DEC 2024

UK Civil Aviation Authority

WINTER
FLYING

SAFETY SENSE

SS03

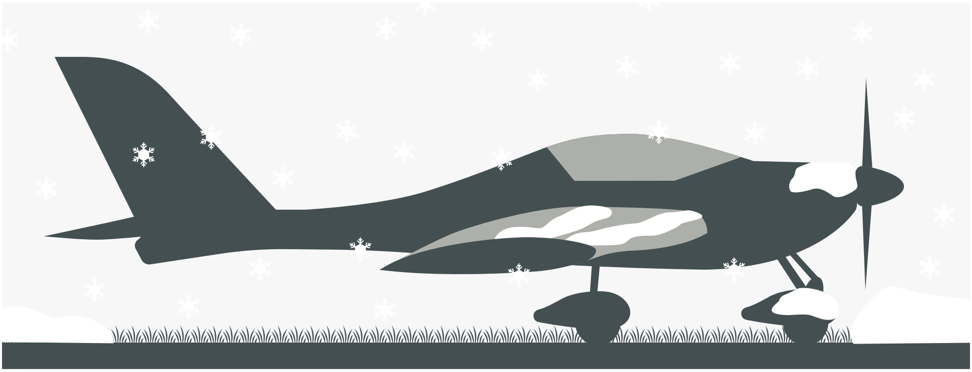
YOUR SAFETY SENSE LEAFLET FOR:
WINTER FLYING

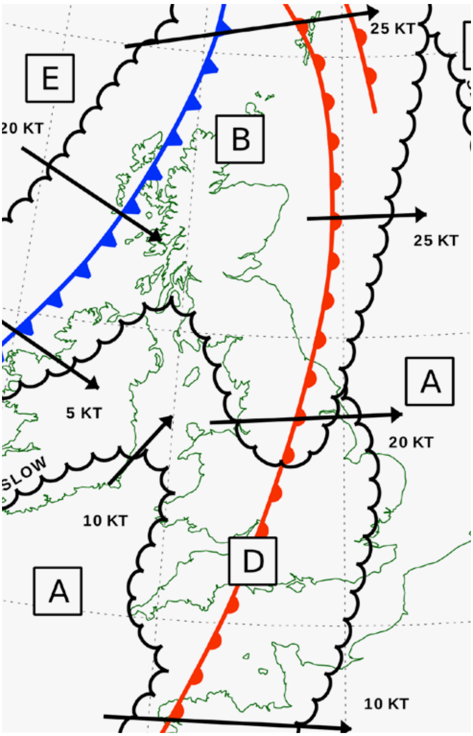
This leaflet is intended to provide guidance on common issues associated with flying light aircraft during the winter, including weather systems, aircraft preparation, operations on contaminated surfaces and flight in icing conditions.

Table of contents

WINTER FLYING

Winter weather





Winter may bring different weather challenges and rewards for GA flying. Colder temperatures and more precipitation bring icing, snow and fog. Weather systems such as depressions will bring low cloud, rain and high winds. But winter can also be a time of stable conditions – crisp mornings, clear skies and good visibility.

One challenge of the UK flying environment is the changeable nature of the weather – as different air masses and weather systems approach, periods of mild temperatures can give way to colder ones. The stability of the weather can change rapidly.

You are encouraged to employ the principles of Threat and Error Management (TEM) when making weather-related decisions. TEM is about awareness of threats and considering plans to mitigate the associated risks. Identifying weather related risks and now to manage them is a fundamental part of good airmanship.

Such understanding and preparation will increase your chances of successful flying and will help to reduce the likelihood of encountering unanticipated weather conditions.

WINTER FLYING

Weather information

The Met Office is designated by the CAA Met Authority as the provider for regulated aviation weather information in the UK. Pre-flight planning should, as a minimum, include reference to regulated aviation meteorological products and information - forecast services for GA are made freely available on the Met Office Aviation Briefing Service webpages.

Other sources and platforms that disseminate weather information for aviation can be useful supplementary tools, but it is important to understand the difference between CAA regulated aviation meteorological products and unregulated sources.

Users should understand the accuracy and validity of the information being reviewed and whether or not data is derived from a regulated forecaster or directly from computer models.

The objective is to have an overall understanding of the weather systems present on your flight and what conditions you are likely to encounter.

For VFR flights, reviewing a good selection of TAFs and METARs is essential and the F215 (Low-Level Significant Weather Forecast) chart remains an excellent source for gaining an overall understanding of forecast weather conditions over the UK.

Surface pressure charts will also give a good indication of how the weather will evolve over the next 72-hour period.

For IFR flights, particular emphasis should be placed on the nature of the clouds present, the freezing level and takeoff and landing minima. Know your forecast requirements under UK Part-NCO for approach and alternate planning.

CAP 1535 – The Skyway Code contains a section on meteorology which provides further guidance on the information available to pilots for pre-flight planning, icing and 'making the weather call'.

TAFs and METARs

It may be worth refreshing your knowledge of some common winter TAF and METAR codes and reporting parameters:

SN	GR	GS	BR	FG
snow	hail	snow pellets	mist	fog

Fog is reported when the prevailing visibility is less than 1000m. Between 1000m and 5000m it will be reported as mist. Descriptions such as Shallow (MI) and patches (BC) can also be used with FG to further specify the type of fog. For more information on METAR codes see CAP 746 (Requirements for meteorological observations at aerodromes), Chapter 4.

! Note: Since 05th November 2021 runway state is no longer included in METARs. Where applicable, runway state is now reported by aerodromes using the new ICAO 'Global Reporting Format' (GRF), which is a standardised format for reporting runway conditions. See p.15 for more details.

