



Weather Threat For VMC Flights

FOR HELICOPTER PILOTS AND INSTRUCTORS

TRAINING LEAFLET



HE 13



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1. RELEVANT WEATHER CRITERIA

1.1 AIR MASS

An “air mass” is a body of air extending hundreds or thousands of miles horizontally and sometimes as high as the stratosphere and maintaining as it travels nearly uniform conditions of temperature and humidity at any given level. Over your route, it will bring certain types of general weather.

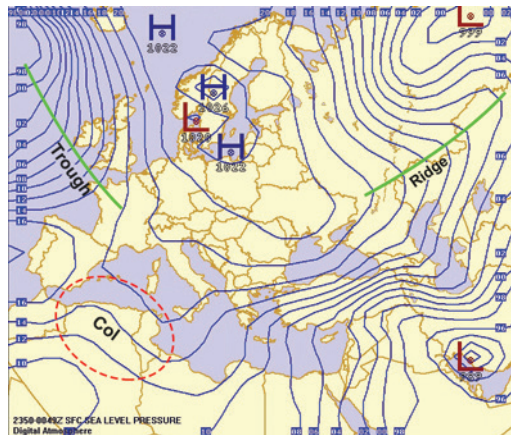
- A “**tropical maritime**” air mass, coming perhaps from the Azores, has high humidity at low altitudes and is generally stable, with poor visibility. In the warm sector of a depression, there is often also low stratus cloud and possibly drizzle, although visibility above the cloud may be good. Advection fog is also possible. In a summer anticyclone, you will usually find either clear skies or overcast stratocumulus cloud. “Returning polar maritime” air, starting from Canada but travelling across the warmer parts of the Atlantic, will give similar conditions, but usually less pronounced. These air masses are frequently found in Western Europe.
- “**Tropical continental**” air, from North Africa or Arabia, brings stable conditions. There is a deep and thick haze layer, with little cloud. “Polar continental” air, from Siberia, brings clear skies and often overnight frost. Visibility is generally good except in any showers (often sleet or snow) from the moisture it may have collected if it has travelled across water. Any cloud is likely to be cumulus type.
- “**Polar continental**” air, from Central Europe and Siberia; hot air coming from these areas will generate dry summers, whereas cold air will bring snow in winter. However, it usually happens from November to April, bringing clear skies and very negative temperatures.
- “**Polar maritime**” air, direct from Canada, is generally unstable, with good visibility outside precipitation, but because it has collected moisture there is usually much more cloud. In summer, the base of “fair weather cumulus” may be high, but especially in winter frequent, possibly heavy showers from deeper cumulus are likely. Thunderstorms are also possible if there is a suitable “trigger” to start them. In winter, cumulus may form over the sea and coastal areas even when the land is too cold to produce convection.
- If “**Arctic maritime**” air from North of Norway, is forecast, the cold unstable air will include cumulonimbus clouds which form over the sea and drift a short distance over land, and snow will almost certainly fall in coastal areas. Although the visibility outside showers will be excellent, snow will reduce that dramatically.
- Weather fronts mark the boundary between two air masses, which often have contrasting properties. For example, one air mass may be cold and dry and the other air mass may be relatively warm and moist. These differences produce a reaction in a zone known as a front. Across a front there can be large variations in temperature, as warm air comes into contact with cooler air. The difference in temperature can indicate the ‘strength’ of a front, e.g. if very cold air comes into contact with warm tropical air the front can be ‘strong’ or ‘intense’. If, however, there is little difference in temperature between the two

air masses the front may be 'weak'. Warm air follows a warm front and cold air follows a cold front. We also tend to see increased amounts of cloud and rainfall along the front itself particularly when warm and moist air is forced to lift up by the cold air mass and, as a consequence towering cumulus or cumulonimbus develop.

1.2 PRESSURE PATTERNS

Anticyclones (HIGH) produce settled weather with light winds. However, the air becomes progressively more stable, and surface visibility becomes steadily worse (and the inversion at the top of the haze layer lower) unless the air mass changes. There may be no cloud, but especially in winter stratocumulus cloud may form daily, dispersing at night. In summer, with no cloud (or thin cumulus) temperatures may increase daily and slow down the visibility reduction, but in winter the clear skies may lead to radiation fog which takes daily longer to clear.

In an anticyclone (high pressure) the winds tend to be light and blow in a clockwise direction (in the northern hemisphere). Also the air is descending, which reduces the formation of cloud and leads to light winds and settled weather conditions.



