KAVAN 1979

AEROBATIC FLIGHT

BASICS AND REQUIREMENTS

Model helicopter aerobatics generate spectacular interest for the public and spectating co-modellers alike. They raise appreciation and respect. However, a well founded experience in helicopter flying, technical knowhow and a fine sense for the flying model, as well as an expertly prepared helicopter, is required for a successful performance.

Basically, the helicopter's movements and the control inputs needed for aerobatic maneuvers are quite similar to those of fixed wing aircraft. The longitudinal control corresponds to an elevator, roll control acts like ailerons, while the anti torque rotor replaces a rudder.

The largest difference must be seen in the different ways of lift production. While an inverted fixed wing remains more or less effective by reversing its angle of attack, an inverted rotary wing continues generating lift in a "downward" direction. Thus, inverted helicopter flight is not possible to be flown under full control. In principle, inverted movements can only be achieved by the motion energy of a movement which was initiated from an almost normal attitude. As it would lead to a hazardous loss of control, and cause negative loads in an inverted position, pushing the cyclic stick forward should be avoided.

Helicopter Preparation

In order to ensure the motion energy required for entering inverted attitudes, as much spare power as possible, should be available. Only a well broken-in, fine tuned Schnuerle engine fills the bill adequately. The fuel system has to deliver a foamless, bubble-free supply to the engine in any possible flight attitude and G-load. You should use our "Expert" Main Rotor Blades, art.no. 3040 for aerobatics. Their larger width adds to the aerodynamic efficiency and control response, while improving the stall characteristics under extreme loads and velocity. Of course, you built and prepared them with great care, and according to the instructions. Experts recommend reinforcing the root section with 4" wide glass tape prior to gluing the hardwood grip doublers. Thus the blades will easily withstand extreme centrifugal forces due to excessive RPM.

Replace the aluminium stabilizer paddles by our Wooden Paddles, art.no. 3318a.

For added rigidity of the main rotor head, wrap the main rotor shaft with electric tape in order to "thicken" the slid-on rubber damper. A new damper piece (Rubber Damper, art.no. 3326 N) out of harder rubber material, and with a tapered bore, is used for stiffening the rotor head on the rotor shaft. This contributes to a better cyclic response, desirable for aerobatic flying. It is an optional extra. Now the bolted-on Hub, art.no. 3301 will be stiffened on the shaft considerably. The entire airframe will follow any rotor movements more directly. This calls for a well set-up and accurately balanced rotor.

Adjust the engine/rotor system so that the engine reaches its full RPM potential during hovering and fast forward flight, and shows no audible signs of RPM decrease on rapid application of collective pitch. Possibly a slight decrease of the rotor blade incidence might be necessary. Maximum RPM at the tail rotor should peak about 5,500 RPM.

By placing the control rods in the outer holes of the cyclic servo disks, maximum control throws are obtained.

Recheck all control rods and ball links for excellent condition; replace parts that appear to be worn or damaged. Carelessness, being barely tolerable for normal flight, will lead to malfunction under aerobatic loads.

A slight nose heaviness will aid in the helicopter's ability to return to normal flight should control be lost when inverted. Shift the power pack or add lead ballast if required.

Flying Preparation

During several flights get accustomed to the now considerably more responsive, "snappy" helicopter. Frequently fly at 100 - 150 feet, to get used to the model flying fast in a relatively large vertical distance. Perform diving and climbing turns, gradually becoming steeper and faster. Practice entering loops by pulling up out of shallow dive. Upon reaching an almost vertical attitude, rotate it 180° by anti-torque deflection. Return the same flight path down, and recover smoothly. On the diving portion you will notice the now unloaded rotor system and engine speeding up audibly. Avoid an excessive RPM gain by retarding the throttle/pitch to about 50% stick travel. Also avoid excessive airspeed, because any helicopter becomes unstable longitudinally, tending to pitch up uncontrolled. In practicing those loop entries and exits, tighten and steeper from time to time, you have taught yourself neat wingovers and stall turns.

The Loop

Have the model climb to about 150 feet height, and initiate a shallow dive with about three quarters power. Pull it up smoothly, and hold back pressure (about 80% of the full cyclic deflection). Do not release it when passing through the inverted attitude! On the diving semicircle retard the power/pitch slightly. Be ready to increase the cyclic back pressure even more when flying through the last part of the dive (from about 270° on), in order to exit the loop at the entry height. Release the stick in time to prevent another climb-up. The pitch-up tendency of the fast helicopter will lead into it. Here, the Horizontal Stabilizer Control Set, art.no. 3079 should be pointed out; this control set connects the horizontal stabilizer, in an elevator-like manner, to the nick servo. It will aid in aerobatic flying, especially on the pull-up phase of loops.

