraft or injuries to the four on board. The transmission oil cooler return line was found cracked.

24 May 2001 **B412**
Lac Culotte, Que.
TSB Occurrence No. A01Q0094
On final for a confined helipad, the main rotor struck a tree and all blades were substantially damaged. The landing was aborted, and the aircraft continued to fly for approximately two minutes to a better site. The pilot and passenger escaped injury.

26 May 2001 **B205A1**
Mirabel, Que.
TSB Occurrence No. A01Q0083
Accidental release of an underslung ventilation unit.

29 May 2001 **B206B**
Chilliwack, B.C.
TSB Occurrence No. A01P0159
Tail rotor struck an object and was substantially damaged. Pilot continued unaware to base, and the damage was found on the next morning's pre-flight inspection.

29 May 2001 **MD500D**
Yellowknife, N.W.T.
TSB Occurrence No. A01W0132
Precautionary landing following vibration caused by blower belt slipping. No damage or injury.

30 May 2001 **MD500D**
Yellowknife, N.W.T.
TSB Occurrence No. A01W0128
Hard landing during autorotation training, with no injuries to the two crew.

02 Jun. 2001 **B206B**
Boyle, Alta
TSB Occurrence No. A01W0134
Just after takeoff with three on board, the pilot felt a vibration and observed rising turbine outlet temperature (TOT). He reduced power and turned back to camp, then the oil pressure started to fluctuate. The engine failed approximately six feet above the ground. No damage or injuries.

11 June 2001 **R22 Beta**
High River, Alta.
TSB Occurrence No. A01W0137
The aircraft landed hard and severed the tail boom during autorotation practice. The pilot and instructor were not injured.

12 June 2001 **B206B**
Porcupine River, Yukon
TSB Occurrence No. A01W0138
During cool down, the aircraft rocked backwards and tipped left. Four on board were uninjured, but the aircraft was substantially damaged.

14 June 2001 **B206B**
39N Fort St. John, B.C.
TSB Occurrence No. A01W0142
The pilot entered autorotation after hearing the Low Rotor and Engine Out warning horns, which he said sounded "different". The aircraft ended up on its side. Investigation revealed the generator switch had not been selected "ON."

20 June 2001
Uxbridge, Ont. **R22 Mariner/Cessna 170B**
TSB Occurrence No. A01O0164
A mid-air collision occurred between the R22 and a Cessna, claiming the life of the helicopter pilot. The pilot of the airplane was not injured.

23 June 2001 **Erickson S64E**
Quetico Prov. Park, Ont.
TSB Occurrence No.A01C0134
The U.S.-registered aircraft sustained minor damage after landing in a bog with a transmission oil problem. The two crew members were uninjured.

27 June 2001 **R44**
80N Fort St. John, B.C.
TSB Occurrence No. A01W0151
Following an apparent clutch problem shortly after takeoff, the main rotor RPM could not be maintained and the aircraft descended into the trees resulting in substantial damage. The two occupants were not injured.

27 June 2001 **B212**
80N Roberval, Que.
TSB Occurrence No. A01Q0105
The 212 was working with a water bucket in support of forest fire suppression when it crashed due to fuel exhaustion. Pilot and

passenger were seriously injured, and the aircraft was heavily damaged.

11 July 2001 **B206L**
Mayo Creek, B.C.
TSB Occurrence No. A01P0162
On approach to a logging road with seven on board, the aircraft suffered an engine failure. Successful autorotation resulted in no injuries or damage.

21 July 2001 **R22 Beta**
Pelly Lake, B.C.
TSB Occurrence No. A01P0173
After takeoff from the shore with two people on board, the low rotor horn sounded. The aircraft struck the water and sank. Both occupants were rescued by a boat.

23 July 2001 **B206B**
20SW Fort McMurray, Alta.
TSB Occurrence No. A01W0178
Main rotor struck a wire on takeoff with minor damage.

30 July 2001 **AS350BA**
25W Grande Cache, Alta.
TSB Occurrence No. A01W0190
Approaching to land with six on board, aircraft struck ground and rolled. One passenger sustained injuries.

01 Aug. 2001 **AS350BA**
2N Nekite River, B.C.
TSB Occurrence No. A01P0181
Minor damage when the tail rotor struck a camouflaged object in a confined area. Contributing factor was restricted visibility because of fogged up windows as five wet passengers had just embarked the helicopter.

03 Aug. 2001 **R44**
Brandon, Man.
TSB Occurrence No. A01C0191
Sprague clutch failed about 3 minutes after takeoff from Brandon. The pilot completed a successful autorotation with no reported damage.