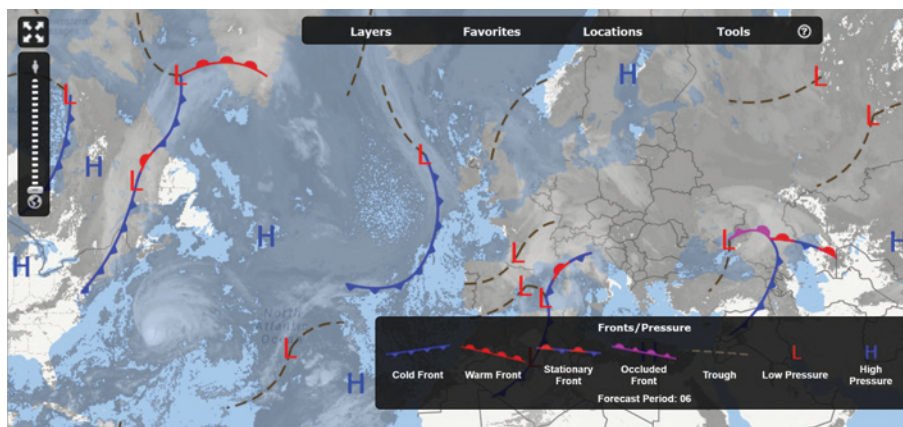
Ridges of high pressure tend to move away quickly, so although the weather will again be settled for a time, the disadvantages are less likely to take effect.

Depressions (LOW) move quickly, produce unsettled weather with strong winds, and their effects are mainly associated with frontal systems. However, even if no frontal system is marked on a chart, the centre of a depression generally contains thick convective cloud with few gaps, and often showers with a low cloud base.

In a depression (low pressure), air is rising and blows in an anticlockwise direction around the low (in the northern hemisphere). As it rises and cools, water vapour condenses to form clouds and perhaps precipitation. This is why the weather in a depression is often unsettled - there are usually weather fronts associated with depressions.

Troughs of low pressure are often a combination of fronts. Lines of showers or periods of continuous precipitation are common. Especially over or near high ground there will be a lot of cloud at low altitude, possibly triggering thunderstorms.

Cols, areas surrounded by 2 ridges and 2 troughs, may encourage radiation fog in autumn or winter, and thunderstorms in summer.



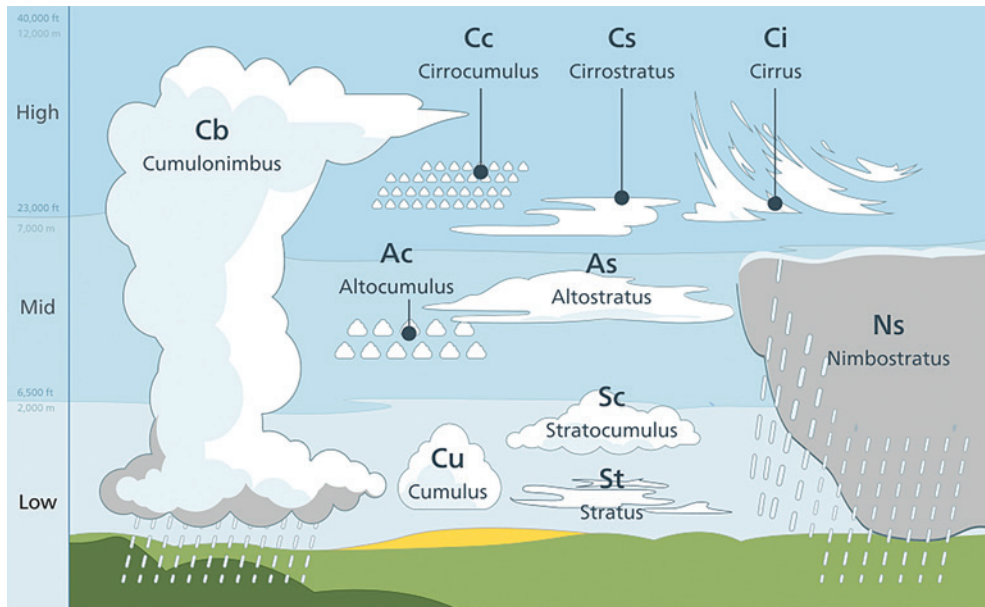
View of fronts and pressures

Source: Schneider Electric

1.3 CLOUDS

1.3.1 Patterns From The Ground

Clouds can provide information about weather in the distance. Increasing amounts of thickening upper cloud are the classic sign of an approaching warm front. However, often the cloud changes come in different forms. More frequently, small amounts of stratus type cloud will appear in bands, far in advance of the surface front. The rain which we expect about fifty miles before a surface warm front often comes in surges, not a progressively increasing amount. The picture shows a sky with a warm front coming from the direction of a range of hills which has broken up the theoretical cloud pattern.



Various types of clouds and their altitudes

Source: Wikipedia

You will seldom see an approaching cold front; it will be hidden by low cloud in the warm sector. However, when it has arrived, perhaps giving heavy rain, often rays of sunlight can be seen in the distance to indicate the clearance behind it. The actual passage of the cold front will be indicated by the surface wind veering as the air temperature and dew point drop, even if the sky does not immediately clear.

