# HEIGHT VELOCITY CURVE for GYROPLANES

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"Deadman's Zone"! - An ominously descriptive term for the Height Velocity (HV) curve for rotorcraft. Helicopter pilots are drilled on this issue and the limitations it presents for helicopter operations. Most people think that helicopters can go straight up from the ground and straight down to a landing. They can, but you won't catch a lot of helicopter pilots doing this. Ever notice how most helicopters takeoff at hover height as they accelerate along the ground before climbing out. They do this to avoid "Deadman's Zone"!

What is the HV curve and why is it important to rotorcraft? The HV curve is an actual graph (Figure 1) that depicts the minimum combination of height potential energy and speed potential energy required to make a safe landing IF the engine is not available – if the engine QUITS! Or more accurately, it depicts the area of flight, combination of height and velocity, that should be avoided. The HV curve mostly applies if the engine quits. You might not ever get in trouble flying within "Deadman's Zone," but should we really take a chance with the engines we fly?

FIGURE 1
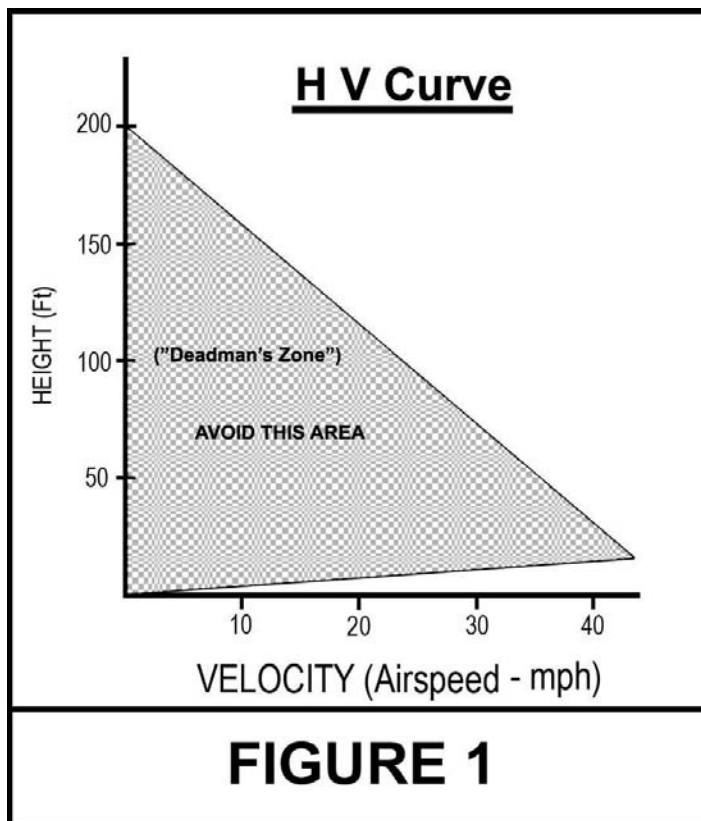
When you might see a helicopter takeoff straight up or land straight down, understand they are betting their lives on the engine(s) not quitting when they are within the HV curve – and they are in circumstances that absolutely require it! Some pilots have a pretty good bet IF their helicopter happens to have two engines or highly reliable turbine engines! But, if there is just one engine, and that engine might possibly quit on take-

off or landing, you will see most pilots maintain or attain adequate airspeed at lower heights until close to the ground – below the HV curve – on both takeoffs and landings! Pilot skill is also an important element in the risk equation pilots should be aware of if they are tempted to fly within "Deadman's Zone!"

In some helicopter applications and circumstances, you might see the pilot actually climb straight up or set down vertically in a clearing – but that is most often with helicopters that have reliable twin turbine engines – such as military applications.

HV curves also apply to gyroplanes – they have "Deadman's Zones" also! All rotorcraft require a sufficient amount of rotor RPM and airspeed to be able to raise the nose and make a safe "deadstick" landing. If the engine is not available to provide some of this landing energy, the rotorcraft – and gyroplane – has only its potential energies of height and velocity to use up for the required energy for a safe landing. Height is a form of energy – "potential" energy because you can convert height above the ground into landing energy of rotor RPM and airspeed. Airspeed is also a form of potential energy, and if there isn't enough airspeed for a safe landing, the pilot needs to increase airspeed by trading some height for additional velocity, or applying engine power. This is the rub! If the engine is not available, all the landing energy must come from the existing airspeed and any extra height the pilot can convert into more airspeed.

All rotorcraft have different HV curves. Figure 1 is a typical HV curve for a light 2-place gyroplane – but yours may be different. Heavier, and the curve probably starts at a higher height and requires a higher airspeed close to the ground. Lighter single seat gyroplanes might start as low as 150 ft, and maybe require only as little as 35 mph close to the ground – in order to make a safe landing if the engine quits there! Helicopters tend to have HV curves that start about twice the height above the ground as a similar gyroplane. A typical light helicopter might have its HV curve start at 400 – 500 ft above the ground. Because the HV curve of a gyroplane tends to be somewhat smaller than a helicopter, some people might be tempted to ignore the "Deadman's Zone" for gyroplanes – DON'T! If your gyroplane engine quits within the prohibited area of your particular HV curve, you might have a worse day than just an emergency landing!

How to use the HV curve – referring to **Figure 1**:

• If you are at zero mph, in a vertical descent, you must be at least 200 ft above the ground in order to be able to lower the nose and make a safe landing if the engine suddenly quit or was not available. The closer you are to penetrating this HV curve, the more skill it requires to trade the height you do have for adequate rotor RPM and airspeed to make a safe landing.
• If you are about 100 ft above the ground at approximately 25 mph, you have just barely enough speed and height energy in total to attain adequate landing rotor RPM and airspeed for a safe landing – if you do it right!