The Roll

Start like you did for the loop. Enter a shallow dive to build up airspeed. Attain a 10° pitch-up attitude briefly without losing airspeed, and quickly apply full left cyclic - any helicopter rolls easier towards the retreating rotor blade. Hold full left until return to the upright attitude. By no means push the stick forward when passing through inverted. Instead of saving height, like you did with a fixed wing, you would decelerate the chopper which then might become sluggish on the controls, stop rolling, and rotate out of its original directions. It even might stay on its back, becoming completely uncontrollable. Just keep the cyclic stick full left. Neutralize in time when the model approaches the level attitude again. Rolls are not that difficult, are they?

Combined Maneuvers

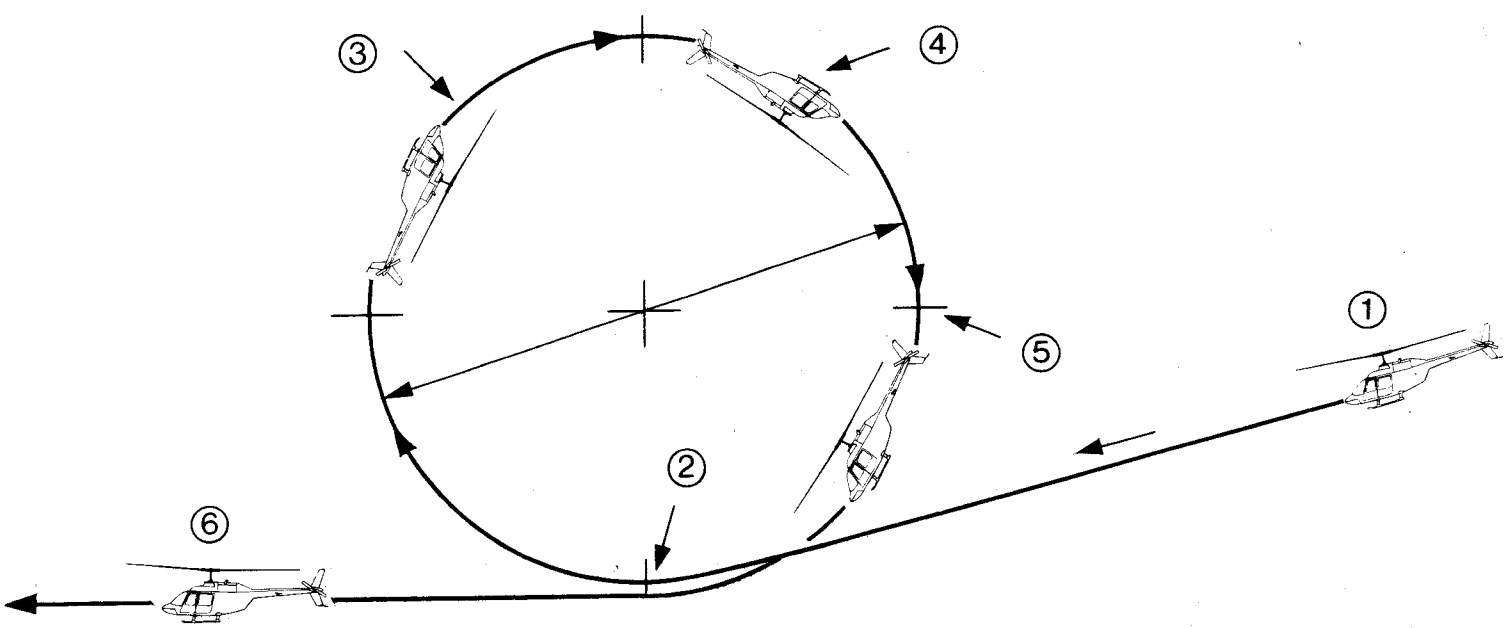
After practicing and exhibiting the prestigeous basic aerobatics loop and roll, you will start combining them to form a split S (watch our for the speed and RPM building up rapidly), an Immelmann (enter with high speed, start the half roll on time), and even the Cuban eight (maintain minimum safe height).

Becoming skilled and confident, you will gradually develop your own flying technique, exceeding what was described here. The aim of our advice can only be to provide the basic knowledge for your first loops and rolls.

Always fly safely, keep the security of your spectators in mind! Execute your aerobatic flying only over open areas, clear of people!

