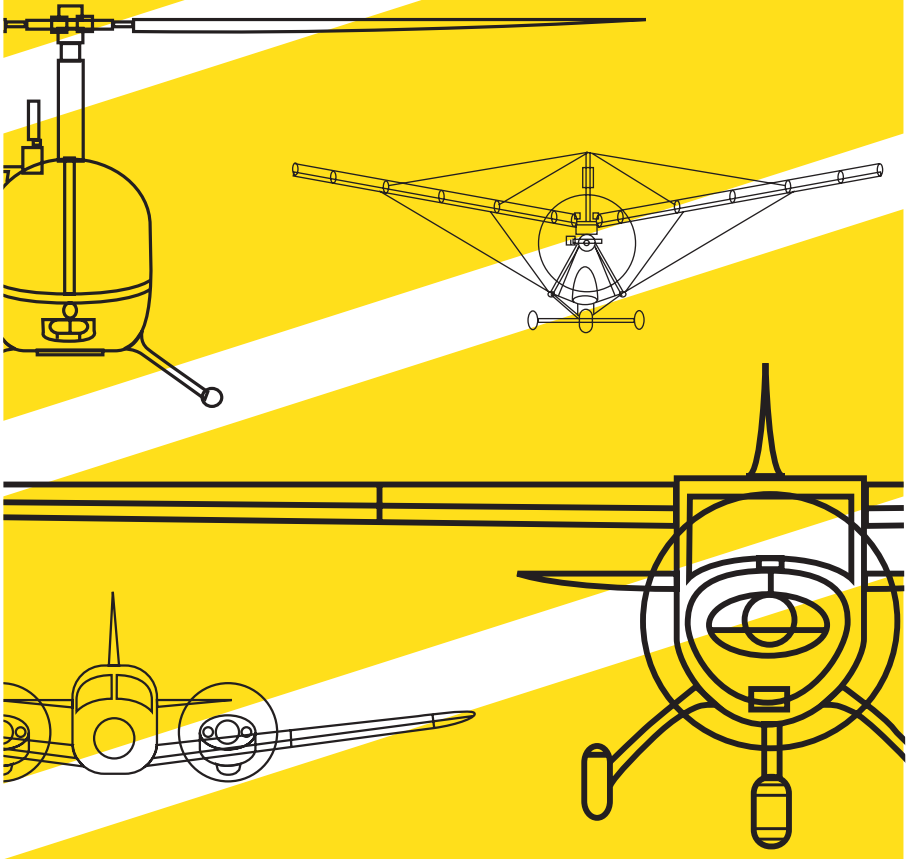
GENERAL AVIATION SAFETY SENSE

CIVIL AVIATION AUTHORITY

5D

VFR NAVIGATION



VFR NAVIGATION

Photos: John Thorpe

1 INTRODUCTION

a This leaflet contains useful advice for pilots of all aircraft, including balloons, gliders and microlights. It is particularly relevant to aircraft flying in UK airspace. It should be noted that Visual Flight Rules are defined in Rules 24 to 27 of the *Rules of the Air.* Some pilots seem to think VMC stands for Very Marginal Conditions!

b This Leaflet should be read in conjunction with several of the Leaflets listed on the back page.

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.

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 you need greater detail, this is provided by the larger scale 1:250,000 topographical charts, (eg major power lines are shown). Remember that Controlled Airspace with a lower limit above an altitude of 5000 ft is ***not*** shown. You should always carry a 1:500,000 as well.

d Instrument approach and landing charts and aerodrome charts, are published in the UK AIP (AD) for licensed aerodromes. Although not primarily intended for the VFR pilot, these charts contain a wealth of information which can make it easier to recognise, and make a good final approach to the ***right*** aerodrome whilst keeping you clear of 'instrument' traffic. Also, commercial Flight Guides carry many other aerodrome charts which help in identifying your destination aerodrome.

3 UP-TO-DATE INFORMATION

a Confirm that each of your charts are the latest edition by referring to Green Aeronautical Information Circulars (AICs) or your Chart Agent. Note the date of the 'Validity of Aeronautical Information' at the bottom of each chart and then check the Aeronautical Information Publication (AIP), NOTAMs etc for amendments which affect your area of operation or route, eg a changed frequency.

b Many Flying Clubs receive the Bi-weekly Bulletin which provides consolidated information by Regions.

c AIS pre-flight bulletin information is available from the AIS website on the internet at http://**www.ais.org.uk**. The system is fully described in AIC 8/1998 (White 298)*. Bulletins available include Aerodrome Information and UK Daily Nav Warnings, which can be accessed individually, in groups, or as complete bulletins. Information for VFR flight in adjacent FIRs is also available, as are 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; see AIC 144/1997 (Pink 160)* 'Flight Over and in the Vicinity of High Ground'. It contains a lot of useful advice on mountain waves, turbulence etc. Then check:

