

## HAND SWINGING PROPELLERS

This is a subject that most people approach with some trepidation – with good reason. It is potentially dangerous! The fact is however that sooner or later you will be required to or asked to hand swing a propeller to start an engine with a flat battery or with no starter at all.

For those who entered the flying scene before the 80's, prop swinging was taught as a matter of course at aero club level as there were still many aircraft without starters. Since then, the subject would appear to have been dropped as a formal part of training.

We are going to introduce you to methods and procedures which will minimise the risks with prop swinging and give you the confidence required to carry out this function safely without damage to yourself or the aircraft.

### ***The aircraft***

The aircraft should be on a flat level surface with the main wheels chocked and parking brake on so it is restrained from moving forward.

Ensure that the aircraft is placed so it will not blow over any other aircraft or blow dust or debris into any hangar or building.

The cockpit should be occupied by a person rated on the aircraft and familiar with the brake system (if fitted), fuel system, and engine controls.

### ***The prop swinger***

Must be familiar with the aircraft and engine. This is essential as some engines have magnetos and others have electronic ignition. These systems react differently when the propeller is swung. Also, certain engines require a certain sequence to be observed while starting.

Must not wear loose clothing including scarves or anything hanging around the neck that could become entangled with the propeller.

Must wear secure footwear which will ensure that the prop swingers footing is not lost. Jandals. Thongs etc. are OUT!

Must ensure that the ground they are standing on to swing the prop is flat, firm and not slippery.

***Basic prop swinging procedure***

Your guarantee of personal safety requires you to clearly state your intentions and actions to the pilot or person occupying the pilots seat in the aircraft. Whatever instructions you relay to the pilot **MUST** be repeated to you correctly **BEFORE** you carry out any action.

**REMEMBER THAT ALL PROPELLERS MUST BE TREATED AS BEING 'LIVE' AT ALL TIMES!**

If you intend to use two hands to swing the blade, position yourself squarely in front of the propeller blade you intend to swing. If you intend to wing the blade with one hand, position yourself at 45° to the blade bearing in mind that certain engines rotate clockwise and some anti-clockwise from your perspective.

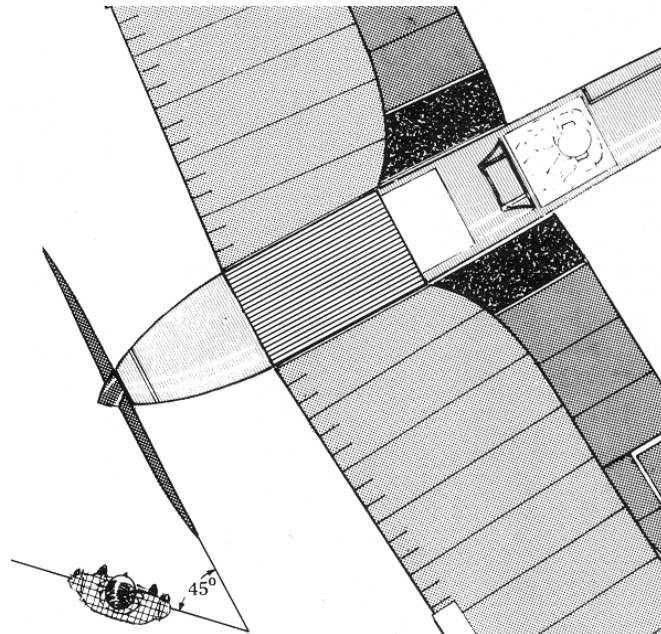


Fig.2.5.1 For a single hand swing stand at 45° to the propeller

After ensuring the ignition is OFF, move the blade forward until compression is felt.

Position your hand(s) on the face of the blade at least 2/3rds out from the hub ensuring that you do NOT WRAP your fingers around the trailing edge. You may allow your fingers to curl slightly around the trailing edge to gain extra purchase.

After ensuring that the throttle is set and the ignition is ON move the blade smartly down through the compression while **stepping backwards at the same time**. This action will ensure you have created a safety zone between you and the propeller should the engine fire.

The reason you do not wrap the fingers around the propeller trailing edge is because the engine may kick back taking your fingers with it before your hands can clear the blade. If you curl your fingers as suggested, if the engine backfires, your hands will still fly clear of the blade and not cause any damage to yourself - maybe a little tingling in the fingertips.