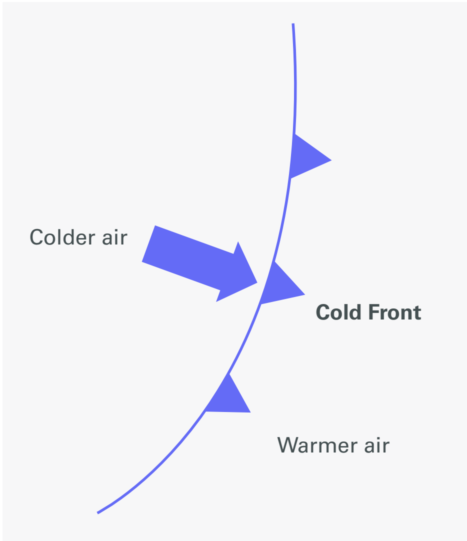
WINTER FLYING

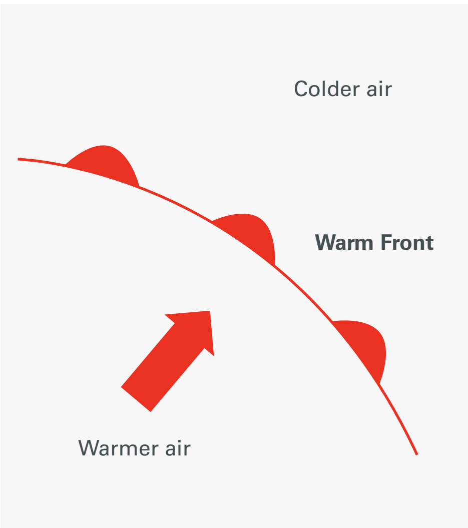
Weather systems

Cold Fronts

Cold fronts will normally bring cold and unsettled weather. Showers and even winter thunderstorms are likely at the leading edge of the front. Visibility tends to be good, but the weather will be changeable, with sudden drops in visibility likely as rain or snow clouds develop. Temperature, wind speed and direction may change rapidly as the front passes, particularly if it is interacting with warmer air. After the passing of the front the weather will likely be unsettled for a while, but good flying can often be had in the clear air left behind.

Be cautious as further showers and high winds often follow after the cold front has past. Any rainfall may subsequently freeze overnight as the temperature falls. As the wind drops and the skies clear, overnight radiation fog also becomes likely.





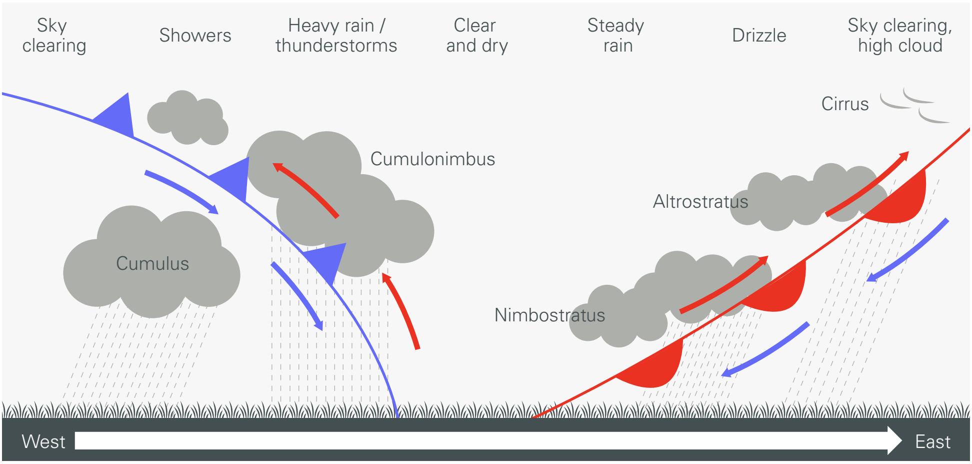
Warm Fronts

Warm fronts in the winter tend to bring mild weather, typically stratus cloud with rain. Flying conditions may be reasonable under a weak warm front but watch both the cloud base and visibility as they will lower significantly as the leading edge of the front passes at ground level.

WINTER FLYING

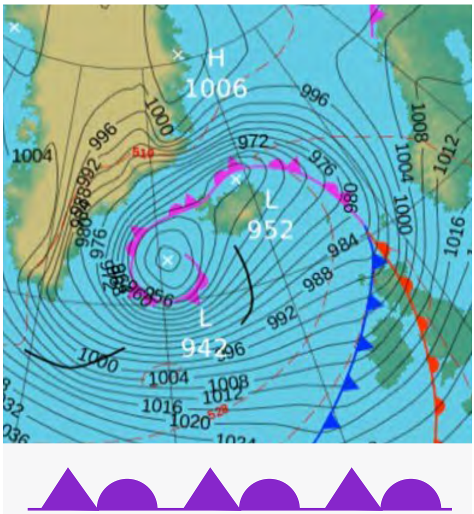
Weather systems

Depressions



A common weather system during the UK winter is the 'Depression' – this is an area of low pressure, with fronts of cold and warm air circling around it. These systems mainly form over the Atlantic before moving east towards land. The warm front comes first, the signs of which will be a lowering cloud base, mild weather, some precipitation and strengthening winds. The pressure will start to drop and continue to do so until the warm front passes. The cold front then brings lower temperatures, showery precipitation and gusty winds.

