SAFETYSENSE LEAFLET 5e
VFR NAVIGATION

1 INTRODUCTION

a) This leaflet contains advice for pilots of all aircraft, including balloons, gliders and microlights, and should be read in conjunction with other General Aviation Safety Sense Leaflets. It is particularly relevant to aircraft flying in UK airspace.

b) Visual Flight Rules are defined in Rules 25 to 31 of the Rules of the Air Regulations 2007. Some pilots seem to think VMC stands for Very Marginal Conditions!

2 THE CHARTS

a) The law requires, and good airmanship demands, that you **must** carry all the charts you need for your flight and for any diversion which may reasonably be expected, and these must contain current information.

b) The best 'all round' charts for VFR flight within the United Kingdom airspace are the Aeronautical Charts ICAO 1:500,000. Their scale and degree of topographical, hydrographical, and terrain detail are suited to map reading at the speeds and altitudes commonly flown by general aviation aircraft. The chart shows aeronautical information up to and including flight level 245, and is amended frequently.

c) If flying at low speeds, greater detail is provided by 1:250,000 topographical charts (e.g. major power lines are shown). However, Controlled Airspace with a lower limit above 5000 ft altitude is not shown, so carry a 1:500,000 as well.

d) Aerodrome charts are published in the UK AIP (AD) for licensed aerodromes. These charts can make it easier to recognise, and make a good final approach to, the *right* aerodrome. Commercial Flight Guides contain many other aerodrome charts which help in identifying your destination or alternate. Carry them with you.

3 UP-TO-DATE INFORMATION

a) Confirm that your charts are the latest edition, and note any updates of chart detail or frequencies (included in amended "frequency reference cards") since the publication date, from the CAA website at www.caa.co.uk, through "aeronautical charts".

b) Obtain the latest pre-flight bulletin information from the AIS website www.ais.org.uk or by fax pollback. The system is fully described in AIC 65/2007 (White 138)*, and in a NATS leaflet. Having registered, a "Narrow Route Brief" should provide details close to your route. Information for VFR flight in adjacent FIRs is also available, as are the UK AIP, AICs and AIP Supplements.

4 PLANNING THE ROUTE

a) Erase all previous track lines and pencil information from the chart.

b) Draw in your intended route. Does it cross:

- a major hazard;
  Why fly in a straight line over high ground (weather hazards/few forced landing options) when a slightly longer track could keep you over a friendly valley and well clear of cloud and other weather-related hazards? AIC 6/2003 (Pink 48) 'Flight Over and in the Vicinity of High Ground' contains useful advice on mountain waves, turbulence etc.*
- Controlled Airspace;
- an aerodrome with an active Aerodrome Traffic Zone (ATZ) – *follow Rule 45 of the Rules of the Air Regulations (in CAP 393);*
- an active aerodrome *without* an ATZ – *follow Rule 12;*
- a Prohibited, Restricted, or Danger Area;
- a Military Aerodrome Traffic Zone (MATZ);
- an ATS Advisory Route;
- the extended runway of an aerodrome with an Instrument Approach Procedure (IAP), indicated by a 'cone' symbol;
- a gliding, parachuting, paragliding, hang gliding, or microlight site;
- an air navigation obstruction;
- a high-intensity radio transmission area or nuclear power station;
- a bird sanctuary;
- any other restriction published by Mauve AIC or NOTAM, e.g. an air display or Temporary Controlled Airspace (see paragraph 5(k)).

Do any of these affect your route? If not sure, consult the chart legend. You may need to change your route; others will require prior permission, or a positive ATC clearance to transit at certain altitudes. If your final intended track relies on weather or clearances, **plan an alternate route**, complete with timings and fuel.

c) Study the topography, terrain and water features of the en-route area.

d) Identify high ground from the spot heights and contours and remember that the highest point en-route is often the top of an obstruction. Calculate and note the minimum altitude you can safely fly each leg.