Why would the engine kick back? Some engines have ignition systems that are set as far as 31° before top dead centre (BTDC) and, if the blade is not swung fast enough, the engine will fire before the propeller blade has passed through the compression. On most certified light aircraft, the engine designer has fitted an ignition retarding device in the form of an impulse coupling on the magneto(s) to ensure that the engine will not fire before it has passed through its compression. Engines fitted with an impulse coupling are much safer to swing than those without.

NEVER TURN YOUR BACK ON A PROPELLER! The engine may start with a surge of power, jump the chocks, or the aircraft brakes may not hold. If you turn your back on the propeller you will never get the chance to avoid death or maiming.

### ***A typical starting procedure***

This procedure will suit most engines with some variations due to ignition and fuel systems.

#### **Normal start**

- Prepare the aircraft for starting – position – security – pilot in cockpit. Swinger suitably clothed and shod and on good flat firm ground.
- **Swinger** – FUEL ON – SWITCHES OFF – THROTTLE CLOSED
- Pilot checks fuel is on, engine is primed (choke set), ignition switches are off and the throttle is closed and replies – FUEL ON – SWITCHES OFF – THROTTLE CLOSED
- **Swinger** – THROTTLE SET - CONTACT
- Pilot sets the throttle and turns on the ignition and replies – THROTTLE SET - CONTACT
- **Swinger** positions him/herself and swings the blade through one compression (multiple compressions if the engine has a gearbox) or more if the engine does not start at once. Remembering to be on firm footing and to step back each time the blade is swung.

If the engine has not fired there are two possibilities.

- There is not enough fuel; or
- There is too much fuel and the engine is flooded.

If the former is true, carry out the start sequence again as shown above.

If the latter is true, the excess fuel will have to be expelled before the start sequence can be repeated.

**Flooded engine procedure.**

- **Swinger** calls SWITCHES OFF – THROTTLE WIDE
- Pilot turns the ignition switches off and opens the throttle wide and replies SWITCHES OFF – THROTTLE WIDE
- **Swinger** positions him/herself in front of the propeller and proceeds to turn the propeller BACKWARDS at least 8 blades for a four-cylinder engine. Remember to treat the propeller as LIVE at all times.
- At the end of this sequence, the standard start drill can be repeated.

All this might seem pedantic to you but without due care, and the challenge and response system, there is a real danger that you could be hurt so don't take any shortcuts.

There have already been fatalities in New Zealand swinging propellers without observing the basic safety procedures and many fine aircraft are badly damaged or destroyed by persons taking shortcuts with the procedures.

***Problems with single seat aircraft***

Many accidents happen with single seat aircraft where the pilot can get no assistance to start and therefore does it him/herself. This in itself is not a problem providing the pilot takes certain precautions to ensure the continuation of health and well being.

When acting alone, the following precautions should be taken when swinging a propeller;

- Always secure the aircraft with chocks, to a nearby fence, or to a stake in the ground.
- Tie the elevator control in the UP position with the seat belt to ensure the tail does not rise off the ground when the engine starts (tailwheel aircraft).
- Be ultra aware of the propeller. Without assistance any accident could rapidly turn nasty.

***Pusher propellers***

Hand swinging pusher propellers poses new problems when it comes to handling the propeller blades. Due to accessibility problems the swinger can be faced with swinging the propeller from the back of the blade. Due to the shape of the blade from this angle, the swinger is forced to curl the fingers around the trailing edge of the blade. Any backfire would be extremely painful if not damaging. I would strongly recommend that if the engine does not have magnetos with impulse couplings, hand swinging from this position should not be attempted.

***Never do these things***

1. Never change your challenge and response system. Any confusion between the prop swinger and the pilot can cause a dangerous situation. i.e. if you are using the word 'Contact' to indicate that the ignition is on, don't change to 'Switches ON'.
2. Propeller swinging can be quite a strenuous exercise to the extent that some people tend to raise one foot/leg off the ground to gain that extra leverage. DON'T DO IT! People have lost their foot in this way after losing balance.
3. Never turn the propeller through a compression without treating it as being LIVE. This goes for propellers of aircraft in the hangar. Treat ALL propellers as being live. It only takes a faulty magneto earth (P) lead to be faulty to make the magneto live all the time.
4. Never attempt to swing a propeller on an aircraft that has not been chocked or secured.
5. Never ask, or expect, a person who has had no training to swing your propeller for you.

**Notes:**