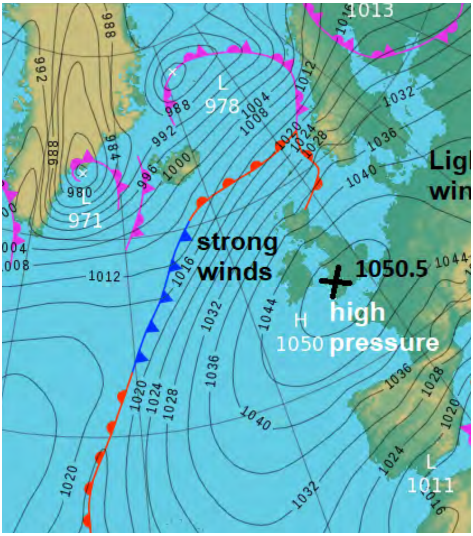
Often by the time it reaches the UK, a depression will have started to 'occlude', whereby the cold air behind the warm starts to lift the warm air above ground level. This starts at the centre of the depression and moves along the leading edge of the warm front. The occluded part of the depression tends to be slower moving but also brings low cloud and precipitation.



Occluded Front

WINTER FLYING

Weather systems



High pressure

Winter can often see periods of high pressure and associated stability in the atmosphere. Areas of high pressure are known as 'anti-cyclones' and elongated areas as 'ridges'. Temperature inversion layers will tend to form and fog may be more persistent. When the pressure is high, air descends slowly in the atmosphere, so fewer clouds will form and those that do will be shallow. Sometimes a low and widespread blanket of stratus cloud will develop, as low-level rising air meets the inversion layer.

Although the weather will be stable, after a few days haze and smog will tend to build since particles in the atmosphere cannot escape in the normal way. Combined with low winter sun, this can severely reduce visibility, even if conditions may look pleasant from the ground.

Fog

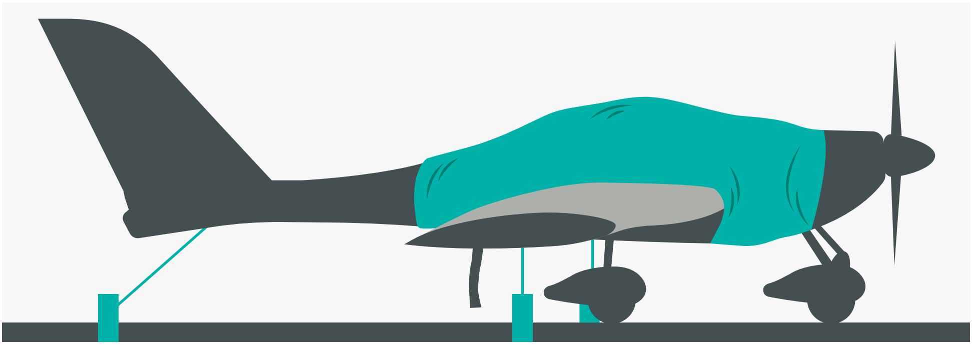
Fog can be persistent and difficult to predict. Most inland winter fog in the UK is 'radiation' fog, which is caused by the rapid cooling of the ground, normally after sunset. The loss of heat from the ground will tend to cool the air immediately above, reducing its capacity to hold moisture. A key indicator is the reported temperature and dew point comparison, if the difference is reducing, the likelihood is that mist or fog will occur.

Radiation fog tends to form under clear skies when the temperature is cold and the winds are light. Sometimes heavy rain that leaves a lot of standing water can encourage fog to form if the temperature subsequently drops. During the winter, fog is slow to clear, often taking much of the morning. Fog clearance is rarely uniform and can vary over small geographic areas or with elevation changes. If fog has lifted at your departure point, check it is not lingering elsewhere.

WINTER FLYING

Aircraft Preparation

Exposure to the elements



Keeping your aircraft in a hangar has advantages, but for many this is not an option. Most GA aircraft of metal construction can be kept outside year-round in the UK, provided they are suitably covered and secured. For aircraft made from other materials, particularly wood, life outside may not be suitable and could result in premature deterioration.

In the UK, there will normally be several winter storms each year with sufficiently high winds to move and damage unsecured light aircraft. Using tie-downs is advisable, but ensure the design is likely to withstand the weight of the aircraft being lifted by high winds.

Small blocks of concrete or water tanks are unlikely to be heavy enough to provide much resistance to the aircraft's weight. Covering the wings may reduce the lift generated by high winds and reduce the likelihood of the aircraft moving. Monitor the weather forecast and check the aircraft is as secure as possible before periods of high wind.

A good quality cover that protects the main body of the fuselage is recommended – this will reduce rainwater ingress through door seals and other vulnerable areas. However, even modern breathable covers may result in condensation build up underneath. If the aircraft is not used regularly, remove the cover from time to time to allow any moisture to dissipate and the inside of the cover to dry out.

Apertures such as air intakes, vents and the pitot/static system are vulnerable to water ingress, which may freeze during flight.

Aircraft are often flown less in the winter, making it more likely that insects or birds take up residence. Cover as many potential risk areas as possible and pay extra attention during preflight checks to ensure nothing is blocked.

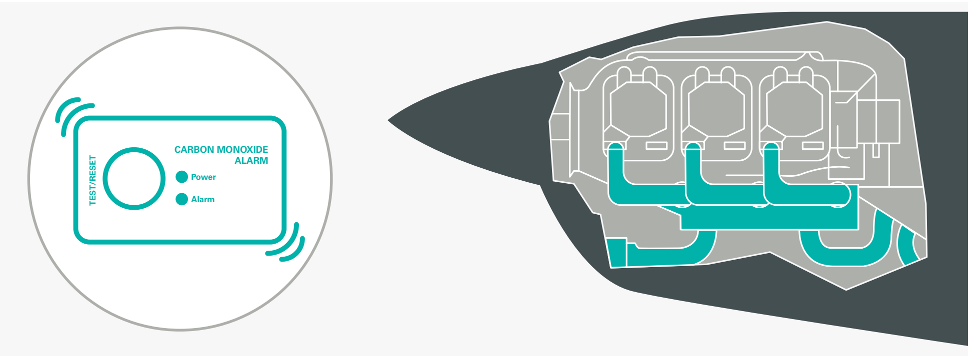
Items such as pitot tube or static port covers should be designed to be highly visible. Control locks, either internal or external, are recommended. Ensure everything is removed before flight.