The Maximum Elevation Figures (MEF) on charts give the elevation of the highest known (or likely) feature in each quadrant in hundreds of feet amsl. These figures provide no safety margin from the features.

e) Plan to fly on QNH, essential when under or near Controlled Airspace, but use Regional Pressure Settings when in sparsely populated areas or unable to obtain an accurate local QNH. Do not plan to fly below 1500 ft AGL; it hides features, you may meet high speed military aircraft (see *Safety Sense Leaflet No. 18 'Military Low Flying'*), and it reduces options in the event of engine failure.

f) Make use of line features. If a river, valley, railway, road, ridge or tree line is reasonably close and runs roughly parallel to the direct track, then (airspace constraints permitting and not forgetting the right-hand traffic rule, Rule 19) plan to keep it in sight. A modest increase in track distance is a small price to pay for being sure of your position. Line features at right angles to the route can be useful ETA checks.

g) How can you best pin-point your position? Look for distinctive areas of water; line features which cross one another; prominent obstructions etc. However, you will be looking down at a shallow angle; check that they will not be hidden by high ground or woods. Could a similar point nearby lead to confusion?

h) Large built-up areas make poor pin-points. If you overfly them, you must be able to glide clear if an engine fails [Rule 5(3)]. Think twice about using active aerodromes as pin-points — apart from circuit and other traffic, small grass ones are often difficult to identify. Do **not** fly over aerodromes with a parachuting symbol, hard to see free-fall parachutists could be dropping. Avoid glider winch-launching sites, also. Disused aerodromes with hard runways may be useful as check points, but may not be unique.

i) The hard runway pattern at both active and disused aerodromes is shown on the 1:250,000 charts, although information for disused aerodromes cannot be guaranteed.

j) The best pin-points have line features which lead you to them. Use these, wherever possible, for turning points and for airspace entry and exit points. Because these will be popular features, it is a good idea to pass to one side (ideally right) of them. The same applies to the Visual Reference Points (VRPs) marked on charts; use them as references, not aiming points, although a published 'Entry Point' is just that. Unprotected Instrument Approach Procedures, indicated by 'cones'  , do not mean that the approaches will always be to the runway with the 'cone'.

k) An unfamiliar aerodrome will be easier to spot if the sun is to one side or behind you. Arriving into sun will make it harder to see.

l) Taking all these factors into account, decide on your final route, altitudes and diversion aerodromes. Load the route into your GPS set if you have one, and 'run' it as a "gross error check". Read *SafetySense Leaflet 25 "Use of GPS".*

m) Obtain the latest **weather** information, allowing a margin for safety. Wind affects not only headings and times, but take-off and landing! Confirm the TAFs accuracy with METARs, but only the Area forecast (F215) can warn you about the weather between aerodromes. Make sure you can fly the route as planned. Unless everything is 'GO', you should postpone your flight!

5 THE ROUTE PLAN/LOG

a) You should **never** fly a route without a written route plan, containing, at the very least:

- Magnetic headings, time/distance marks, *minimum safe VFR altitudes*, planned altitude for each leg, *including* that to any alternate aerodromes, and freezing level;
- Total distance, time, and fuel to destination *and* alternate aerodromes;
- Time available on reserve fuel;
- Weather for the *route* and *destination/alternate* aerodromes;
- Positions of check and turning points with estimated time of arrival (ETA) so you can log and compare it with your actual time of arrival.

b) Have you practised your system for adjusting headings as you approach or pass each check point? You may wish to mark 'drift lines' on the chart to reduce the calculations if you do get off-track.

c) Select 'ETA Check' features, preferably line features at a maximum of 15 minute intervals.

d) Note your plans for alternate routings and other contingencies. You may have to remain clear of, or alter your route through, Controlled Airspace; note the frequencies and conspicuity squawks. In any case be ready to pass entry/exit positions and ETAs. *See SafetySense Leaflet 27 "Flight in Controlled Airspace".*

e) Which aerodromes do you plan to use if the weather deteriorates, your radio fails, or some mechanical failure occurs?

f) Note all contact frequencies, including parachute drop zone activity information services. Can the aircraft equipment operate on all the frequencies you may need? Do you know how to select 25 kHz channels?

g) Use the Lower Airspace Radar Advisory Service (LARS) whenever possible. Brief details, including frequencies, are on the chart. There is a full explanation in SafetySense Leaflet 8, '*Air Traffic Services outside Controlled Airspace'*, and a map showing the areas of coverage is in the AIP (ENR 1.6). However, many military units close at weekends.

h) If your route penetrates a MATZ, plan to make contact on the controlling aerodrome frequency (it's on the chart) at least 15 nm or 5 minutes' flying time from the boundary. Plan a pin-point to help you. Details on MATZ penetrations are in the AIP (ENR 2-2-3-1), and in SafetySense Leaflet 26.