Thunderstorms bring many hazards for aviation, including surface wind changes a long distance away, and can spread rapidly. Light aircraft pilots should avoid them by at least 10 nautical miles.

Especially in frontal zones, cumulonimbus clouds are sometimes “embedded” (hidden by other clouds). However, individual distant cumulonimbus will often be indicated either by the cirrus cloud of an “anvil” (a flat top), or by towering cumulus with large vertical extent, which will themselves turn into storm clouds.

Cumulus type clouds at high altitudes, “altocumulus castellanus”, will often turn into cumulonimbus very soon.

1.3.2 Estimating Cloudbase From The Ground

It is often difficult to decide the amount and height of the cloud base (the lowest altitude of the visible portion of the cloud) from the ground. If you have no direct cloud base measurement at your location, and cannot receive reports from nearby aerodromes, it is often tempting to take-off and find the base yourself.



View of cloud base

Source: istockphoto.com

If cloud is touching a mast or other obstruction, the height of the cloud base is obvious. However, experienced pilots can also estimate cloud base by watching patches of cloud drifting in the wind. The relative movement of the patches as you watch is affected by wind speed and cloud height.

If you know the temperature and dew point, you can calculate the approximate cloud base, temperature and dew point close together indicating that cloud may form at very low heights.

1.3.3 Cloud Patterns From The Air

When you are flying, the same information is usually available as from the ground, although nearby cloud may hide some indications such as cumulonimbus anvils. However, if a pilot looks ahead and around, he can see other clues to possible problems. Darkening clouds suggest precipitation, and a rainbow guarantees it!

In generally good visibility, if the visibility changes around the horizon, either cloud is below the aircraft's present altitude, or precipitation is falling there. Neither is good news for a private pilot, so descend, but not below your planned minimum VFR altitude. If you cannot see a clear horizon, change your route, away from the precipitation. "Curtains" of cloud which appear to be falling from above indicate precipitation, which may obscure the horizon. Precipitation may spread quickly, especially around the base of a large cumulus, so

have another safety option (diversion, turn around or land) before you try to fly around precipitation from an overcast (or even broken) cloud base.

In good visibility under broken cloud, the areas of sunlit ground, or beams of sunlight shining through gaps, can indicate how much cloud is in that direction. This can help to plan possible route changes if the cloud base starts to lower.

Cloud shapes can give warning of hazards. Cloud which forms below the main cloudbase usually indicates not only precipitation, but often turbulence. “Funnel” cloud may indicate an embedded cumulonimbus which must be avoided. A cloud which “rolls”, or forms a “hook” as you see it, is an indication of at least moderate turbulence at cloud level and below.



Lenticular cloud: smooth, round or oval lens-shaped cloud often seen near a mountain ridge.

Source: Strangesounds.org



Cumulonimbus clouds: dense vertical cloud associated with thunderstorms and atmospheric instability

Source: istockphoto.com



Shelf clouds: early stage of a thunderstorm

Source: istockphoto.com



Roll clouds: low, horizontal, tube-shaped, and relatively rare type of cloud.

Source: Strangesounds.org

1.3.4 Cloud Base And Ceiling

- 'Cloud ceiling' refers to the lowest cloud that covers more than half the sky – so broken (BKN) or overcast (OVC) cover would constitute a cloud ceiling.
- 'Cloud base' refers to the lowest visible cloud, which could also be the cloud ceiling, or it could be few (FEW) or scattered (SCT) cloud.

From your review of the weather you should have established what the likely cloud base and ceiling will be at the different points of the flight. When considering your ability to remain in visual conditions at a given altitude, consider what the cloud cover is reported as, and whether there is a likelihood that it will lower during any stage of the flight.

Remember cloud height figures from TAFs and METARs are from aerodrome level – a 1500ft cloud ceiling at an airfield may be shrouding the tops of hills not too far away from it.

The typical problem with cloud is when it is too low to enable safe flight without hitting the ground or other obstacles.

But how low is too low? It depends on a number of factors:

- What sort of flight are you going for?
- What are the terrain and obstacles like along the route?
- Is the weather getting better or worse in the direction you are going?
- What will it be like at your destination?

Generally speaking VMC flight with a cloud ceiling of (1500ft AGL) or less warrants special attention to terrain and obstacles. VMC flight below (1000ft AGL) is generally only suitable for local flying in areas you are familiar with – actually going anywhere of distance, even with reasonable visibility below cloud, is likely to involve close encounters with hills, radio masts and other low level hazards.

1.4 VISIBILITY

1.4.1 The Ground From The Air (Slant)

It is good to fly above a haze layer. However, if the air to ground slant visibility reduces, expect the visibility when the aircraft descends, to also become worse.

Patches of low cloud or mist may be seen in valleys; these warn of probable radiation fog ahead. Any cloud appearing below your cruising altitude must be treated as a potential threat. Often you will see the first low cloud on hill slopes, but further cloud is likely to form over flatter terrain. Patches of cloud indicate probable carburettor icing conditions, as does the top of a haze layer.