WINTER FLYING

Aircraft Preparation

Maintenance considerations

Consult any guidance in the aircraft flight manual (AFM) or maintenance manuals regarding cold weather operations. Some aircraft will have specific winterisation procedures. An overall winter health check is sensible to reduce the likelihood of issues.



Heater checks
An important check for piston engine aircraft is the cabin heater system – this normally uses exhaust heat and can be a source of carbon monoxide poisoning if the heat exchanger leaks exhaust gases into the cabin. This may go unnoticed during the summer when the cabin heat or demist vents may not have been used.

Check that hot air comes from the heater as intended – the demist function could be vital with a windscreen covered in ice or condensation. A visual inspection of the exhaust and heat exchanger should spot obvious cracks or holes, but a pressure test is recommended to ensure there are no smaller leaks that may not be visible.

A smell of smoke/fumes in the cabin and/or a large drop in engine RPM when applying carburettor heat are often associated with an exhaust system requiring attention. The heat exchanger shroud may also show black, sooty deposits and discolouration, which should not be ignored. If the aircraft has a separate combustion heater, this could also be a source of carbon monoxide, so consider having it checked as well.

Ensure your maintenance inspection schedule includes a monitoring check of CO in the aircraft cabin during ground runs. Links to further guidance can be found in SSL 34: Carbon Monoxide Safety.

From January 2025, operators of piston engine aircraft are required to have a functioning active carbon monoxide detector on board when carrying passengers who do not hold a recognised pilot qualification. To facilitate compliance, the CAA allows both aviation standard and commercial-off-the-shelf (COTS) active CO detectors as an acceptable means of compliance. The requirement to have an active CO detector does not apply to some types of aircraft/operation – see SD-2024/001 for further details.

WINTER FLYING

Aircraft Preparation

Maintenance considerations

Deicing equipment
Check all boots, pads, demisters and fluid systems work as they should. Boots may have developed leaks from damage. If the aircraft is approved for flight in icing conditions, check all the equipment needed for approval is serviceable.

Batteries
For aircraft in a hangar, connecting an on-demand charger will help maintain battery condition. For aircraft stored outside, regular charging may not be possible unless you remove the battery. Consider charging periodically, for example a few days before a planned flight. If left outside in the cold for long periods of time, batteries will likely lose charge. Removing the battery and storing it in a warm location with a condition charger connected will preserve it for future use.

Oil and lubrication
Check that the oil grade in the engine is optimal for winter use, it may be that a different viscosity would work better in lower temperatures. Some oils are designed for engines that are run infrequently. Other lubricants, such as grease on moving parts, should be of an appropriate specification.

On some aircraft the oil breather pipe can be vulnerable to blockage by ice, check that it is clear and whether any winter modifications are advisable. The breather pipe will normally protrude below the engine. A blocked breather pipe will cause an excess of oil pressure and severe oil leak.

Some aircraft may need cooling restrictors to maintain optimum oil temperature in the winter, however this is rare for typical UK temperatures. Consult airworthiness documentation and ensure any modifications are approved for your aircraft.

Lower utilisation
Long periods of inactivity are not good for aircraft condition. Condensation or water ingress may cause internal engine and structural corrosion, fuel becomes stale and engine oil will tend to accumulate at the bottom of the engine casing, reducing lubrication on start up.

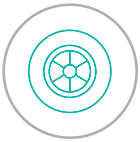
Fly the aircraft as often as possible. Running the engine on the ground from time to time is not recommended since the oil temperature may not rise to a level sufficient to eliminate condensation or provide optimal lubrication.

If not intending to fly the aircraft for long periods, it may be advisable to conduct storage procedures such as draining fluids and using corrosion inhibitors.

WINTER FLYING

Aircraft Preparation

Maintenance considerations



Undercarriage
Wheel fairings tend to trap mud and water, which may subsequently freeze and jam the wheels and/or brakes. It may be advisable to remove them, particularly if operating on grass. Check the applicable airworthiness procedures for removal and refitting.

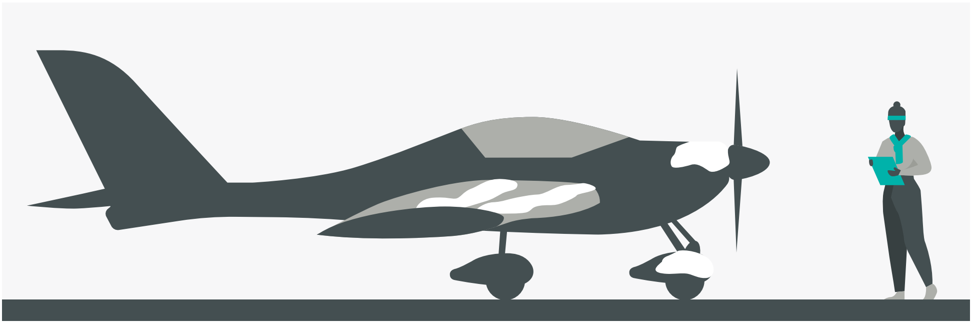
Aircraft with retractable undercarriage require consideration when operating with slush or other winter contamination since it can freeze and interfere with raising/lowering mechanisms. Inspect the wheel wells to ensure they are clear of debris before and after flight. Tyre pressures may fall with colder weather, so check for correct inflation.

Control cables
Control cables may need adjusting as slight contraction may occur in colder temperatures.

WINTER FLYING

Aircraft Preparation

Preflight checks



Ensure you wear **warm clothing** for the preflight check, you do not want to feel rushed and being cold will reduce your concentration on the task in hand.

