

Safety Notice SN-10

Issued: Oct 82 Rev: Feb 89; Jun 94

FATAL ACCIDENTS CAUSED BY LOW RPM ROTOR STALL

A primary cause of fatal accidents in light helicopters is failure to maintain rotor RPM. To avoid this, every pilot must have his reflexes conditioned so he will instantly add throttle and lower collective to maintain RPM in any emergency.

The R22 and R44 have demonstrated excellent crashworthiness as long as the pilot flies the aircraft all the way to the ground and executes a flare at the bottom to reduce his airspeed and rate of descent. Even when going down into rough terrain, trees, wires or water, he must force himself to lower the collective to maintain RPM until just before impact. The ship may roll over and be severely damaged, but the occupants have an excellent chance of walking away from it without injury.

Power available from the engine is directly proportional to RPM. If the RPM drops 10%, there is 10% less power. With less power, the helicopter will start to settle, and if the collective is raised to stop it from settling, the RPM will be pulled down even lower, causing the ship to settle even faster. If the pilot not only fails to lower collective, but instead pulls up on the collective to keep the ship from going down, the rotor will stall almost immediately. When it stalls, the blades will either "blow back" and cut off the tailcone or it will just stop flying, allowing the helicopter to fall at an extreme rate. In either case, the resulting crash is likely to be fatal.

No matter what causes the low rotor RPM, the pilot must first roll on throttle and lower the collective simultaneously to recover RPM before investigating the problem. It must be a conditioned reflex. In forward flight, applying aft cyclic to bleed off airspeed will also help recover lost RPM.

Safety Notice SN-18

Issued: Jan 85 Rev: Feb 89; Jun 94

LOSS OF VISIBILITY CAN BE FATAL

Flying a helicopter in obscured visibility due to fog, snow, low ceiling, or even a dark night can be fatal. Helicopters have less inherent stability and much faster roll and pitch rates than airplanes. Loss of the pilot's outside visual references, even for a moment, can result in disorientation, wrong control inputs, and an uncontrolled crash. This type of situation is likely to occur when a pilot attempts to fly through a partially obscured area and realizes too late that he is losing visibility. He loses control of the helicopter when he attempts a turn to regain visibility but is unable to complete the turn without visual references.

You must take corrective action before visibility is lost! Remember, unlike the airplane, the unique capability of the helicopter allows you to land and use alternate transportation during bad weather, provided you have the good judgement and necessary willpower to make the correct decision.

OVERCONFIDENCE PREVAILS IN ACCIDENTS

A personal trait most often found in pilots having serious accidents is overconfidence. High-time fixed-wing pilots transitioning into helicopters and private owners are particularly susceptible. Airplane pilots feel confident and relaxed in the air, but have not yet developed the control feel, coordination, and sensitivity demanded by a helicopter. Private owners are their own boss and can fly without discipline, enforced rules, or periodic flight checks and critique by a chief pilot. A private owner must depend on self-discipline, which is sometimes forgotten.

When flown properly and conservatively, helicopters are potentially the safest aircraft built. But helicopters are also probably the least forgiving. They must always be flown defensively. The pilot should allow himself a greater safety margin than he thinks will be necessary, just in case.

Safety Notice SN-19

Issued: Jul 85 Rev: Jun 94

FLYING LOW OVER WATER IS VERY HAZARDOUS

Many helicopter accidents have occurred while maneuvering low over water. Many pilots do not realize their loss of depth perception when flying over water. Flying over calm glassy water is particularly dangerous, but even choppy water, with its constantly varying surface, interferes with normal depth perception and may cause a pilot to misjudge his height above the water.

MAINTAIN 500 FEET AGL WHENEVER POSSIBLE AND AVOID MANEUVERS OVER WATER BELOW 200 FEET AGL.

Safety Notice SN-20

Issued: Sep 85 Rev: Jun 94

BEWARE OF DEMONSTRATION OR INITIAL TRAINING FLIGHTS

A disproportionate number of fatal and non-fatal accidents occur during demonstration or initial training flights. The accidents occur because individuals other than the pilot are allowed to manipulate the controls without being properly prepared or indoctrinated.

