# Late Takeover

**It has long been recognized by aviation safety workers that the attribution of an accident or incident to "pilot error" leaves unanswered the question of *why* the error was committed.**

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With the premission briefing complete, the instructor pilot and his two students made their way out to the UH-1N helicopter in preparation for a three-hour training flight. They were scheduled to practice emergency procedures, including autorotations, in addition to normal transition maneuvers at an auxiliary field a few miles away from home base.

While the pilots completed their preflight duties, the instructor flight engineer went over the takeoff data and weight-and-balance computations with his three students. Soon the aircraft was all buttoned up and ready to go. The crew had the Huey's two engines started and the rotors up to speed in short order. Five minutes after takeoff, they were at the aux field. The student, who occupied the right seat, started out with a few normal approaches before the instructor gave him a number of simulated emergencies from the left seat, including single-engine work, prior to starting practice autorotation training.

The IP performed the first autorotation straight ahead as a demonstration and to check the aircraft's performance. He then turned over control to the student who made several additional straight ahead autorotations. After completing these, the instructor reviewed techniques for initiating the flare, because the student was starting it a little early, causing the airspeed to bleed off sooner and at a higher altitude than desired. But considering the student's training level, he was doing fairly well and making satisfactory progress.

Before moving on to turning autorotations, the IP demonstrated a regular turning approach and discussed techniques for preventing the rotor rpm from increasing too much while in an autorotative turn—a common tendency during that maneuver. The student then tried a turning approach to get the feel for the control inputs that would be necessary. Having no problems with the turning approach, the right-seater brought the aircraft back around to base leg and the IP gave the go-ahead for him to initiate a right turning autorotation. A slightly late entry into the turn caused a small overshoot of the desired aim point. The student also tended to pump the collective pitch lever up and down causing the rpm to vary. But the fluctuations were all within normal rpm range. After the student recovered at a higher-than-normal altitude and with 15 to 20 knots forward airspeed the IP verbally critiqued his relatively high flare and rpm control. The right-seater again climbed to about 600 feet AGL and brought the Huey around to the same position on base leg for another try. He then lowered the collective, rolled the throttles to flight idle and banked the helicopter into a right descending turn. In trying to coordinate all the required control inputs the student pushed a little too hard on the right pedal, resulting in a slight right yaw and left sideslip. This contributed to another small overshoot. Because of a slightly higher-than-normal nose-up attitude caused by the application of aft cyclic, airspeed decreased from 95 knots at the beginning of the turn to around 60 to 70 knots as he rolled out at 300 feet. The left side-slip was still evident to the IP but the student was maintaining a 30-degree ground track correction back to the aim point. The rate of descent was high—about 2,500 feet per minute—and varied a little as the student attempted to control the rotor rpm by pulling up on the collective. This higher collective pitch setting caused a steady decay of the rotor rpm during the descent. Finally, when the low-rpm warning horn sounded, coupled with the still high rate of descent, the instructor took control of the aircraft. They were now only about 150 to 200 feet AGL and closing fast.

The IP rolled the throttles full open and bottomed the collective in an attempt to gain back precious rotor rpm before initiating the flare that would reduce the descent rate. This action, along with the flare, however, only increased rpm to approximately 94 percent and did not appreciably reduce the descent rate. Realizing that ground contact was imminent, he pulled maximum collective which lowered the rotor speed still further, slowed airspeed to about 20 knots and reduced the sink rate considerably. With such an abrupt control input, the aircraft yawed to the right and the instructor was unable to successfully counter it in time. A nose-high attitude produced by the exaggerated flare caused the helicopter's tail boom to strike the ground first, followed immediately by the tail rotor. Because they were still in a left sideslip the skids collapsed sideways when they hit, and the aircraft rolled over one and a quarter times before coming to rest on its left side. A fuel-fed fire started and the cabin was soon engulfed in flames. Fortunately all seven crewmembers escaped fast enough to avoid burns and suffered only bumps and bruises.

*The tail skid, centered in this photo, hit first.*

**Discussion**

It is clear that if the instructor had taken control of the aircraft a little earlier the mishap probably would not have occurred. But just pointing a finger at someone won't necessarily prevent a recurrence. What might prevent it, however, is figuring out *why* the IP waited as long as he did to take over. We also need to make sure we and those we fly with are aware of the conditions which, if not countered, are very likely to produce another accident like this one, perhaps with much


*Ground scars show the helicopter's crash path.*

more tragic results. Following are some of the factors which played critical roles in the sequence of events that led to the complete destruction of a perfectly flyable aircraft, and very nearly cost the lives of seven irreplaceable people.

**Rotor RPM Control**

Rotor rpm tends to increase during turning autorotations and if not monitored and controlled with up collective, can quickly overspeed. This, of course, becomes easier to control with practice but for a student unused to the aircraft it is a common problem. The IP emphasized the necessity for using collective to control rotor speed. The student over compensated in this case, but the instructor apparently felt they could recoup all of the lost rpm later on, possibly in the flare. As the rpm decayed, an additional problem may have been created. Loss of some tail rotor effectiveness caused by the low main rotor rpm may have accounted for at least part of the reason the IP was unable to straighten the aircraft and reduce the yaw and sideslip that caused it to roll over after ground contact.

**Rate of Descent**

With a field elevation in excess of 5,000 feet and a temperature above 85 degrees Fahrenheit, the density altitude was extremely high, contributing directly to the high rate of descent experienced by the pilots during the autorotation. The turning maneuver only increased the aircraft's descent rate through the relatively thin air.


**Airspeed**

To keep the helicopter from nosing over excessively when first entering the autorotation, the student used aft cyclic pressure. Because his airspeed was about 90 knots, this was a good technique. However, continued back pressure caused the airspeed to slowly bleed off. This, combined with the high rate of descent compressed the time they had to regain either airspeed or trade it for rotor rpm during the flare.

**Conclusion**

While these factors of rotor rpm, airspeed, and high rate of descent induced by high density altitude are by no means the only important problems facing the pilots, they do point up some of the common variables encountered every time we fly rotary-wing aircraft. Teaching others to control and coordinate these, along with numerous other inputs, is no easy task. But the parameters for safe flight, not to mention the laws of aerodynamics, are not waived just because a *student* is at the controls. Keeping this in mind may help you, whether you're an IP or not, to prevent a mishap that no one else in the cockpit is anticipating.