Check the **aircraft is clear of frost** or other frozen precipitation.
See p.13 for guidance on removal.

Winter can bring **fuel tank condensation**, so pay extra attention to draining and examining the fuel to ensure no water is present. Deterioration of filler cap seals may allow rainwater into the tanks. Ensure all the **fuel drains work correctly and close** as they should. A moderate shake of the wings is sometimes required to dislodge any condensation present. Leaving the **fuel tanks full** will reduce the propensity for condensation to form.

Pay extra attention to the **pitot static system** and **activate any system drains** that may be fitted to the aircraft – this will reduce the likelihood of trapped water freezing in flight. Check that the **pitot heater** works correctly.

Consider making a **checklist of items** such as **tie downs, control locks and/ or different covers**, which must be removed before flight and reinstalled when securing the aircraft afterwards.

WINTER FLYING

Aircraft Preparation

Removal of ice and snow from the aircraft

Frost will likely form on aircraft parked outside during the winter months. Covering the aircraft will prevent this, although it may not be practical to cover all the wing surfaces.

If the aircraft lives outside, parking it in a location that receives direct sunlight most of the day will assist with the dispersal of frost. If the aircraft is in shadow, moving it into sunlight will melt small amounts of frost on the wings, but ensure the controls are free of any water that could refreeze. If there is still mist around, check that new frost is not forming – it may not be advisable to fly on such days.

Even aircraft in a hangar are not necessarily immune, if you put away a wet aircraft in an unheated hangar, the water on it may freeze overnight and be stubborn to remove the next day.

All surface frost, ice or snow must be removed from the aircraft before flight. Even a very light film of frost may reduce lift by as much as 30% and drag by 40%. 'Laminar flow' wings tend to be more vulnerable.

Small amounts of frost or snow can normally be brushed off using a broom or similar but be careful not to scratch the aircraft. Be wary of using a car style scraper on windows – aircraft transparencies tend to be more vulnerable to scratches than automotive glass.

Larger amounts of frost or water that has frozen on the aircraft will take longer to remove. The use of a deicing fluid will expedite the process and discourage new frost from forming. A ladder may be required for larger high-wing aircraft or if the tailplane is high up.

Ensure any deicing fluid used is suitable – for example products such as 'Kilfrost' are available in a form suitable for light aircraft. The best way to apply fluid is using a handheld sprayer with a capacity of at least several litres. If ordering deicing fluid at an aerodrome, 'Type I' fluid should be specified – other common ones such as 'Type II' or 'IV' are intended for larger aircraft, and at typical light aircraft speeds, will not disperse correctly on takeoff.

Note that 'Type I' fluids do not normally have a significant 'hold over' time – they will only stop new precipitation freezing on the aircraft for a very short period of time, if at all. Consult the technical data for the product used to understand its capabilities.

It is possible to remove frost and ice with hot water but be very careful to ensure the aircraft is dried afterwards and check no water has found its way into control hinges or other places where it could refreeze and cause issues in the air.

It is a good idea to have a selection of equipment to deal with frozen deposits on the aircraft such as brushes, ladder (if required), sprayer and some microfibre cloths or chamois to wipe off windows and dry the aircraft if necessary.

When making trips away, consider the weather forecast for overnight stays and whether you need to bring any deicing equipment with you, or what may be available at your destination. If you may need to remove ice the next morning, allow extra time for this.

WINTER FLYING

Aircraft Preparation

Engine handling

Most light aircraft engines are air-cooled and therefore vulnerable to the effects of rapid changes in operating temperature. Particularly in winter, power changes should be made in a smooth and linear fashion. Long periods at idle power, both in flight and on the ground, should be avoided.

Long warm up periods at low power are not necessarily good for an engine – the oil may not circulate well at low temperatures and carbon deposits on the spark plugs are more likely.

The AFM should specify minimum engine parameters for takeoff. If the engine stumbles when applying higher power, it may need more time to reach the correct operating temperature. In flight, monitor temperatures and pressures as normal and look out for excessively low oil or cylinder head temperatures.

Starting

Follow any AFM guidance on starting in low temperatures. Battery condition may be reduced in cold weather, so avoid running the electrics from the battery for any significant time before start. If the battery is weak or flat, starting with an external power supply may be necessary, so review procedures for this.

Starting by hand swinging the propeller may be an option, but not all engines/propellers are suitable for hand swinging, and you must be suitably trained to do so. Hand swinging should only be conducted with someone at the controls and on level ground that is not slippery. If your aircraft is designed for starting using an external power source, this may be safer.

A common issue with starting in cold weather is over priming – if an engine does not start after the recommended fuel priming amount has been applied, avoid the temptation to repeatedly add more fuel – you will likely flood the engine and create a fire risk. Know the procedure for clearing a flooded engine and dealing with a fire during start-up.

You may find winter exposes weaknesses in the alternator at low engine speeds – even after starting it can help to keep electrical load low until the battery has had time to recover from the start, and keep the engine above idle power.

In temperatures below 0°C engines will be easier to start if preheated using a gas or electric system designed for light aircraft use. Preheating raises the temperature of the oil, which will improve lubrication on start-up. It will also reduce ice or condensation that may be present in the engine.

Repeated starts of a cold engine at freezing temperatures will lead to increased engine and starter motor wear. The use of preheating is not widespread in the UK, but if you fly regularly in cold conditions, you should consider it.

WINTER FLYING

Takeoff and Landing

The snow clearing capabilities of most GA aerodromes in the UK are limited. It may not be possible to operate with significant snow or other winter contamination on the ground. More common issues are likely to be ice on hard surfaces and grass that is wet and muddy. If flying to another aerodrome, it may be prudent to discuss runway conditions with the aerodrome operator before departure. For example, many private strips may not be suitable during the winter.