A pilot should always be aware of a possible Degraded Visual Environment (DVE). A pilot can note an object on the ground ahead that has just become visible and record the time until he/she is over it. If the time reduces you should consider whether to turn back, divert or land. At low heights, you must be able to see the ground beyond the next ridge before crossing it. If the same objects remain at the limit of your vision as you fly towards them, that indicates a fog bank or very low cloud.

Even if the cloud ceiling is high enough, you still need sufficient in flight visibility to control the aircraft visually, navigate and avoid other aircraft. Aviation forecasts and reports will give an indication of surface visibility, however actual in-flight visibility can only be judged while in the air. Watch out for warm high pressure days in the summer when the visibility is often surprisingly poor due to haze, especially into the sun. During the winter, low sun can also dramatically reduce forward visibility when flying towards it.

1.4.2 Ground Visibility (Horizontal)

It is worth noting that weather (precipitation) and visibility are closely linked. For example, slight rain or drizzle may have little or no impact on visibility but heavy drizzle could reduce visibility to less than 2500m.

Horizontal visibility is reduced by the presence of the following events:

- Fog (radiation, advection)
- Mist
- Precipitation (rain, snow)
- Inversions (suspended particles)

1.5 WIND

The forecast gradient wind (2000 ft) velocity is likely to be quite accurate, however it can be subject to change. The wind at the surface is impacted by frictional drag due to the Earth surface resulting in a reduction and a change in direction. By contrast, hills, forests, valleys, force the wind to slow down/speed up and change direction (see HE7 “Techniques for helicopter operations in hilly and mountainous terrain”, chapter 2). An indication of surface wind velocity can be given by wind socks, smoke, GPS, wind farms, wind lanes on water, etc.

Wind shear or wind gradient, is a difference in wind speed and/or direction over a relatively short distance in the atmosphere. It may be vertical or horizontal if the variation of speed and directions occurs vertically or horizontally and it is the most frequent cause of the atmospheric turbulence.

Usually wind shear is a microscale meteorological phenomenon occurring over a very small distance, but it can be associated with mesoscale or synoptic scale weather features such as squall lines and cold fronts. Sometimes the origin of wind shear is the microburst.

A microburst is a localized column of exceptionally intense and localized sinking air that results in a violent outrush of air at the ground. It is connected with the presence of a thunderstorm and its size is less than or equal to 3 miles in diameter.

There are two primary types of microbursts: 1) wet microbursts if are accompanied by significant precipitation and 2) dry microbursts if it is not accompanied with precipitations.

The microburst go through three stages in their cycle, the **downburst**, **outburst**, and **cushion stages**.

Microbursts can cause extensive damage at the surface, and in some instances, can be life-threatening. The strong straight-line winds are similar to that in some tornadoes, but without the tornado’s rotation, it can be particularly dangerous to aircraft, especially during landing, due to the wind shear caused by its gust front.

1.6 TURBULENCE

A turbulence can be defined as small-scale, short term, random and frequent changes to the velocity of air. This can either be mechanical turbulence (due to the friction of the air over uneven ground at low levels), or thermal turbulence (due an air temperature instability at mid-levels).

Reading the local terrain is an important skill for anticipating turbulence. For example, a 10kt wind could create challenging turbulence if it spills over a local feature. Winds above 35kts or so are often indicative of bumpy conditions.

Turbulence affects the behaviour of the aircraft in flight and increases the threat of retreating blade stall, vortex ring and LTE as the ground and air speed fluctuates. For helicopters equipped with teetering rotor systems there is the additional danger of main rotor mast bumping and rotor / tail strike.

Severity of turbulence:

- Light turbulence: is the least severe, with slight, erratic changes in attitude and/or altitude.
- Moderate turbulence: is similar to light turbulence, but of greater intensity - variations in speed as well as altitude and attitude may occur but the aircraft remains in control all the time.
- Severe turbulence: is characterised by large, abrupt changes in attitude and altitude with large variations in airspeed. There may be brief periods where effective control of the aircraft is impossible. Loose objects may move around the cabin and damage to aircraft structures may occur.
- Extreme turbulence: is capable of causing structural damage and resulting directly in prolonged, possible terminal loss of control of the aircraft.

In addition to the above helicopter pilots can also encounter the following types of turbulence at low level:

- Temperature inversion
- Frontal turbulence
- Mountain wave turbulence
- Thunderstorm turbulence

Turbulence can be experienced anywhere and without warning, therefore it should always be anticipated, especially in hilly and mountainous terrain where mountain wave turbulence can occur frequently. Pilots should always be prepared for turbulence by keeping a positive grip on the flying controls and reducing the airspeed to the recommended RFM 'turbulent airspeed'.

1.7 PRECIPITATION

Precipitation can have adverse effects on the flight and therefore should be treated as a threat to be managed.