If a student begins to lose control of the aircraft, an experienced flight instructor can easily regain control provided the student does not make any large or abrupt control movements. If, however, the student becomes momentarily confused and makes a sudden large control input in the wrong direction, even the most experienced instructor may not be able to recover control. Instructors are usually prepared to handle the situation where the student loses control and does nothing, but they are seldom prepared for the student who loses control and does the wrong thing.

Before allowing someone to touch the controls of the aircraft, they must be thoroughly indoctrinated concerning the extreme sensitivity of the controls in a light helicopter. They must be firmly instructed to never make a large or sudden movement with the controls. And, the pilot-in-command must be prepared to instantly grip the controls should the student start to make a wrong move.

Safety Notice SN-21 has been deleted.

Safety Notice SN-24

Issued: Sep 86 Rev: Jun 94

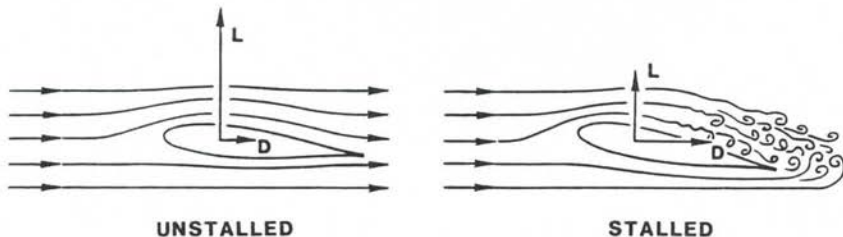
LOW RPM ROTOR STALL CAN BE FATAL

Rotor stall due to low RPM causes a very high percentage of helicopter accidents, both fatal and non-fatal. Frequently misunderstood, rotor stall is not to be confused with retreating tip stall which occurs only at high forward speeds when stall occurs over a small portion of the retreating blade tip. Retreating tip stall causes vibration and control problems, but the rotor is still very capable of providing sufficient lift to support the weight of the helicopter.

Rotor stall, on the other hand, can occur at any airspeed and when it does, the rotor stops producing the lift required to support the helicopter and the aircraft literally falls out of the sky. Fortunately, rotor stall accidents most often occur close to the ground during takeoff or landing and the helicopter falls only four or five feet. The helicopter is wrecked but the occupants survive. However, rotor stall also occurs at higher altitudes and when it happens at heights above 40 or 50 feet AGL it is most likely to be fatal.

Rotor stall is very similar to the stall of an airplane wing at low airspeeds. As the airspeed of an airplane gets lower, the nose-up angle, or angle-of-attack, of the wing must be higher for the wing to produce the lift required to support the weight of the airplane. At a critical angle (about 15 degrees), the airflow over the wing will separate and stall, causing a sudden loss of lift and a very large increase in drag. The airplane pilot recovers by lowering the nose of the airplane to reduce the wing angle-of-attack below stall and adds power to recover the lost airspeed.

The same thing happens during rotor stall with a helicopter except it occurs due to low rotor RPM instead of low airspeed. As the RPM of the rotor gets lower, the angle-of-attack of the rotor blades must be higher to generate the lift required to support the weight of the helicopter. Even if the collective is not raised by the pilot to provide the higher blade angle, the helicopter will start to descend until the



Wing or rotor blade unstalled and stalled.

Safety Notice SN-24 (continued)

upward movement of air to the rotor provides the necessary increase in blade angle-of-attack. As with the airplane wing, the blade airfoil will stall at a critical angle, resulting in a sudden loss of lift and a large increase in drag. The increased drag on the blades acts like a huge rotor brake causing the rotor RPM to rapidly decrease, further increasing the rotor stall. As the helicopter begins to fall, the upward rushing air continues to increase the angle-of-attack on the slowly rotating blades, making recovery virtually impossible, even with full down collective.

When the rotor stalls, it does not do so symmetrically because any forward airspeed of the helicopter will produce a higher airflow on the advancing blade than on the retreating blade. This causes the retreating blade to stall first, allowing it to dive as it goes aft while the advancing blade is still climbing as it goes forward. The resulting low aft blade and high forward blade become a rapid aft tilting of the rotor disc sometimes referred to as "rotor blow-back". Also, as the helicopter begins to fall, the upward flow of air under the tail surfaces tends to pitch the aircraft nose-down. These two effects, combined with aft cyclic by the pilot attempting to keep the nose from dropping, will frequently allow the rotor blades to blow back and chop off the tailboom as the stalled helicopter falls. Due to the magnitude of the forces involved and the flexibility of rotor blades, rotor teeter stops will not prevent the boom chop. The resulting boom chop, however, is academic, as the aircraft and its occupants are already doomed by the stalled rotor before the chop occurs.