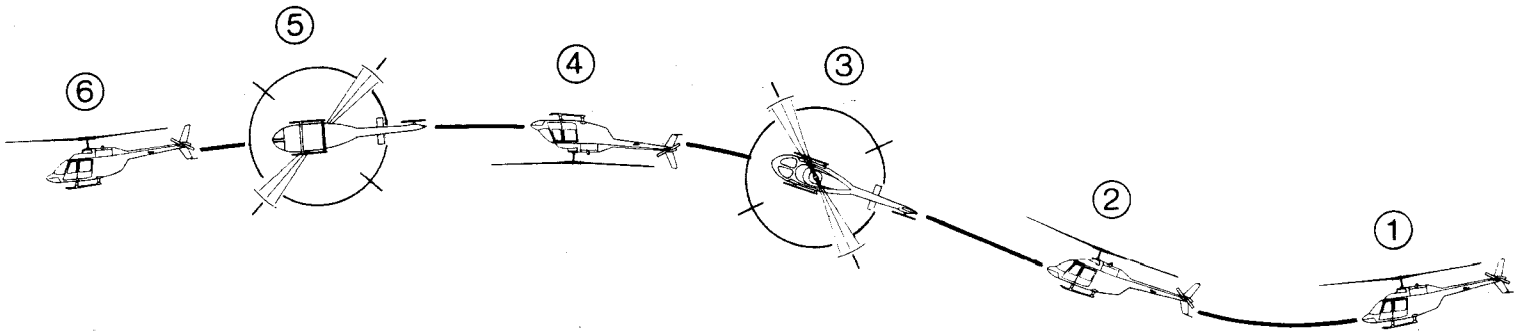
K A V A N

L O O P



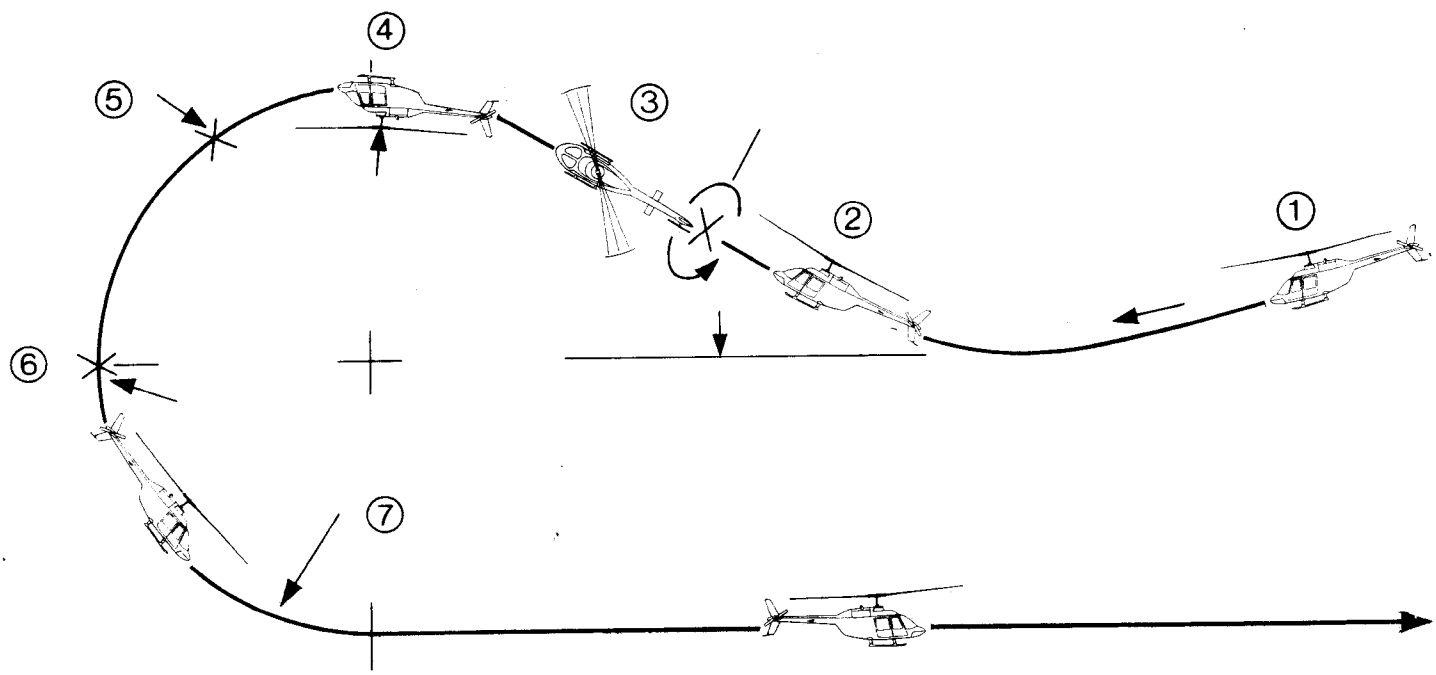
1 80-90% top speed
2 pull cyclic smoothly to app. 80%
3 maintain cyclic back pressure
4 reduce power to app. 50%
5 increase cyclic back pressure
6 neutralize cyclic, prevent from climbing

ROLL



1 80-90% top speed
2 10-20° pitch-up altitude
3 full left cyclic
4 do not push cyclic!
5 maintain full left
6 neutralize cyclic, correct the altitude

SPLIT-S



1 80-90% top speed
2 20° pitch-up altitude
3 full left cyclic
4 neutralize cyclic, pull back gently then
5 reduce power
6 increase cyclic back pressure
7 neutralize cyclic, prevent from climbing