Types of precipitation to be considered are rain, freezing rain, snow, drizzle, hail, sleet.

1.8 ICE

By definition ice is the solid state of the water and it is a transparent solid crystal. The transition occurs when the water is cooled at a temperature below 0 °C.

The ambient conditions favourable to ice formation are:

- OAT \leq 10 °C with any form of visible moisture (fog with visibility of one mile or less, rain, drizzle, snow, ect.), or
- OAT \leq 10 °C with dew point 3 °C or less from OAT.

In-Flight Airframe Icing occurs when supercooled water freezes on impact with any part of the external structure of an aircraft during flight. Liquid drops are present at outside air temperatures (OAT) below 0 °C in these clouds. At OAT close to 0 °C, the cloud may consist entirely of such drops, with few or no ice particles present. At decreasing temperatures, the probability increases that ice particles will exist in significant numbers along with the liquid drops. In fact, as the ice water content increases, the Liquid Water Content (LWC) tends to decrease since the ice particles grow at the expense of the water particles. At temperatures below about -20 °C (-4 °F), most clouds are made up entirely of ice particles.

There are different types of airframe ice:

- **Clear ice or Glaze ice** is often clear and smooth. Supercooled water droplets, or freezing rain, strike a surface but do not freeze instantly. Often “horns” or protrusions are formed and project into the airflow.
- **Rime ice** is rough, milky and opaque, formed by supercooled drops rapidly freezing on impact. Forming mostly along an aerofoil’s stagnation point, it generally conforms to the shape of the aerofoil.
- **Cloudy or Mixed ice** is a combination of clear and rime ice.
- **Frost ice** is the result of water freezing on unprotected surfaces while the aircraft is stationary. This can be dangerous when flight is attempted because it disrupts an aerofoil’s boundary layer airflow causing a premature aerodynamic stall and, in some cases, dramatically increased drag making takeoff dangerous or impossible.
- **SLD ice** refers to ice formed in Supercooled Large Droplet (SLD) conditions. It is similar to clear ice, but because droplet size is large, it extends to unprotected parts of the aircraft and forms larger ice shapes, faster than normal icing conditions.

1.9 LIGHTNING

A lightning strike is a brilliant electric spark discharge in the atmosphere, occurring within a thundercloud, between clouds, or between a cloud and the ground.

It mostly originates in a cumulonimbus cloud and terminates on the ground, called cloud to ground (CG) lightning. A less common type of strike, called ground to cloud (GC), is upward propagating lightning initiated from a tall grounded object and reaches into the clouds. About 25% of all lightning events worldwide are strikes between the atmosphere and earth-bound objects. The bulk of lightning events are intra-cloud (IC) or cloud to cloud (CC), where discharges only occur high in the atmosphere.

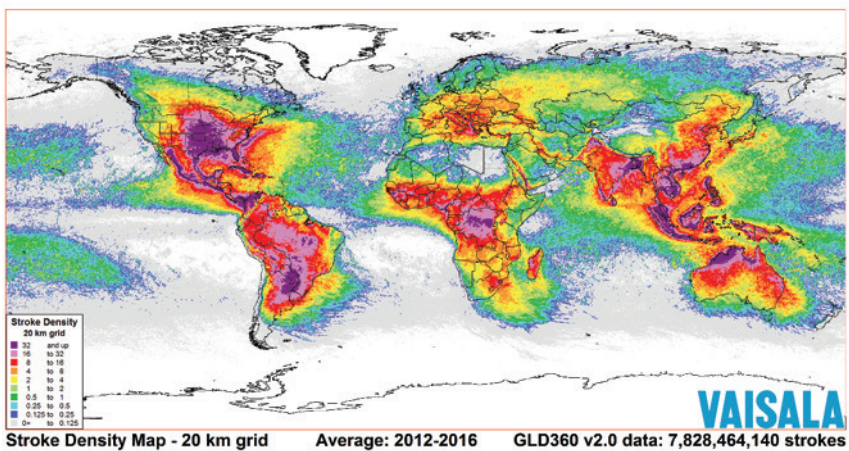
A single lightning event is a “flash”, which is a complex, multi-stage process, some parts of which are not fully understood. Most cloud to ground flashes only “strike” one physical location, referred to as a “termination”. The primary conducting channel, the bright coursing light that may be seen and is called a “strike”, is only about one inch in diameter, but because of its extreme brilliance, it often looks much larger to the human eye and in photographs. Lightning discharges are typically miles long, but certain types of horizontal discharges can be upwards of tens of miles in length. The entire flash lasts only a fraction of a second. Most of the early formative and propagation stages are much dimmer and not visible to the human eye.