07 Aug. 2001 **B206B**
30N Slave Lake, Alta.
TSB Occurrence No. A01W199
Main rotor struck aluminum communications mast with minor damage.

09 Aug. 2001 **MD500D**
Near Baird Penn., Baffin Island
TSB Occurrence No. A01Q0139
The helicopter crashed, rolled down a hill and burned. The accident took the lives of the pilot and one passenger, and the second passenger was seriously injured.

12 Aug. 2001 **AS350B2**
30W Cody, Wyoming U.S.A.
TSB Occurrence No. A01F0106
During landing with a lightweight, synthetic longline attached, the tail rotor struck the longline and sheared the drive shaft. The ensuing forced landing resulted in substantial damage but no injuries.

13 Aug. 2001 **B206B**
Near Clearwater, N.B.
TSB Occurrence No. A01A0100
Crashed on takeoff from a staging area. The pilot sustained minor injuries and the aircraft was heavily damaged.

14 Aug. 2001 **B212**
Prince George, B.C.
TSB Occurrence No. A01P0198
Pilot noticed engine oil pressure falling and elected to shut down that engine and return to the airport. Investigation found the oil filler cap had been left off.

15 Aug. 2001 **B206B**
5E Portage La Prairie, Man.
Multiple bird strikes during a night training exercise. No damage.

22 Aug. 2001 **B206A**
Pointe du Lac, Que.
TSB Occurrence No. A01Q0147
Hard landing at night with two on board resulted in substantial damage to the U.S. registered helicopter. The passenger received minor injuries.

23 Aug. 2001 **MD500D**
Yellowknife, N.W.T.
TSB Occurrence No. A01W0213
During autorotation training, the aircraft landed hard. No injuries.

23 Aug. 2001 **AS350B**
40W Rocky Mountain House, Alta.
TSB Occurrence No. A01W0212
Tail rotor struck a road sign while landing at the scene of an automobile accident. Substantial damage but no injuries.

08 Sept. 2001 **R22**
Beloeil, Que.
No injuries to instructor or student, but substantial damage when tail rotor stuck ground during training flight.

16 Sept. 2001 **Enstrom 280FX**
Sandy Lake, Nfld.
TSB Occurrence No. A01A0117
Aircraft descended into a lake and sank following engine failure. No injuries to the two occupants.

26 Sept. 2001 **AS350D**
Near Wabush, Labrador
TSB Occurrence No. A01A0121
The pilot noticed a baggage pod warning light, and was landing to investigate when the latches failed. A seat cushion flew out and struck the tail rotor, causing considerable damage, but the aircraft landed safely in a bog. After repeated attempts on several frequencies, the pilot was able to contact an airliner on 121.5 MHz and the information was relayed to Wabush FSS. The pilot was uninjured and picked up by another helicopter.

05 Oct. 2001 **MD500C**
Fort Simpson, N.W.T.
TSB Occurrence No.A01W0255
The aircraft descended into trees following an engine failure on approach to a helipad.
The pilot did not survive the accident, and the passenger was seriously injured.

29 Oct. 2001 **S64E**
North Island, B.C.
TSB Occurrence No. A01P0281
Main rotor strike while manoeuvring to pick up logs. No injuries.

31 Oct. 2001 **R22 Beta**
Near Montebello, Que.
TSB Occurrence No. A01Q0175
The helicopter struck trees in bad weather and was substantially damaged. The pilot escaped with only minor injuries.

01 Nov. 2001 **R22 Beta**
10NW Edmonton City Centre Airport
TSB Occurrence No. A01W0268
The helicopter crashed during a training exercise with no injuries to the student or instructor.

04 Nov. 2001 **R22**
Lac Viking, Que.
TSB Occurrence No. A01Q0177
During a night approach to the shore of a lake, the aircraft struck the water and sank. People on shore attempted unsuccessfully to rescue the pilot, who did not survive.

08 Nov. 2001 **SA315B**
Near Cranbrook, B.C.
TSB Occurrence No. A01P0282
The Lama was lifting a log when it suffered a drive system failure and suddenly descended to the ground. The pilot was fatally injured.

10 Nov. 2001 **S76A**
Halifax, N.S.
TSB Occurrence No. A01A0138
The aircraft experienced torque fluctuations and oil pressure indications on one engine. They elected to shut down the engine and proceeded to Halifax International Airport where a safe landing was made with emergency crews standing by.

