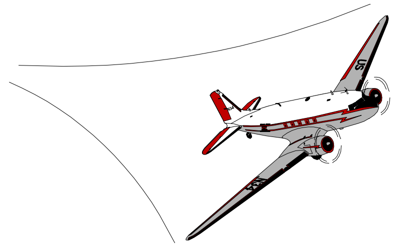
SPECIAL AIRWORTHINESS INFORMATION



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This is issued for informational purposes only and any recommendation for corrective action is not mandatory.

ROBINSON MODELS: R-22 and R-44.

MAIN ROTOR/AIRFRAME CONTACT ACCIDENTS

INTRODUCTION

The purpose of this Special Airworthiness Information is to advise all pilots of the Robinson R-22 and R-44 helicopters of fatal accidents in those aircraft resulting from main rotor contact with the airframe. This information recommends procedures to reduce the probability of these types of accidents. This is for information purposes only, and recommendations for corrective action are not mandatory.

BACKGROUND

This Special Airworthiness Information has been issued in order to update and more widely disseminate safety information previously provided to registered owners of Robinson helicopters in Special Airworthiness Alert ASW-94-2 dated July 22, 1994.

In 1994, there were six Robinson helicopters destroyed in fatal accidents involving in-flight contact between the main rotor and the airframe. Five of those accidents, three R-22's and two R-44's, occurred outside of the United States.

According to data provided by the National Transportation Safety Board and foreign airworthiness authorities, there have been 26 fatal accidents in the R-22 that resulted from main rotor blade/airframe contact since certification of the helicopter in 1979. There have been two such accidents involving the R-44 since certification of that helicopter in 1992. Most of those accidents have been attributed to low rotor RPM stall or mast bumping.

Pilot experience was a factor in 24 of those rotor/airframe contact accidents. Of the pilots assumed to be manipulating the controls during the accidents, their average flight experience was 119 hours in helicopters and 2610 hours in airplanes.

<u>Rotor Stall</u>: Many factors may contribute to main rotor stall and pilots should be familiar with them. Any flight condition that creates excessive angle of attack on the rotor blades can produce a stall. Low rotor RPM, aggressive maneuvering, high collective angle (often the result of high density altitude, over-pitching [exceeding power available] during climb or high forward flight airspeed) and slow response to the low rotor RPM warning horn and light may result in rotor stall. The effect of these conditions can be amplified in turbulence. Rotor stall can ultimately result in contact between the rotor and airframe. Additional information on rotor stall is provided in Robinson Helicopter Company Safety Notices SN-10, SN-15, SN-20, SN-24, SN-27, and SN-29.

Mast Bumping: Mast bumping may occur with a teetering rotor system when excessive main rotor flapping results from low g (load factor below 1.0) or abrupt control input. A low g flight condition can result from a cyclic pushover in forward flight. High forward flight speed, turbulence, and excessive sideslip can accentuate the adverse effects of these control movements. The excessive flapping results in the rotor hub assembly striking the main rotor mast with subsequent rotor system separation from the helicopter. Both the models R-22 and R-44 are configured with a teetering rotor system design common to two-bladed rotor systems. The subject of mast bumping is further discussed in Robinson Helicopter Company Safety Notices SN-11, SN-20 and SN-29.

Although the FAA is conducting a comprehensive research program to address the issue of main rotor/airframe contact accidents, the complete results of that research are not yet available. In the absence of additional operating limitations or design changes, education and awareness are our best weapons against those types of accidents. This Special Airworthiness Information was developed to achieve that goal. By alleviating the factors known to accompany rotor RPM decay and low g, the occurrence of main rotor/airframe contact accidents can be reduced or eliminated. The onset of rotor/airframe contact is insidious, occurs with little prior warning to the pilot, and usually results in catastrophic damage to the helicopter. The only reliable way to survive a main rotor/airframe contact accident is to avoid it. In order to avoid such an accident, you must know the conditions that may culminate in rotor stall and/or mast bumping.

RECOMMENDATIONS

Until the FAA completes its research into the conditions and aircraft characteristics that lead to main rotor/fuselage contact accidents, and corrective type design changes and operating limitations are incorporated, R-22 and R-44 pilots are strongly urged to comply with the following recommended procedures.