Safety Notice SN-25

Issued: Dec 1986 Rev: Jul 2012

CARBURETOR ICE

Avoidable accidents have been attributed to engine stoppage due to carburetor ice. When used properly, the carburetor heat and carb heat assist systems on the R22 and R44 will prevent carburetor ice.

Pressure drops and fuel evaporation inside the carburetor cause significant cooling. Therefore, carburetor ice can occur at OATs as high as 30°C (86°F). Even in generally dry air, local conditions such as a nearby body of water can be conducive to carburetor ice. **When in doubt, assume conditions are conducive to carburetor ice and apply carb heat as required.**

For the R22 and R44, carburetor heat may be necessary during takeoff. Unlike airplanes which take off at full throttle, helicopters take off using power as required, making them vulnerable to carburetor ice. Also use full carb heat during run-up to preheat the induction system.

On aircraft equipped with the carb heat assist system, the control knob should be left unlatched unless it is obvious that conditions are not conducive to carburetor ice.

Carburetor heat reduces engine power output for a given manifold pressure. Approximately 1.5 in. Hg additional MAP is required to generate maximum continuous power (MCP) or takeoff power (TOP) with full heat applied. The additional MAP with carb heat does not overstress the engine or helicopter because power limits are still being observed. Since the engine is derated, it will produce TOP at lower altitudes even with full heat. However, avoid using more heat than required at high altitudes as the engine may reach full throttle at less than MCP or TOP.

Safety Notice SN-26

Issued: Jan 87 Rev: Jun 94

NIGHT FLIGHT PLUS BAD WEATHER CAN BE DEADLY

Many fatal accidents have occurred at night when the pilot attempted to fly in marginal weather after dark. The fatal accident rate during night flight is many times higher than during daylight hours.

When it is dark, the pilot cannot see wires or the bottom of clouds, nor low hanging scud or fog. Even when he does see it, he is unable to judge its altitude because there is no horizon for reference. He doesn't realize it is there until he has actually flown into it and suddenly loses his outside visual references and his ability to control the attitude of the helicopter. As helicopters are not inherently stable and have very high roll rates, the aircraft will quickly go out of control, resulting in a high velocity crash which is usually fatal.

Be sure you NEVER fly at night unless you have clear weather with unlimited or very high ceilings and plenty of celestial or ground lights for reference.

Safety Notice SN-29

Issued: Mar 93 Rev: Jun 94

AIRPLANE PILOTS HIGH RISK WHEN FLYING HELICOPTERS

There have been a number of fatal accidents involving experienced pilots who have many hours in airplanes but with only limited experience flying helicopters.

The ingrained reactions of an experienced airplane pilot can be deadly when flying a helicopter. The airplane pilot may fly the helicopter well when doing normal maneuvers under ordinary conditions when there is time to think about the proper control response. But when required to react suddenly under unexpected circumstances, he may revert to his airplane reactions and commit a fatal error. Under those conditions, his hands and feet move purely by reaction without conscious thought. Those reactions may well be based on his greater experience, i.e., the reactions developed flying airplanes.

For example, in an airplane his reaction to a warning horn (stall) would be to immediately go forward with the stick and add power. In a helicopter, application of forward stick when the pilot hears a horn (low RPM) would drive the RPM even lower and could result in rotor stall, especially if he also "adds power" (up collective). In less than one second the pilot could stall his rotor, causing the helicopter to fall out of the sky.

Another example is the reaction necessary to make the aircraft go down. If the helicopter pilot must suddenly descend to avoid a bird or another aircraft, he rapidly lowers the collective with very little movement of the cyclic stick. In the same situation, the airplane pilot would push the stick forward to dive. A rapid forward movement of the helicopter cyclic stick under these conditions would result in a low "G" condition which could cause mast bumping, resulting in separation of the rotor shaft or one blade striking the fuselage. A similar situation exists when terminating a climb after a pull-up. The airplane pilot does it with forward stick. The helicopter pilot must use his collective or a very gradual, gentle application of forward cyclic.