- Controlled Airspace;
- an aerodrome with an active Aerodrome Traffic Zone (ATZ);
- an active aerodrome ***without*** an ATZ;
- a prohibited, restricted, or Danger Area;
- a Military Aerodrome Traffic Zone (MATZ);
- an ATS Advisory Route;
- an Instrument Approach Procedure (IAP) in the open FIR, indicated by a 'cone' symbol;
- a low-level corridor or special route;
- a gliding, parachuting, hang gliding, microlight or paragliding site;
- an area of intense aerial activity (AIAA) or aerial tactics area (ATA);
- an air navigation obstruction;
- an high-intensity radio transmission area, a nuclear power station or gaol;
- a bird sanctuary;
- an altimeter setting region (ASR) boundary;

- a NOTAM or mauve AIC restriction, eg one which may apply to an air display, a military exercise or Royal low-level corridor and purple airspace (see para 5l).

Do any of these items affect you? Most will require a change of route; others will require prior permission, or even a positive ATC clearance to transit at certain altitudes. If you are not sure, ***read the chart legend.***

c Now study the topography, hydrography and terrain of the en-route area.

d Where is the high ground? Identify the spot heights and contours and remember that the highest point en-route is often the top of an air navigation obstruction. Current charts show Maximum Elevation Figures (MEF), which are the highest known feature including terrain and obstacles in each quadrant in thousands and hundreds of feet amsl. **THESE ARE NOT SAFETY ALTITUDES.**

Note: Land-based obstacles up to a height of 299 ft AGL are ***not*** normally shown.

e Do not plan to fly below 1000 ft AGL, this airspace can be heavily used by high speed military aircraft (see Safety Sense Leaflet No. 18 'Military Low Flying'). It also reduces options in the event of engine failure.

f Where are the best 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.

'Where are the best line features'

g How can you best pin-point your position? Look for distinctive areas of water; line features which cross one another; prominent obstructions etc. Look again and check that they will not be hidden by hills, ridges, or woods. Is there a similar pin-point nearby which could lead to confusion?

h Large built-up areas do ***not*** make good pin-points. If you overfly them, your minimum permissible height may be dictated by engine-out height limitations (Rule 5.1). Think twice about using active aerodromes as pin-points — the smaller grass ones are often difficult to identify, and some of them will have other aircraft in the area. Do not use aerodromes with a parachuting symbol as a turning point, hard to see free-fall parachutists could be using the area. Disused aerodromes with hard runways can be useful as check points, but in some areas there are many of them, so another feature should be used as a cross-check.

i As a landmark feature, the hard runway pattern at both active and disused aerodromes is shown on the 1:250 000 Series, 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 any airspace entry and exit points. The United Kingdom Aeronautical Information Publication (UK AIP) (AD) details specific Visual Reference Points (VRPs) both for routeings into and across Controlled Airspace as well as keeping clear of unprotected Instrument Approach Procedures, indicated by 'cones'. VRPs and entry/exit points defined in the UK AIP are shown on topographical charts.

k If you are flying to an unfamiliar aerodrome, it 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 — **and the weather** — into account, decide on your final route, altitudes and diversion aerodromes. Unless everything is 'GO', consider postponing your flight!

5 THE ROUTE PLAN/LOG

a You should **never** fly a route without a written route plan, (which has a column for Safety Altitude) containing, at the very least:

- Magnetic headings, time/distance marks, *minimum safe altitudes,* freezing level and planned altitude for each leg, *including* that to any diversion aerodromes;
- Total distance, time, fuel to destination *and* diversion aerodromes;
- time available on reserve fuel;
- weather for the *Route* and *Destination/Diversion* aerodromes;
- estimated time of arrival (ETA) at each visual reference or turning point so you can log and compare it with your actual time of arrival.

b Have you a foolproof system for adjusting ETAs as you pass each check point? Have you marked 'Drift Lines' on the chart? These remove the guess-work if you do get off-track.

c Have you made best use of 'ETA Check' line features? You should aim to check the ETA at 15 minute intervals.

