TIE ME AIRCRAFT DOWN, SPORT

Tie down tips to keep your aircraft secure

Of all the skills pilots learn, tying down an aircraft at the end of a flight is one of the simplest. It's surprising, then, that a casual inspection of just about any flight line will reveal such a variety of techniques – some effective, some not.

Unsecured: Reports of storm damage to unsecured aircraft often exceed $50,000

Ineffective tie-down can cost you thousands of dollars in aircraft damage. Even moderate winds can cause an aircraft lift and hit the ground with damaging force. In high winds the damage can be severe. Reports of storm damage to parked aircraft exceeding $50,000 are not uncommon.

To secure your aircraft, park it as close as possible into the prevailing wind and tie it down. The spacing of tie-downs should allow for ample clearance between aircraft. This is generally equal to the major axis (wingspan or fuselage length) plus 3 metres. Use wheel chocks rather than rely on the aircraft's parking brake, particularly if the aircraft is to be left for more than an hour or so, or if the brakes are still hot from a hard application. Most light aircraft brakes are hydraulically operated and they can lose effectiveness for parking as a result of fluid temperature changes. Also, if you set a parking brake with a still-hot brake rotor it could cause warping of the rotor on some types.

Installed cables: Many aerodromes have installed tie-down or mooring cables made of wire rope with U-bolt anchors along their lengths, and fastened at each end. To use a tie-down cable, position the aircraft so the underwing tie-down points are directly over the cable, place your tie-down line vertically between the aircraft and the cable. This kind of vertical anchor significantly reduces the impact loads that can occur during gusty conditions.

◆ When strong winds, storms or cyclones are forecast, the best defence is to get the aircraft into a hangar or fly it out of the area altogether (if it is safe to do so).

You can secure the line to the wire with a clove hitch and then attach the line to the aircraft's tie-down point with a bowline. The clove hitch is strong and easy to untie and is suitable in this case because it is strong under tension. You should tie the vertical line under tension raising the cable slightly off the ground.

Chains alone should generally not be


Mike Smith

used as tie-down lines as they lack elasticity. They are good, however, when used with wire rope cables because the flex in the wire rope absorbs a lot of the impact load in gusty conditions. Use straight link chain with a round-pin shackle or a carabineer at each end. Secure the chain by looping it through the tie-down point so the chain itself takes most of the load.

If fixed cables or tie-down points are not available you should picket your aircraft to secure it.

When strong winds, storms or cyclones are forecast, the best defence is to get the aircraft into a hangar or fly it out of the area altogether (if it is safe to do so). If you need to secure an aircraft outside in these conditions, there are some additional precautions that can minimise damage. Start by making sure the fuel tanks are full to increase the aircraft's weight. Floatplane owners might consider partially flooding the aircraft's floats.

You should try to find a sheltered place to do this, such as the lee of a building or belt of trees. Ask the locals, as they should be able point out the most protected areas. If a sheltered place cannot be found, think about parking a truck or tractor in front of the aircraft, and use it as an extra tie-down point.

The aerodynamic effects of strong winds can be reduced by the use of spoiler boards secured span-wise along the top of the wing about a third of the way back from the leading edge. These can be made from lengths of 50 x 50 mm softwood with some foam rubber or carpet glued along the side that will be in contact with the aircraft surface. Position the boards and hold them in place with some nylon cord or bungee straps.

If your aircraft has been parked outside during a storm you should take care with your pre-flight inspection. Look for any structural damage around control hinges or wing skins at points where high loads collect. Check all hinges and controls for unusual slackness.

Tie-down kit: There are many occasions when a permanent tie-down fixture is not available, so you might like to consider getting a portable tie-down kit made for you, or making one yourself.

To make a kit, cut a Star® Post into three 400 mm lengths and grind a point onto the two that don't have points, matching the profile of the factory supplied point. Drill a hole in the top section of each picket and use a D shackle to secure the line. To make up a portable tie-down kit, place the above items in a sturdy drawstring bag along with a 1 kg mallet.

The Star® Post is very strong and is easily driven into even the toughest ground. If you pull them back and forth a few times they will pull out of even the toughest ground easily.