Severe thunderstorm with significant lightning

Source: istockphoto.com

Historical world map of lightning strokes



Source: Vaisala

2. READING REPORTS

Although you may have considered the likely conditions before flight, you will never have all the information which a forecaster has, and you must never fly without a helicopter weather forecast. You must check the area forecast for your route, and also TAFs and METARs for all aerodromes you expect to pass, and any which might be useful as diversion aerodromes. Compare the actual weather with the forecast; if it is worse now, what will happen later?

TAFs are forecasts, METARs are reports and you should be able to read and decode these (some websites provide plain language interpretation of METARs). For example, remember TAFs/METARs give the cloud based on the ground level at the reporting airport – take account of that when comparing them to the planned altitude of your route.

The values in TAFs do not represent a single forecast value but rather a range of potential values which represent the most likely forecast conditions expected for a particular period of time. These ranges are defined by ICAO and change groups in the TAF exist to represent changes in the weather that are expected to occur outside of a particular range of values. Therefore forecasts are not normally amended until certain criteria for change are exceeded.

The specific value of any of the elements given in a forecast should be understood to be the most probable value which the element is likely to assume during the period of the forecast. Similarly, when the time occurrence or change of an element is given in a forecast, this time should be understood to be the most probable time.

“TEMPO”, “OCNL”, and even “ISOL” will almost certainly affect your flight, as will any gusts in the forecast wind. Always be ready to divert to another aerodrome if you cannot land at your intended destination, but take note of the possible weather problems and know which other aerodrome is most suitable. If there is uncertainty in the TAFs (forecasts) for example if the time of a weather change is not precisely forecast or there are periods where ‘PROB30’ or ‘PROB40’ are being used, delve a bit deeper into the wider weather picture.

TAFs/METARs will give a good indication as to when particular weather will be passing through and when it is likely to get better or worse. By looking at several over a given area you will likely see a pattern of weather and as such TAFs and METARs are an invaluable weather resource but by also making use of other information available it is possible to build an even more comprehensive picture of expected conditions. For example consulting a rainfall map and radar images can help to understand the intensity of showers and thunderstorms and how they are developing.

Also, use of surface pressure charts are useful from around four days in advance of a flight. They give indications of where fronts and their associated areas of high pressure and low pressure are and where they will likely move to. A skill in forecasting weather is often in working out when fronts will arrive in particular

places and how they will interact with the other air masses they meet. Using these charts to gain an initial understanding of the general conditions which might be expected can be a valuable tool, for example air mass that arrives from the south over Europe is more likely to be dry, but might be hazy and polluted. Weather from the south-west is likely to contain moisture, bringing rain and low cloud, while weather from the north-west is likely to bring clear air following a cold front but with a higher risk of showers.

When there is either frontal, convective weather or fog around, it can be hard to predict exactly what conditions at a certain point will be, study the weather carefully and consider escape options in different scenarios should the weather be worse than anticipated – calculate altitudes that if forced below by weather, you will turn back or divert.

3. NEW TECHNOLOGIES

Tools exist nowadays to help improve safety by displaying current and forecasted ceiling and visibility levels 24/7, as well as other low level adverse weather conditions. Thus, pilots can make swift go/no-go decisions at any time.

In addition, pilots may use the same cutting-edge tools to view in real-time the various types of precipitation events happening on their flight path: rain, snow, etc..

The most recent technologies, including online tablet and Smartphone, even allow ground operators and/or pilots to send their flight routes in advance to some weather services experts.

Such integration with flight planning applications, which can overlay weather onto aeronautical charts, enable receipt of receive weather warnings and alerts during flight to avoid such hazardous areas.

4. WEATHER MINIMUMS FOR HELICOPTERS

SERA.5001 VMC visibility and distance from cloud minima

VMC visibility and distance from cloud minima are contained in Table S5-1.

ALTITUDE BAND	AIRSPACE CLASS	FLIGHT VISIBILITY	DISTANCE FROM CLOUD
At and above 3.050 m (10.000 ft) AMSL	A(**) B C D E F G	8 km	1.500 m horizontally 300 m (1.000 ft) vertically
Below 3.050 m (10.000 ft) AMSL and above 900 m (3000ft) AMSL, or above 300 m (1000 ft) above terrain, whichever is the higher	A(**) B C D E F G	5 km	1.500 m horizontally 300 m (1.000 ft) vertically
At and below 900 m (3000ft) AMSL, or 300 m (1000 ft) above terrain, whichever is the higher	A(**) B C D E	5 km	1.500 m horizontally 300 m (1.000 ft) vertically
	F G	5 km (***)	Clear of cloud and with the surface in sight

(*) When the height of the transition altitude is lower than 3 050 m (10 000 ft) AMSL, FL 100 shall be used in lieu of 10 000 ft.

(**) The VMC minima in Class A airspace are included for guidance to pilots and do not imply acceptance of VFR flights in Class A airspace.