i) Tell a "responsible person" what you are doing and how to alert ATC if you become overdue. If you plan to fly over water more than 20 miles wide or over a sparsely-populated area, file a Flight Plan (*Safety Sense Leaflet 20 VFR Flight Plans*), which is mandatory if leaving UK airspace. You may need to activate it after take-off and close it on arrival, especially if you divert.

j) Plan the arrival at your destination (see paragraph 9). Note any noise or other special procedures.

k) Use Freephone **0500 354 802** to check on Red Arrows displays and Emergency Restrictions.

l) Many pilots transfer the important information such as headings and ETAs to their chart to reduce clutter.

m) Finally, *check for legibility*. Does the route and all other information stand out clearly on the chart and route plan?

n) If using GPS to back-up your visual navigation, double check that you have programmed it correctly and do not use it unless you are thoroughly conversant with **all** its modes of operation.

o) 'Book-out', and it helps to clean the windshield!

6 AIRBORNE

a) Air Traffic Services are there to help, but are not clairvoyant. If you can, consider setting heading from overhead the aerodrome. Check you really are heading the right way from landmarks, GPS track, and the sun, and haven't, for instance, confused zero-three with three-zero.

b) Select a point well ahead of you and aim towards it. Frequency changes are best made with a landmark in sight ahead. You can then concentrate on the transmission and report your position confidently.

c) Try to stay in R/T contact at all times. If using the Flight Information Service, remember it is generally a non-radar service. If you lose contact, continue to transmit your position 'blind' at regular intervals to inform others of your presence.

d) Check your DI for precession against the magnetic compass (remember the inherent errors), try to ensure level, balanced flight when synchronising and double-check using line features parallel to track.

e) Select your transponder to ALT and code 7000 unless told otherwise.

f) Don't forget a **FREDA** check every 10 minutes:

- **Fuel**
- **R**adio
- **E**ngine instruments, mixture, carburettor heat
- **D**I
- **A**ltimeter

g) Before turning onto a new track, look out carefully in that direction for other aircraft and possible weather problems. You can also select a feature towards which you wish to fly. After each turn, check heading as in paragraph 6(a).

h) Call ATC for clearance well before entering Controlled Airspace, Danger Areas with a crossing service, MATZs and Advisory Routes. If in any doubt about your clearance, orbit over a chosen pin-point until clearance is **positively** obtained, or fly the planned alternative route around it.

i) If you use radio nav-aids to confirm your visual observations don't forget to 'ident' the station. Radio aids and GPS are to assist visual navigation, NOT substitute for it.

j) Minimise time spent looking inside the cockpit. Lift the map and other documents into your field of

view. Look as far ahead as possible, not only for an aiming point, your planned navigation features and other aircraft, but also for potential weather problems.

k) If the weather deteriorates, turn back or divert. Don't be lulled into a false sense of security by still being able to see blue sky. Stay within your licence privileges and your current capabilities. If necessary, carry out a forced-landing with power (see paragraph 8).

7 UNSURE OF POSITION

a) Immediately you become unsure of your position *note the time* and if you are in touch with an ATC unit, request assistance. Otherwise, if you are short of fuel or think you may be near Controlled Airspace, call the Distress and Diversion Cell on 121.5 MHz. If that is not necessary, check the DI and compass are still synchronised. Continue to fly straight and level and on route plan heading. Then think how far you have travelled since your last positive pin-point.

b) Compare the outside with your estimated position, working from ground to map. Does the general picture make sense? Look at the terrain for hill and valley shapes, including those at a distance. Can you see a distinctive line feature such as a motorway, railway, or river? A coastline is ideal.

c) Keep checking the heading and do not relax **lookout** for other aircraft.

d) If you are happy with the general picture, continue to update your estimated position regularly while looking for unique features such as a lake, TV mast, or a combination of roads, rivers and railways.

8 LOST

a) If you are still uncertain, then TELL SOMEONE. Call first on your 'working' frequency and say you are LOST. If you have no contact on that frequency, change to 121.5 MHz and make a PAN call. Select 7700 with ALT on your transponder if fitted.

b) If any of the items below apply, call for assistance immediately – **'HELP ME'**:

H High ground/obstructions – are you near any?

E Entering controlled airspace – are you close?

L Limited experience, low time or student pilot, let them know

P PAN call in good time – don't leave it too late

M Met conditions – is the weather deteriorating?