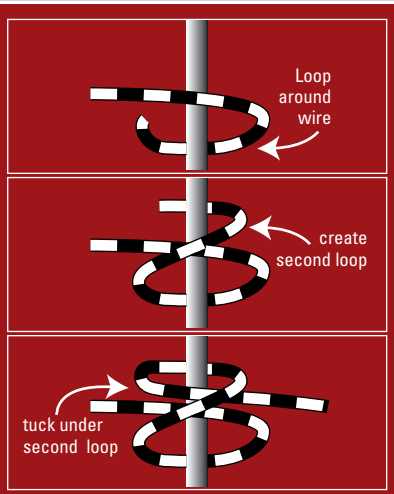
Another very effective tie-down design consists of a triangular piece of steel plate (around 6-8 mm thick) with three holes drilled in a triangular pattern and with a U bolt attached inside the triangle for attaching the line. The plate is fixed to the ground by hammering steel pins made from 7 or 8 mm thick rod and at least 400 mm long through the holes at an angle.

If you use this kind of system, arrange it so the pull is not straight up – angling the tie down points increases their resistance to being pulled out of the ground.

Commercially available screw-type tie-downs look, at first glance, like they might do the job. They work well in grass-cov-

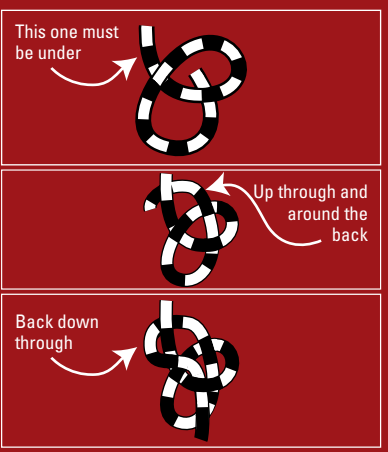
KNOT KNOWLEDGE

CLOVEHITCH



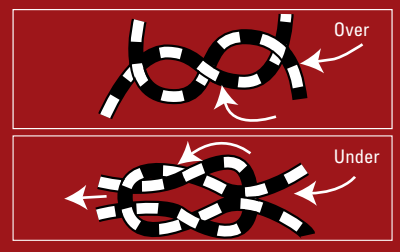
To tie the line to a wire use a clovehitch. You can add one or two half hitches on the standing line for a more secure attachment.

BOWLINE



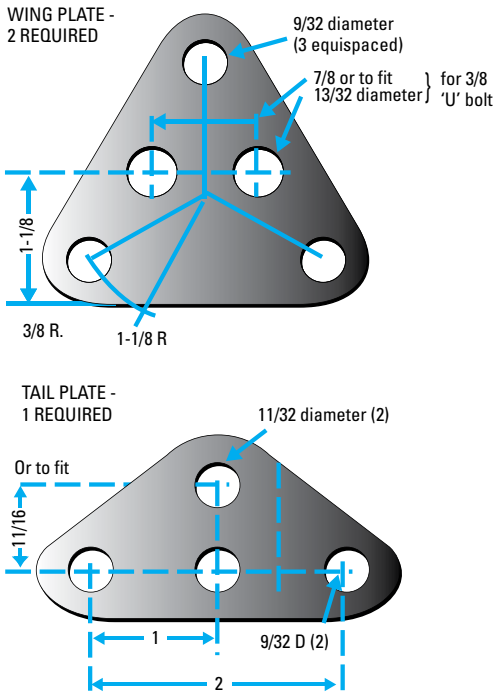
The bowline can be used to attach a line to an aircraft tie-down point. It has a tendency to work loose, so you might like to add a "stopper knot".

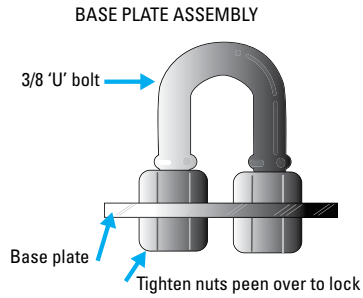
REEF KNOT



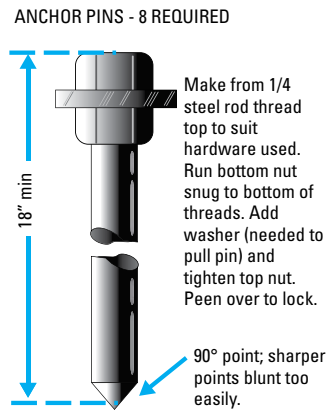
The reef knot will not jam, so it is always easy to untie. A useful alternative to the bowline for attaching to an aircraft tie-down point.