To stay alive in the helicopter, the experienced airplane pilot must devote considerable time and effort to developing safe helicopter reactions. The helicopter reactions must be stronger and take precedence over the pilot's airplane reactions because everything happens faster in a helicopter. The pilot does not have time to realize he made the wrong move, think about it, and then correct it. It's too late; the rotor has already stalled or a blade has already struck the airframe and there is no chance of recovery. To develop safe helicopter reactions, the airplane pilot must practice each procedure over and over again with a competent instructor until his hands and feet will always make the right move without requiring conscious thought. **AND, ABOVE ALL, HE MUST NEVER ABRUPTLY PUSH THE CYCLIC STICK FORWARD.**

Also see Safety Notices SN-11 and SN-24.

Safety Notice SN-30

Issued: Jun 94 Rev: Apr 2009

LOOSE OBJECTS CAN BE FATAL

Fatal accidents have occurred due to loose objects flying out of the cabin and striking the tail rotor. Any object striking the tail rotor can cause failure of a tail rotor blade. Loss of or damage to a tail rotor blade may cause a severe out-of-balance condition which can separate the tail rotor gearbox or entire tail assembly from the tailcone, resulting in a catastrophic accident. Accidents have also been caused by fuel caps, birds, and other objects striking the tail rotor. Before each flight perform the following:

- 1) Walk completely around the aircraft checking fuel cap security and tail rotor condition. Ensure no loose objects or debris in helicopter vicinity. Verify cotter rings or pins are installed in all door hinge pins.
- 2) Stow or secure all loose objects in the cabin. Even with doors on, items such as charts can be sucked out of a vent door.
- 3) Instruct passengers regarding the dangers of objects striking the tail rotor. Warn them never to throw anything from the helicopter or place items near vent doors where they could get sucked out.
- 4) Firmly latch all doors.
- 5) Never fly with a left door removed. (Remove only the right door for ventilation.)

Safety Notice SN-31

Issued: Dec 96

GOVERNOR CAN MASK CARB ICE

With throttle governor on, carb ice will not become apparent as a loss of either RPM or manifold pressure. The governor will automatically adjust throttle to maintain constant RPM which will also result in constant manifold pressure. When in doubt, apply carb heat as required to keep CAT out of yellow arc during hover, climb, or cruise, and apply full carb heat when manifold pressure is below 18 inches.

Also remember, if carb heat assist is used it will reduce carb heat when you lift off to a hover and the control may require readjustment in flight.

Safety Notice SN-34

Issued: Mar 99 Rev: Apr 2009

AERIAL SURVEY AND PHOTO FLIGHTS - VERY HIGH RISK

There is a misconception that aerial survey and photo flights can be flown safely by low time pilots. Not true. There have been numerous fatal accidents during aerial survey and photo flights, including several involving Robinson helicopters.

Often, to please the observer or photographer, an inexperienced pilot will slow the helicopter to less than 30 KIAS and then attempt to maneuver for the best viewing angle. While maneuvering, the pilot may lose track of airspeed and wind conditions. The helicopter can rapidly lose translational lift and begin to settle. An inexperienced pilot may raise the collective to stop the descent. This can reduce RPM thereby reducing power available and causing an even greater descent rate and further loss of RPM. Rolling on throttle will increase rotor torque but not power available due to the low RPM. Because tail rotor thrust is proportional to the square of RPM, if the RPM drops below 80% nearly one-half of the tail rotor thrust is lost and the helicopter will rotate nose right. Suddenly the decreasing RPM also causes the main rotor to stall and the helicopter falls rapidly while continuing to rotate. The resulting impact is usually fatal.

Aerial survey and photo flights should only be conducted by well trained, experienced pilots who:

- 1) Have at least 500 hours pilot-in-command in helicopters and over 100 hours in the model flown;
- 2) Have extensive training in both low RPM and settling-with-power recovery techniques;
- 3) Are willing to say no to the observer or photographer and only fly the aircraft at speeds, altitudes, and wind angles that are safe and allow good escape routes.

Also see Safety Notice SN-24.