E Endurance – is fuel getting low?

c) Transmit as much of the following information as you feel able to, but do not waste time composing the call:

- **PAN PAN - PAN PAN - PAN PAN**
- Call sign and aircraft type
- Nature of emergency
- Your intentions
- Your best estimate of position, flight level/altitude and heading
- Are you a student pilot, or what are your instrument qualifications?
- Fuel endurance
- Your transponder status
- Persons on board.

d) The Emergency Service may be terrain limited, and you may be asked to climb. **Do not agree to climb** into IMC unless you are in current practice to fly on instruments, when you must climb above Safety Altitude.

e) If you cannot make use of the emergency service:

- maintain VFR;
- note your fuel state;
- look for an area suitable for a precautionary landing.

f) Transmit your intention to make a precautionary landing and carry out appropriate actions. Give yourself time to make one or more low pass to check wind direction, surface, and any obstacles affecting the approach.

9 APPROACHING DESTINATION

a) With your destination area in sight, do not put aside your chart until you have positively identified the **correct** aerodrome (and any Visual Reference Points).

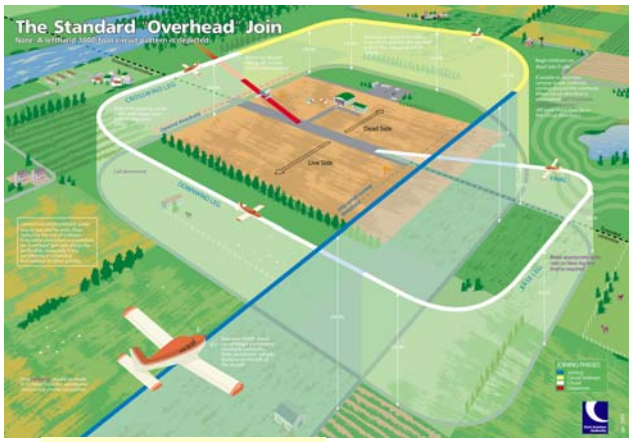
b) Select the appropriate radio frequency in plenty of time to obtain landing information as part of a last **FREDA** check.

c) Note the aerodrome elevation; an ATZ extends to 2000 ft *above aerodrome level*. Check the pattern altitude and noise sensitive areas. Check your altimeter setting and confirm that any change from QNH to QFE equals the aerodrome elevation.

d) Have you positively identified the high ground and any significant obstructions within the ATZ?

f) Do not just rely on the compass or DI to establish the circuit pattern. Use line features to help you to line up with the **correct** runway.

g) Make appropriate calls; **look out** and **listen out** to identify the other aircraft in the pattern or joining it. Even if prior permission is not officially required, you should have checked beforehand for other operations and special procedures. Unless these procedures, or safety reasons or Controlled Airspace, prevent it, join the circuit pattern in the standard 'overhead' manner, as shown on the poster on the CAA website and in LASORS. *See SafetySense Leaflet 6 "Aerodrome sense".*



10 POST-FLIGHT

a) Were you satisfied with your navigation, or would more pre-flight preparation have helped? Using your chart, log and GPS track if available, run through what actually happened to try to learn from the flight.

b) If you think that the chart would benefit from any change, contact the:

VFR Chart Editor
Aeronautical Charts and Data Section
CAA House K6
45– 59 Kingsway
London WC2B 6TE.

Tel: 020 7453 6572
Fax: 020 7453 6565

*The AICs referred to in this leaflet may have been superseded, check that you are consulting the latest edition.

11 SUMMARY

- Use up-to-date charts and update the information
- Prepare a route plan which considers other airspace users, high ground etc.
- Plan to fly above 1000 ft agl to keep clear of military traffic
- Plan and note minimum safe VFR altitudes for each leg
- Get an aviation weather (including area) forecast, and if the actual weather turns out worse than predicted **KNOW WHEN TO TURN BACK OR DIVERT**
- Check NOTAMs at www.ais.org.uk for latest airspace/frequency information and Freephone 0500 354802 for late Restrictions/Red Arrows Displays
- Let someone responsible know your route and timings, or file a Flight Plan
- Look out ahead and around for features, other aircraft, and weather
- Check DI against compass at regular intervals as part of your **FREDA** check
- If you encounter bad weather, turn back, divert or land
- Use the Lower Airspace Radar Service (LARS)
- Obtain permission before entering anyone else's airspace
- Know what to do if you become lost or suffer an emergency
- Don't be afraid to call for help
- Check when near your destination that it really is the correct aerodrome
- Fly within your licence privileges and current capability

TO FAIL TO PREPARE IS TO PREPARE TO FAIL