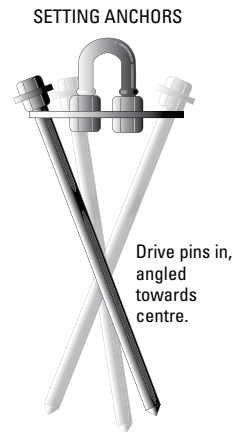
TIEDOWN BASEPLATES (make from 1/8 steel)





While requiring more effort than a star-post anchor, this do-it-yourself anchor is strong, lightweight and easy to use. They are easily made from 1/8 inch (3.175 mm or greater) steel plate and 1/4 inch (6.35 mm or greater) steel rod.





ered sandy ground, but are almost impossible to screw into the harder ground that is so common at Australian aerodromes.

Knot on: The choice of ropes is important too, as is tying good knots. For single-engine aircraft, tie-down ropes should have a tensile strength of 1,500 kg; 2,000 kg is recommended for light twins. The best ropes to use are ultraviolet resistant braided nylon or Dacron. Manilla and hemp ropes are generally unsuitable as they deteriorate easily, especially in damp conditions. The most suitable knots are the bowline, clovehitch and the reef or square knot as illustrated.

There are differing opinions as to whether tailwheel aircraft should be tied down tail into wind. Remember, aircraft are designed to meet airflow head-on, and control surfaces can easily be damaged if control locks are not in placed when aircraft are parked tail into wind.

Tailwheel aircraft also have a tendency to turn into the wind. Therefore, if your aircraft is parked that way (and not properly secured), it could be blown over as it is rotated into wind by a sudden gust.

Aeroplanes should be tied down with only 20 or 30 mm of movement in the ropes. Too much slack allows the aircraft to jerk against the ropes, which could cause structural damage or pull the stakes out of the ground. Tie-downs tied too tight can impose inverted flight loads that many aircraft are not designed to withstand.

On tricycle undercarriage aircraft, secure the middle of a length of rope to the tie-down ring under the tail section then pull each end of the rope away at an angle of 45 degrees and secure to your ground anchors. If extreme weather is expected, tie down the nosewheel as well.

No matter how long you're leaving your aircraft, it's vital the controls are protected from the wind with proper control locks. Locking the control column (and rudder peddles where possible) is generally adequate for short-term parking.

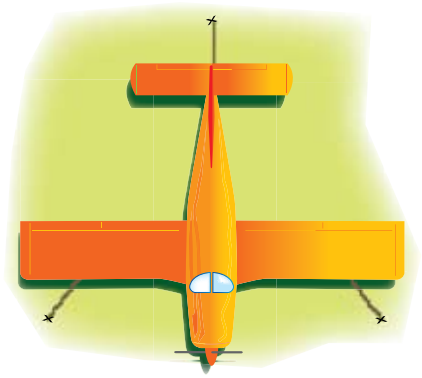
Longer term you should consider the external types of control surface clamps which provide improved protection for the control surfaces and limit the loads placed on cables, pulleys, bell cranks, rods and brackets which make up the control system.

Finally, make sure you include the tiedown kit in your weight and balance calculations and that it is well secured in the aircraft before flight.

Remember, for the protection of your aircraft, and those parked around you, always tie your light aircraft down. It's not only a sensible measure against the weather, but it can help secure your aircraft against other aircraft pilots who might inadvertently have their prop driven machine with the wind blast pointing straight at your pride and joy.

Adapted and updated from an article that first appeared in Vector, September-October 2001.

SPREAD THE TIEDOWNS



Spread out: Spread the tiedowns so pull in not straight up. You will need longer ropes, but angling the tiedown points will increase their resistance to being pulled out of the ground.