'Prepare a thorough route plan'

d What are your plans for en-route contingencies? You may not be given clearance to cross a Danger Area — then is ***not*** the time to replan the route. You may be told to hold and await clearance through Controlled Airspace — you will almost certainly be asked for entry/exit ETAs. Have you read AIC 7/1999 (Pink 185)*?

e Which aerodromes do you plan to use if the weather deteriorates, your radio fails, or some degree of mechanical failure occurs? The nearest aerodrome might not necessarily be the best, but will you have enough fuel, bearing in mind a possible headwind, to get to the one that is?

f Have you made a note of all the contact frequencies? Do you know which ones are on the chart? Does the aircraft equipment operate on all the frequencies you may want to use? Do you know how to select 25 kHz channels?

g Make use of the Lower Airspace Radar Advisory Service (LARS) Brief

details, including frequencies, are on the Half-Million chart. Many are military aerodromes operating only on weekdays. A map showing the areas of coverage is in the AIP (ENR 1.6). There is a full explanation in AIC 20/1998 (Yellow 287)* *Services to Aircraft Outside Controlled Airspace and Safety Sense Leaflet 8D, 'Air Traffic Services outside Controlled Airspace'.*

h If your route penetrates a MATZ, you should plan to make contact on the MATZ frequency (it's on the chart) at least 10 nm or 5 minutes' flying time from the zone boundary. Have you planned a pin-point to help you? Details on MATZ penetrations are in AIC 48/1996 (Yellow 222)* *Military Aerodrome Traffic Zones.*

i If you plan to fly over an expanse of water more than 20 miles wide or over a sparsely-populated area, it is advisable to file a Flight Plan (see Safety Sense Leaflet 20A VFR Flight Plans). Don't forget that you will need to cancel the Flight Plan on arrival, (unless ATC does it for you) or if you divert. A Flight Plan is mandatory if leaving UK airspace.

j Does your aircraft have a transponder? Do you know how to use it? Do you know the emergency codes?

k Are there any activities which could lead to special procedures, eg gliding at your destination? Is there a noise sensitive area?

l Use Freephone **0500 354 802** to check on Royal Flights, Red Arrows displays and Emergency Restrictions. The information is updated daily and available from about 19.00 hrs the day before.

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

n Don't forget to 'book-out' and it's a sensible idea to start with a clean wind shield.

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

6 AIRBORNE

a Air traffic are there to help you, but they are not clairvoyant. If you are permitted to do so, set heading from overhead the aerodrome. Check that you really are heading the right way from landmarks or the sun and haven't, for instance, confused zero-three with three-zero.

b Frequency changes are best made with a landmark in sight ahead. You can then concentrate on the transmission and report your position with confidence.

c You should try to stay in R/T contact at all times. If you use the Flight Information Service, do remember it is generally a non-radar service.

If you lose contact, then continue to transmit your position 'blind' at regular intervals. You could prevent an AIRPROX (Airmiss).

d Check your DI for precession against the magnetic compass (remember the errors inherent in magnetic compasses), try to ensure level, balanced flight when synchronising and then double-check using those line features parallel to track. Don't forget a FREDA check every 10 minutes:

- **F**uel
- **R**adio
- **E**ngine Instruments and carb heat
- **D**I
- **A**ltimeter

e Call ATC in plenty of time before entering Controlled Airspace, Danger Areas with a crossing service, ATAs, AIAAs and Advisory Routes. If there is any doubt about your clearance, then orbit over a chosen pin-point until clearance is ***positively*** obtained, or fly the planned alternative route around it. Many unlawful and hazardous infringements of controlled airspace occur because this advice is not heeded.

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

g If the weather deteriorates, don't press on — 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 para 7) (not doing this has killed many people).

'turn back or divert'

h Immediately you become unsure of your position *note the time* and if you are in touch with an ATC unit, especially a radar unit, you should request assistance. Check that the DI and compass are still synchronised. Continue to fly straight and level and on *route plan heading*. Then calculate a rough distance travelled since you last had a positive pin-point.

Now compare the outside with your estimated position. Does the general picture make sense? Look at the terrain *eg* ridges, hill lines, valleys, escarpments. Can you see a distinctive line feature *eg* motorway, dual-carriageway, railway, river? Look at the shape of the woodland. Is there a coastline visible? As a general rule work from the ground to the chart.

i Keep checking that heading and do not relax your lookout for other aircraft.

j If you are happy with the general picture, then narrow your sights to more specific features, but remember to up-date your estimated position regularly. Look for unique features such as a lake or reservoir, a TV mast, a road with a river or railway running alongside.