It is important to consider the conditions as applicable to your aircraft and skills – it may be that others are flying, but for example a taildragger with oversized tyres will likely be able to operate on surfaces where a nose gear aircraft would struggle.

Anticipate how conditions are likely to evolve over the day. In the morning, frost and ice may make conditions slippery. Snow and ice may thaw as the day goes on, but not always consistently. Grass surfaces can become muddy once they begin to thaw. Towards the end of the day temperatures will start to fall and contamination may refreeze and become hard and slippery again.

Taxiing

If in any doubt as to whether a surface is safe to taxi on, inspect it on foot first. Even on apparently clear surfaces, ice is still a possibility, so taxi slowly. Anticipate when you will need to slow down and minimise the use of the brakes. Avoid taxiing through mud or slush that may stick to the underside of the aircraft and foul the wheels and brakes.

Global Reporting Format

Larger aerodromes will issue runway condition reports via the Global Reporting Format (GRF). GRF consists of a 0-6 rating depending on surface condition, with 6 being a normal dry runway and 0 a runway with contamination such as wet ice or snow over ice with minimal/non-existent braking action. GRF information will be disseminated by SNOWTAM[1] or aerodrome ATIS.

The GRF is aimed at transport category operations, however it is still useful for light aircraft as guide for what sort of contamination is present and the associated braking action. If operating at a larger aerodrome where surface contamination is a possibility, review the GRF criteria and how to read SNOWTAMs.

Runway friction levels derived from surface measurement are often no longer reported, since experience has shown an inconsistent correlation between measured surface friction and the actual braking action quality reported by pilots.

[1] A SNOTAM is a special series NOTAM notifying the presence (or removal) of hazardous conditions due to snow, ice, slush or standing water associated with snow, slush and ice on the movement area, by means of a specific format.

WINTER FLYING

Takeoff and Landing

Takeoff

Apply any performance factors necessary for runway surface conditions.
Use AFM data if available but note tit is unlikely there will be figures for every real-world scenario.
Safety Sense Leaflet 9 recommends the following safety factors for takeoff calculations:

Wet grass	x 1.3 (1.2 for dry grass)
Soft ground or snow	x 1.25 or more
Overall Takeoff Factor	x 1.33

! Factors should be multiplied together if multiple conditions are present. The factor of 1.33 is additional to the others and is similar to that required to be applied by commercial operators of piston aircraft.

Use any AFM techniques appropriate to the conditions, such as 'soft field', to improve takeoff performance. Note that AFM figures may be dependent on certain procedures, such as running up to full power on the brakes, which may not be practical on contaminated surfaces.

Ice on the runway may not necessarily increase the takeoff distance, but consider what will happen if there is a significant crosswind or you need to abort for some reason – how effective will directional control or the brakes be?

Landing

It may be possible to take off from a contaminated surface, but will it be safe to land again? On wet and muddy grass, the brakes will largely be ineffective, similarly on icy surfaces use of the brakes may cause control difficulties. Safety Sense Leaflet 9 recommends the following safety factors for landing calculations:

Wet grass	x 1.35 (1.15 for dry grass)
Soft ground or snow	x 1.25 or more
Overall Takeoff Factor	x 1.43

! The factor given for soft ground or snow should be treated as a minimum.

As per takeoff, factors should be multiplied together as required.

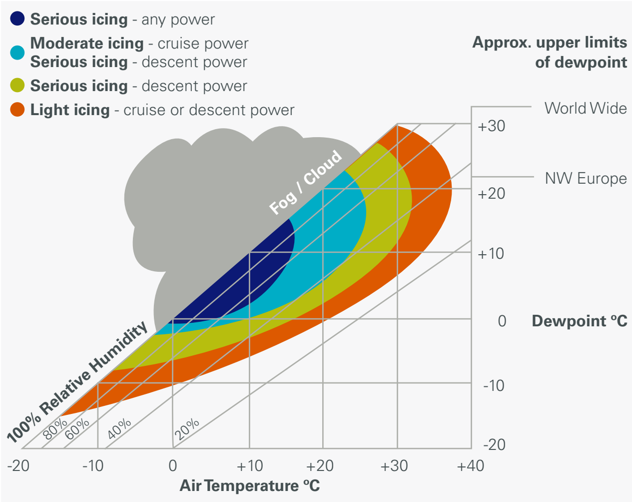
Another issue for landing is low sun at the end of the day – several GA accidents have been caused by poor visibility into the sun and sudden loss of visual references when landing. If conditions allow, it may be appropriate to accept a slight tailwind and land with the sun behind you.

If you are not rated for night flying and/or runway lighting is not available, leave a suitable time margin to ensure you land in daylight – particularly on cloudy days the light will fade very quickly after sunset.

WINTER FLYING

Inflight Icing

Carb icing



For VFR flying the main inflight icing risk is carburettor (carb) icing – the reduced pressure and therefore temperature in the carburettor makes it susceptible to ice forming and blocking the flow of fuel/air mixture into the engine.

Check whether the conditions are conducive to carburettor icing – it is not necessarily in colder temperatures that carb icing becomes more of a risk, but often in the range between 0 and 10°C and with high relative humidity.

Signs of high humidity include the temperature and dew point being the same or close, the ground being wet from condensation, rain or fog and/or a low cloud base. Carb ice tends to form slowly, so keep an eye on engine RPM (or manifold pressure with a constant speed propeller) for any signs of power loss.

Operate the carb heat function in accordance with the AFM. The carb heat works by directing hot air into the engine, which should raise the temperature enough to melt any ice[2].