1. Avoid very high or low airspeeds. At high airspeeds, the rotor can generate a low g condition more quickly and with less forward cyclic movement than at low airspeeds. A low g condition can result in mast bumping and possible rotor separation. At airspeeds below 60 knots indicated airspeed (KIAS) there is very little kinetic energy in the form of airspeed available to the pilot for recovery from a low rotor RPM condition by flaring the helicopter. Pilots are urged to maintain airspeeds greater than 60 KIAS and less than .9 Vne, but in no case less than the minimum safe speeds shown on the height-velocity diagram for the applicable operating altitudes. The prescribed airspeeds for safe operation are presented on page 4-1 of the R-22 and R-44 Rotorcraft Flight Manuals (RFM).

2. Avoid flight at high density altitude. As density altitude increases, the margin between the rotor blade angle of attack and the angle of attack at which rotor stall will occur is reduced. Power available decreases with increasing density altitude and the risk of rotor RPM decay and possible rotor stall is greater at higher altitudes. The ability to recover lost RPM with engine power is also reduced at higher altitude. Additionally, as density altitude is increased, the main rotor flapping resulting from low g flight is increased. Thus, the margin between the maximum flapping angle and contact between the rotor hub and mast is reduced at higher altitudes.

3. Use maximum power-on RPM at all times, unless in autorotation. Rotor RPM decay can result from loss of engine power, exceeding the performance capability of the helicopter, or pilot inattention. Main rotor flapping margin also decreases as RPM decreases. RPM decay is insidious and can be rapid, and RPM control demands pilot vigilance at all times.

4. Maintain balanced flight at all times. Sideslip creates lateral flapping in excess of that encountered during normal flight. This excess flapping allows less margin for lateral cyclic maneuvering in response to a low g induced roll.

5. When hovering out-of-ground-effect, always hover into the wind. Hovering out-of-ground-effect often requires engine power close to the maximum power available. A crosswind or tail wind increases the power required to compensate for the extra tail rotor thrust that may be required. Wind from the right of the helicopter increases the power required to hover due to the extra tail rotor thrust needed to maintain heading. Couple this power demand with pilot attention concentrated outside of the helicopter, and an unrecoverable loss of rotor RPM can result rapidly with the disastrous effects of rotor stall and possible main rotor blade/airframe contact.

6. Pilots should be conditioned to instinctively apply the controls correctly in reaction to low rotor RPM and low g.

a. In the event of a low rotor RPM warning, quickly and simultaneously lower the collective and increase the throttle.

b. If the helicopter rolls to the right in a low g condition, gently apply aft cyclic to restore positive g and rotor thrust.

c. When uncommanded pitch, roll or yaw excursions result from flight in turbulence, smoothly apply the controls to maintain positive g and to eliminate sideslip.

7. Do not fly if any of the following conditions exist: surface winds (including gusts) exceeding 25 knots, surface wind gusts exceeding 15 knots, wind shear forecast or observed, and/or turbulence forecast or observed to be moderate, severe or extreme. "Ride quality" in turbulence is a function of several factors, predominately gross weight. Relatively light gross weights make the R-22 and R-44 more susceptible to the effects of turbulence. Most notably, main rotor flapping and aircraft attitude are affected by turbulence and can lead to blade stall, abrupt control inputs in response to uncommanded attitude deviations and, ultimately, mast bumping. Two recent rotor/airframe contact accidents occurred with high surface winds, wind gusts and turbulence. At least seven rotor/airframe contact accidents were accompanied by such conditions.

8. When encountering moderate, severe or extreme turbulence, limit forward flight airspeed to 80 KIAS or less and land as soon as practical. The effects of turbulence on pilot workload and uncommanded attitude changes are accentuated with increased airspeed.

These recommendations are intended to abate the conditions that culminate in contact between the main rotor and airframe. Adherence to the recommendations will promote safe flying and may keep you from becoming an accident statistic. The key word here is "avoidance". The factors discussed here should be considered by all pilots flying small helicopters configured with a teetering rotor system.

FOR FURTHER INFORMATION CONTACT:

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