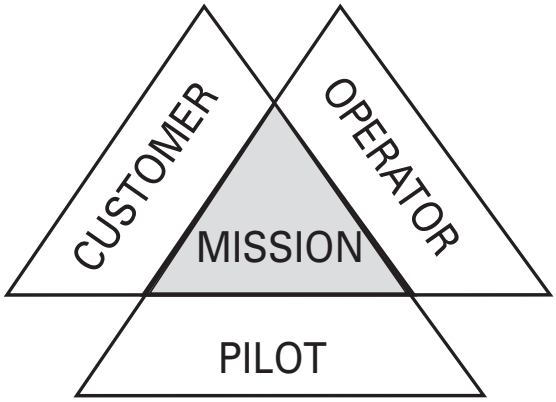
05 Dec. 2001 **B47G2**
15NW Abbotsford, B.C.
TSB Occurrence No. A01P0298
During a training flight in the Pitt Lake area, the throttle froze in the full open position. Initiating a descent would cause overspeed so the only recourse was to shut down the engine and perform a full autorotation. Unfortunately, the terrain in the region would not permit this, so the instructor flew the aircraft over top of an overcast layer back to Abbotsford, where conditions were reported as broken. There, he executed a successful autorotation.

15 Dec. 2001 **B206L**
Clarenville, Nfld.
TSB Occurrence No. A01A0148
While manoeuvring near power lines, the main rotor struck and parted a $1^{1}/_{4}$ in. wire.
Substantial damage to the rotor but no injuries.

18 Dec. 2001 **EC120B**
6NE Yellowknife, N.W.T.
TSB Occurrence No. A01W0297
During a training flight with two on board, the engine lost all power, and the aircraft landed hard with substantial damage. Both pilots received minor injuries.

24 Dec. 2001 **R22 Beta**
10N Port Colborne, Ont.
TSB Occurrence No. A01O0340
Aircraft contacted ground and rolled while hovering in whiteout conditions. Both occupants uninjured.

Helicopter Risk Management



If the customer, operator, and pilot can work in harmony, the goals of each can be achieved without jeopardizing mission safety.

It is a fact that some form of human error is involved in about 80% of all accidents. Mechanical failures, when they do happen, are not nearly as catastrophic as they were 20 years ago. Consequently, accident prevention programs are focusing on human factors and the necessity for eliminating as many hazards as possible before takeoff. One such factor is the triangular relationship between the customer, operator, and pilot. Unless there is a solid understanding and respect for the needs of each, the pilot can unnecessarily become the victim of the other two.

The helicopter pilot is particularly vulnerable. Much of the business is cyclical, with frantic periods of activity in the spring, summer and fall. The desire to maximize production and reduce costs can put an unnecessary strain on a pilot already faced with a hazardous task. Stress and fatigue are often products of customer and operator pressures. This, combined with personality factors, can quickly overload the pilot.

The triangular relationship between the customer, operator and pilot is an intricate play on personalities and conflicting opinions on task accomplishment. The customer's goal is to accomplish the task as quickly as possible within the allotted budget. The operator is profit-motivated, while the pilot's needs are not so clearly defined. In the early stages, he or she is motivated by the desire to fly. Once that desire is satisfied, monetary rewards can take precedence and in later years, time home with the family becomes important. Through these stages, though, is an overriding need for personal safety. The pilot that is unable to defend him- or herself can quickly become the victim of the unscrupulous customer or operator.

The antidote is a three-pronged message:

The customers must be made aware of the limitations of the helicopter and crew. They must accept the flight crew as competent and capable of analyzing difficult missions and assessing potential hazards. Flight crews must have the final say on mission procedures.

The operators' role is more complex. They have a duty to provide the right helicopter and the right pilot for the job. However, equally important is a support system for the pilot. This support begins with customer contract negotiations, at which time the operator can outline flight safety procedures. And, the support must continue on the job. Standard operating procedures (SOP) must be established and field maintenance must be available. Most importantly, management must display, to both customer and pilot, their loyalty and backing of flight crew decisions made on the job. Management-by-coercion has no place in the industry. Pilots must be able to perform their duties without fear of persecution.

Pilots should learn to recognize their own negative (aggressive or withdrawn) behaviour and work on strengthening the positive (assertive) aspects of their personality. The desire to please should not interfere with mission safety. Their self-management and the flight profile are complicated enough without introducing customer and operator pressures. The pilot faced with a four-week shift in the bush can easily feel an apparent lack of control over life events, e.g., separation from family. Some pilots may be demoralized before the job begins. Operator and customer pressures will only amplify these feelings.

The triangular relationship is an intricate and complicated play on personalities. Understanding the priorities of the other two is a start. Positive motivation through effective training, sound maintenance, and SOPs will encourage and sustain a positive attitude in the cockpit. If the three players work in harmony, the goals of each can be achieved without jeopardizing mission safety.

Contact your Regional System Safety Officer regarding the video, Helicopter Risk Management.

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