(***) When so prescribed by the competent authority:

(a) flight visibilities reduced to not less than 1 500 m may be permitted for flights operating: (1) at speeds of 140 kts IAS or less to give adequate opportunity to observe other traffic or any obstacles in time to avoid collision; or (2) in circumstances in which the probability of encounters with other traffic would normally be low, e.g. in areas of low volume traffic and for aerial work at low levels;

(b) helicopters may be permitted to operate in less than 1 500 m but not less than 800 m flight visibility, if manoeuvred at a speed that will give adequate opportunity to observe other traffic or any obstacles in time to avoid collision.

AMC1 SERA.5010(a)(3) - Special VFR in control zones

Speed limit to be applied by helicopter pilots

The 140 kt speed should not be used by helicopters operating at a visibility below 1 500 m. In such case, a lower speed appropriate to the actual conditions should be applied by the pilot.

GM1 SERA.5010(a)(3) Special VFR in control zones

Speed limit to be applied by helicopter pilots

The 140 Kt. speed is to be considered as an absolute maximum acceptable speed in order to maintain an acceptable level of safety when the visibility is 1 500 m or more. Lower speeds should be applied according to elements such as local conditions, number and experience of pilots on board, using the guidance of the table below:

Visibility (m)	Advisory speed (Kt)
800	50
1500	100
2000	120

Note: In some areas (i.e. London CTR) for flight in VFR/SVF, the local airspace requirements may require higher visibility minima than that prescribed by SERA, and of course pilots must always be able to meet the 500 foot rule.

5. OPERATIONAL REQUIREMENTS - FLIGHT DECISION

5.1 Pre-Flight Planning

The basic principles of planning and preparation as outlined in the EHEST HE1 Safety Considerations Leaflet still apply, see Appendix 1 Pre-flight Planning Checklist.

Monitoring information in the days leading up to a flight will help build an understanding of how the weather is evolving. Use of all the relevant information available on the day will help to make effective go/no-go decisions and to make any weather changes en route less of a surprise. In practice of course conditions can change quickly and CAVOK can turn into OVC200 in a short space of time so having a back-up plan is critical.

For planning more than a few days in advance of the flight, normal weather forecasts are the main source of information – nearer the time, aviation weather forecasts should be consulted when making flight decisions so Ensure that you get an aviation weather forecast from an authorised source, including synoptic charts, SIGMET, AIRMET and TAFs and METARs for all aerodromes you expect to pass, and a diversion aerodrome. Compare the actual weather with the forecast; if it is worse now, what will happen later heed what it says, (decodes are available on the internet) and make a carefully reasoned GO/NO GO decision.. Have a planned detour route if you are likely to fly over high ground which may be cloud covered.

Study the forecasts for “PROBs”, which indicate uncertainty, “TEMPO”, “OCNL”, “BECMG” and even “ISOL” will almost certainly affect your flight, as will any gusts in the forecast wind. Always be ready to divert, turn back or land if you cannot reach at your intended destination.

Fuel planning should consider forecast meteorological conditions in accordance with the appropriate regulation for fuel contingency. In flight the pilot should constantly monitor the fuel state.

In helicopters be aware of the conditions that lead to the formation of engine icing, comply with the Rotorcraft Flight Manual (RFM) / Pilot’s Operating Handbook (POM) instructions regarding the use of Carb heat or Engine anti-ice and remember to include Carb Air Temp and OAT in your regular instrument scan.

In wet weather beware of misting of windshield and windows, especially when carrying passengers with wet clothes and carry a cloth to assist demisting the windshield prior to take-off, note: some aircraft when the cabin heating system is started to be used, can produce mist in windshield.

As the destination may be remote from an airfield and associated met facilities, the pilot will be required to interpolate the information provided in the synoptic charts, TAFs, and METARs. If possible, a telephone call to speak to somebody at the landing site for a local weather observation is advised. Information should be collated for both the outbound and return flight, including the anticipated dusk time - in case of a delay. It is important to carry a telephone number/’app” for a met service so that updated weather forecasts can be collected from the LS.

5.2 Pre-Flight Threat Assessment

When planning a VMC flight, there are a number of obvious threats risk factors which should be taken into consideration prior to take-off.

Even for local flights, you should have a reasonable understanding of the general weather conditions before you go flying, particularly how the weather may evolve while during the flight. This should include both an overall appreciation of the weather conditions on the day, as well as the forecast for you specific destination and any alternates if you are going somewhere. This will ultimately inform your decision as to whether it is safe to fly or not. Below are some of the factors you should consider:

- Give yourself **time** before flying to adequately prepare for it (Check the weather for all flights – pilots normally pay special attention to long and complex flights, however many accidents in poor weather are actually relatively local ones. Avoid the false sense of security that may come from short flights in familiar airspace.)
- Does the information available indicate that weather conditions along the route and at the intended destination will be at or above VMC minima
- What equipment is the helicopter fitted with?
- As the pilot the required currency/recency for the flight'
- What navigational equipment in addition to aeronautical charts is carried (GPS, tablet, radio nav. aids) are they up to date and is the pilot trained to their use?
- Is flight planned to take place at a safe height above the ground and has the route minimum safe altitude have been calculated?
- Does a segment of the route involves over-flight of a rural, unpopulated area or large featureless areas such as water, snow etc.?
- Is flight at night when there is no moon, or the stars and moon are obscured?
- Are there, or are likely to be, significant layers of low level cloud en-route (4/8 – 8/8 SCT/BKN/OVC)?
- Is the visibility, or is likely to be, limited en-route, i.e. visual range at or close to the minimum required for conducting a safe flight, (which may be significantly higher than the stated state minima).
- Is there an any probability of encountering DVE?