The carb heat should be checked as part of the pre takeoff power checks – you should see a slight drop in engine RPM (or manifold pressure in the case of a constant speed propeller) when applied since the air entering the engine will be hotter and therefore less dense than through the normal air intake. The RPM should recover once carb heat is selected off. If the engine runs rough, keep the heat applied – ice may have built up while taxiing and the engine should recover once all the melted ice has dispersed.

If operating in conditions conducive to carb icing at cruise power, you should normally apply carb heat for around 15 seconds every 10-15 minutes during the cruise. The carb heat should be applied continuously when the engine is at low power, for example during a descent. Prolonged periods at idle power should be avoided – in a long descent open the throttle for several seconds every thousand feet or so to warm the engine.

Carb heat should be selected off just prior to landing to ensure maximum power is available in the event of a go around.

Be aware that the carb heat normally bypasses the air filter. On the ground, use is only recommended when stationary, otherwise debris may be sucked into the engine.

[2]In very low temperatures, use of the carb heat may not be appropriate since it could raise the intake air into the likely icing range. This would be unusual in the UK, however for flight in very cold climates, a carburettor temperature gauge would be recommended.

WINTER FLYING

Inflight Icing

Other induction icing

Fuel injected engines do not suffer from carb icing, but it is still possible for ice to build in air intakes and/or block the engine air filter. Most aircraft will have an ‘alternate air’ function that bypasses the filter, so check this is functioning correctly.

Airframe icing

Airframe icing will normally only occur when flying in visible moisture and with an outside air temperature of 0°C or less. Airframe icing is therefore much more likely to occur in instrument meteorological conditions (IMC), but it is possible in some circumstances to encounter icing while still in VMC – for example in a frontal temperature inversion rain may fall from warmer air higher in the atmosphere and then freeze or supercool when it meets the cold air below. Icing can also form when cold fuel in the aircraft lowers the temperature of the wings, causing ice to form from the associated condensation.

Airframe icing is a major consideration for IFR flight, particularly during the winter. Only aircraft specifically approved should be flown in ‘known icing conditions’.

Freezing levels and terrain

Flight in IMC above the atmospheric freezing level requires particular consideration – does the terrain or airspace below allow a safe descent to warmer air if a buildup of ice cannot be dispersed? Even aircraft that are approved for flight in ‘known icing conditions’ may not be able to maintain safe flight in a significant ice encounter, so consider the forecast conditions and what escape options there are.

De-icing and anti-icing systems

Know the correct procedures for use of the de-icing systems – for example fluid-based systems normally have to be activated prior to icing conditions to be effective. De-icing ‘boots’ are often more effective at dislodging ice that has already accumulated but will only address ice that is on the boot surfaces and not unprotected areas of the aircraft or propellers.

Equipage with de-icing or anti-icing functions does not necessarily mean that an aircraft is approved for flight in icing conditions – the AFM must specifically state that the aircraft is approved, and all equipment required for this approval must be serviceable. Known icing approval is not necessarily just about the de-icing capabilities, but how the entire aircraft and systems can function safely in an icing environment.

Area	Surface VIS and WX	Cloud	0 C
A	30 KM NIL OCNL 6 KM SHRA/ SHRAGS ISOL 2000 M +SHRAGS / +TS-RAGS ISOL 200 M +SHSN MON ISOL HILL FG	SCT/BKN CU SC AC 015-035 / 0 70 -XXX ISOL CB 015-030 / XXX ISOL SCT / BKN ST 010 / 015	020
B	35 KM NIL OCNL (ISOL FAR SE) 6KM SHRA ISOL 2500 M +SHRAGS / +TSGS ISOL 200 M +SHSN (AND FAR NW) ISOL NW ISOL HILL FG	SCT / BKN (LCA FEW LEE MON) ... ...CU SC AC 0155 - 035 / 080 -XXX ISOL CB 015-030 / XXX ISOL SCT / BKN 010 / 015	015 - 030

Extract from the F215 chart indicating the freezing level for the relevant area

WINTER FLYING

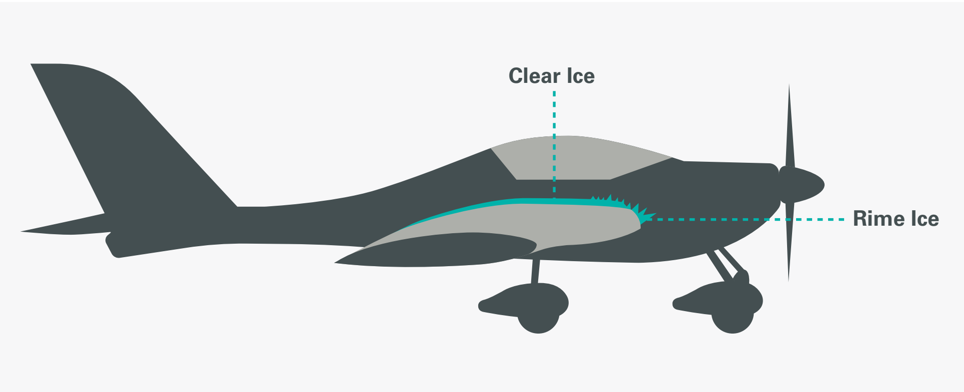
Inflight Icing

Airframe icing

Encountering ice

Most airframe icing occurs between 0 and -10°C, when supercooled water droplets freeze on impact with a cold surface, such as the aircraft. Below -20°C, moisture in the atmosphere tends to already be frozen and is less likely to accumulate on surfaces, but ice formation is still possible as low as -40°C. It is also cloud dependent – thin layers of stratus clouds may only secrete small amounts of ice, whereas larger cumulus clouds, particularly with extensive vertical development, will contain more supercooled water that will quickly accumulate on the aircraft.