7 LOST

a If you are still uncertain, then TELL SOMEONE. Transmit first on your 'working' frequency and do not mince words. Say you are LOST. If you have lost contact on that frequency, then change to 121.5 MHz and make a PAN call. If you have a transponder, set it to Code 7700. It will flash on a radar screen to alert the controller.

b If you are lost and any of the items below apply to you, call for assistance – '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 – fuel remaining; is it getting low?

c The VHF Autotriangulation service can pinpoint you from your radio transmission over the land mass to the east and south of Manchester. See AIC 26/1997 (Pink 138) *'Use of the VHF International Aeronautical Emergency Service'.*

d Transmit as much of the following information as you can:

- PAN PAN/PAN PAN/PAN PAN
- Callsign and aircraft type
- Nature of emergency
- Your intentions
- Your best estimate of position, flight level/altitude and heading
- Whether you are a
  - student pilot
  - pilot with NO instrument qualification
  - pilot with IMC rating or full Instrument Rating
- Fuel endurance
- Transponder equipped
- Persons on board

e The Emergency Service may be terrain-limited if you are flying below 3000 ft amsl so, if requested, climb above that altitude, but *do not* agree to climb into IMC unless you are in current practice to fly on instruments, and climb above Safety Altitude. Don't forget to cancel your PAN CALL when you are safe.

f If conditions (weather, terrain, R/T) preclude safe use of the emergency service, then:

- maintain VFR;
- note your fuel state;
- calculate the time left to look for an area suitable for a precautionary landing.

g Transmit your intention to make a precautionary landing and carry out the appropriate actions.

h Give yourself plenty of time to make at least one low pass to check, approaches for obstacles (eg aerials, cables), the surface and wind direction.

8 APPROACHING YOUR 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).

Select the appropriate radio frequency in plenty of time to obtain landing information. Don't forget a last FREDA check.

b Check the Minimum Safe Altitude and noise sensitive areas. Note the aerodrome elevation, and remember that an ATZ extends to 2000 ft *above aerodrome level.* Check your altimeter setting and confirm that the change from QNH to QFE equals the aerodrome elevation.

c Have you positively identified the high ground and significant obstructions within the ATZ?

'make sure it's the right aerodrome'

d Make sure it's the right aerodrome, plenty of pilots have got it wrong.

e 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.

f Unless you know of different procedures, or safety reasons or Controlled Airspace prevent it, join the circuit pattern in the standard overhead manner.

9 POST FLIGHT

a Were you satisfied with your navigation, or would **more** preflight preparation have helped? Study your route, tracks made good and actual timings to try to learn from the flight.

b Are there any hints and tips which might be useful to other pilots flying that route? If so, publish them through club Newsletter, or via the CAA General Aviation Safety Information Leaflet (GASIL).

c 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

Helpful advice as well as your Charts can be obtained from Chart Room staff.

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

10 SUMMARY

- Use up to date charts
- Prepare a thorough written route plan which takes into account other airspace users, high ground etc
- If the weather deteriorates, know your safety altitude and resist any temptation to fly lower
- Plan to fly above 1000 ft agl to keep clear of military traffic
- Get an aviation weather forecast and if it turns out to be worse than predicted KNOW WHEN TO TURN BACK OR DIVERT
- Check NOTAMs, Bi-weekly Bulletin for latest airspace/frequency information and Freephone 0500 354802 for Royal Flights/Red Arrows Displays
- Let someone responsible know where and when you are going, your ETA, or file a Flight Plan
- 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 elses airspace
- Know what to do if you become lost or suffer an emergency – set the transponder to 7700
- Check when near your destination that it really is the correct aerodrome
- Fly within your licence privileges and current capability
- Don't forget to look out.

TO FAIL TO PREPARE IS TO PREPARE TO FAIL

Other leaflets in this series:

1C	*Good Airmanship Guide*
2B	*Care of Passengers*
3C	*Winter Flying*
6C	*Aerodrome Sense*
7B	*Aeroplane Performance*
8D	*Air Traffic Services Outside Controlled Airspace*
9A	*Weight and Balance*
10A	*Bird Avoidance*
11	*Interception Procedures*
12C	*Strip Sense*
13A	*Collision Avoidance*
14A	*Piston Engine Icing*
15B	*Wake Vortex*
16A	*Balloon Airmanship Guide*
17B	*Helicopter Airmanship*
18A	*Military Low Flying*
19	*Aerobatics*
20A	*VFR Flight Plans*
21A	*Ditching*
22	*Radiotelephony*
23	*Pilots: It's your Decision*
24	*Pilot Health*

New leaflets will appear from time to time on a non-regular basis.

This leaflet does not supersede or replace any formal documents.

If clubs, organisations or individuals wish to receive further copies, please write to Westward documedia Limited, 37 Windsor Street, Cheltenham, Glos GL52 2DG. Fax. No. 01242 584139. Telephone 01242 235151.

Suggestions and technical queries to SRG Safety Promotion Section, Aviation House, Gatwick Airport, West Sussex RH6 0YR. Telephone 01293 573225/7.

ISSN 0266-1519

Prepared by the Safety Promotion Section and the Corporate Communications Department of the Civil Aviation Authority.