5.3 In-Flight Threat Assessment

Once a flight is underway additional threats factors may come into play:

- There is a low level of ambient light.
- There is no visual horizon, or the horizon is only weakly defined at best.
- DVE due to deteriorating weather
- The view from the cockpit is obscured due to precipitation/misting.
- A lowering of cloud base forcing an unplanned descent below planned safe height.

To mitigate any of the above threats a pilot should initially reduce speed to maintain ground reference (recommended V_y) and then, if necessary, consider diverting, turning back or carrying out a precautionary land.

5.4 Enroute – Use Of Radio

A Flight Information Service can provide METARs, SPECIs and TAFs as well as advisories (SIGMET and AIRMET) which the pilot requires. Major aerodromes transmit ATIS (automated terminal information service) messages. “VOLMET” groups the many weather reports on published frequencies. A “TREND” at the end of a report may mention reducing cloud base or visibility; that can indicate general deterioration.

5.5 Winter Flying

It should be noted that there are NO light general aviation helicopters cleared for flight in icing conditions. Flight in falling snow generally requires the fitment of snow guards; refer to your RFM/POM. You should use weather forecasts to avoid snow and icing conditions.

Snow, ice and frost should be completely removed from helicopters before flight. Ice can be shed and endanger persons or property, snow can become loosened and be sucked into engine intakes causing the engine to shutdown. Ice build up not only has a detrimental effect on the efficiency of the rotor blades but also increases the mass of the helicopter and significantly affects the C of G.

Dress for the weather. Wear warm clothing in case of heater failure or a forced/ precautionary landing – you can't put them on in flight!

Snow hides familiar landmarks, making navigation difficult; roads, rivers and railway lines can disappear under snow. Disorientation can occur when snow-covered featureless terrain blends into an overcast (especially high overcast) sky. The horizon disappears and disorientation can quickly set in.

6. GOLDEN RULES

- » Understand weather patterns and their likely effects on your flying
- » Always obtain an aviation forecast
- » Only commence or continue a VMC flight if the information available indicates that at the place of departure, along the route and at the intended destination, conditions will be at or above VMC minima
- » Look for and consider PROB s, TEMPO s, OCNL and ISOL
- » Expect conditions to be worse than forecast
- » Check actual conditions against the forecast
- » Identify alternative routes and suitable diversion aerodromes
- » Carry enough fuel
- » Scan the sky and horizon for possible problems
- » Note local surface winds
- » Check weather reports while flying
- » Be prepared to divert, turn around or land - i.e. make sure there is an alternative course of action available should the weather conditions preclude the completion of the flight as planned
- » Enhance your confidence in weather decision-making, both when flight planning and during the flight, for example watch forecasts on TV, keep an eye on METARs and TAFs even when not flying, study radar and satellite imagery, talk to fellow pilots, share weather experiences, read books and articles and attend courses.

7. GLOSSARY AND METEOROLOGICAL ABBREVIATIONS

Glossary:

Anticyclone	An area of higher surface pressure than its surroundings
Col	Area surrounded by 2 ridges and 2 troughs
Depression	An area of lower surface pressure than its surroundings
METAR	MÉTéorologique Aviation Régulière (<i>English: Aviation Routine Weather Report</i>)
Ridge	High pressure between 2 areas of low pressure
TAF	Terminal Aerodrome Forecast
Trough	Low pressure between 2 areas of high pressure
Volmet	Meteorological information for aircraft in flight

Meteorological Abbreviations:

ISOL	Isolate
OCNL	Occasional
PROB	Probability Forecast The probability or chance of thunderstorms or other precipitation events occurring
BECMG	Becoming The BECMG group is used when a gradual change in conditions is expected over a longer time period, usually two hours
TEMPO	Temporary The TEMPO group is used for any conditions in wind, visibility, weather, or sky condition which are expected to last for generally less than an hour at a time (occasional), and are expected to occur during less than half the time period



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EUROPEAN HELICOPTER SAFETY TEAM (EHEST)

Component of ESSI



European Aviation Safety Agency (EASA)
Strategy & Safety Management Directorate
Konrad-Adenauer-Ufer 3, D-50668 Köln, Germany

Mail ehest@easa.europa.eu
Web www.easa.europa.eu/essi/ehest