Ice tends to accumulate in two basic forms:



'Clear ice' as the name suggests is more transparent and is caused by larger supercooled droplets found in clouds with more vertical development. When they hit the aircraft, the droplets tend to spread and flow back before hardening. Clear ice is more dangerous because it tends to build faster and on areas of the aircraft not covered by anti-icing or deicing systems. It can be hard to see, especially at night since it follows the contours of the wing.

'Rime ice' is composed of smaller supercooled particles that freeze on impact and stick together to form a milky and powdery deposit. It tends to form on the leading edge of the wings and other extremities. It is more common to see rime ice in stable cloud forms.

Some of the most severe icing can be caused by **freezing rain** – flight in such conditions should be avoided in light aircraft, even if approved for flight in known icing conditions.

WINTER FLYING

Inflight Icing

Airframe icing

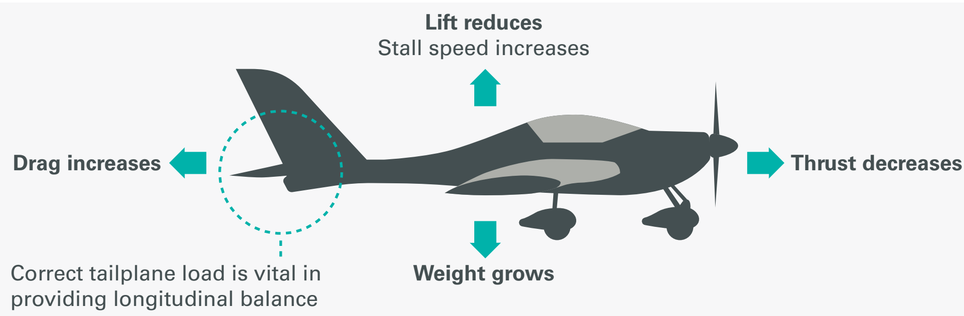
If cruising in icing conditions, check that the equipment is functioning correctly and monitor airspeed – a loss of speed suggests that ice is starting to increase the drag/ reduce the lift of the wings. Early indications of ice will often be around the edges of the windscreen and on protrusions such as the temperature probe.

The worst icing is often found in bands of several thousand feet, so icing may reduce in severity if you climb or descend. Only commence a climb if you have a reasonable performance margin, but it may allow you to cruise in air with less supercooled precipitation present. Descending is normally safer but always remain aware of terrain.

If you experience a severe icing encounter and the ice cannot be dispersed from the aircraft, anticipate control difficulties. Inform ATC and consider declaring a Mayday, depending on how severe the situation is. Keep the aircraft's speed as high as possible – the stall speed will have increased, but you will not know by how much. The stall warner may have frozen and no longer function.

If you suspect propeller icing, on a constant speed unit cycling the RPM up and then down again may shed some ice.

If you can see excessive ice on the wings, there will almost certainly be even more on the tail. This will reduce elevator authority and make the aircraft heavier in pitch. In extreme encounters the tail may stall, leading to loss of control. If the autopilot is engaged, check that it is not applying excessive nose up trim since this is a sign of lift being lost. If you appear to be losing airspeed, carefully disconnect the autopilot and be ready to deal with an out of trim condition. You may need to descend to maintain a safe airspeed.



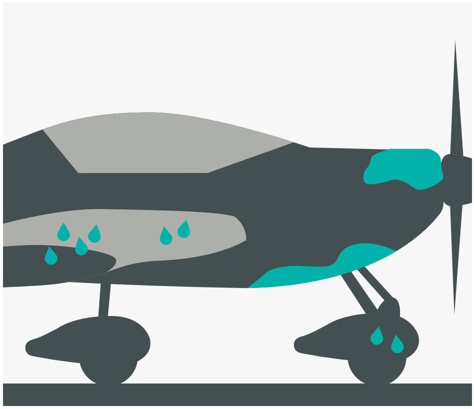
If carrying significant ice when landing, add 20% or more to the approach speed – whatever is needed to maintain control. Consider reducing the use of flap, since this will normally mean less elevator authority is needed to maintain the approach attitude and flare the aircraft. If necessary, divert to a long runway so that stopping distance is not an issue.

If the windscreen is iced up, ensure the demister is on the highest possible setting. If possible, open any windows to see out. If time and fuel permits, it may be possible to divert to somewhere warmer to allow the ice to melt.

WINTER FLYING

Post flight

Clean the aircraft if necessary – mud and slush may dry or freeze and subsequently be harder to remove. Dirt on the underside may cause a reduction in performance. Inspect the wheels and brakes to ensure they are free of contamination. The next pilot may not appreciate finding the brakes frozen with mud.



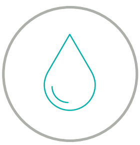
If there is significant water on the wings, wipe the worst of it off – if left overnight it may freeze, leaving the aircraft covered in ice the next day.

Carefully reinstall protection devices such as control locks and pitot covers (ensure the probe is cool so that it does not melt the cover) and tie down the aircraft if required.

Clothing and survival

You should wear suitable clothing for the conditions – as well as being comfortable when conducting the preflight checks, consider the possibility of having to make a forced landing. Particularly in more remote parts of the UK, rescue could be some time and the effects of exposure will quickly set in if you are not dressed to survive.

Under Part-NCO, Part 21 aircraft are required to have a fixed emergency locator beacon (ELT), or for aircraft with less than six passenger seats, the flight may carry a personal locator beacon (PLB) instead. Non-Part 21 aircraft are not required to be so equipped, but a PLB is always a wise precaution. Consider carrying equipment such as survival bags, torches and whistles to aid survival and rescue. If you have an inflatable life raft with a cover, this may provide protection if stranded on exposed terrain.



If conducting a flight over water, SSL 21 on Ditching contains more information on precautions you may wish to take, especially during the winter.