The CIX VFR Club

VATSIM PILOT RATINGS TRAINING MANUAL

Part 3: The P3 RATING

NOT TO BE USED FOR REAL WORLD AVIATION

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Version 1.06

Document History

Date	Version	Changes
03/12/2012	1.00	Initial Draft version
27/09/2014	1.01	Review prior to continuing delevelopment
15/10/2014	1.02	Revised the structure to fit the VATSIM Syllabus structure
09/12/2016	1.05	Completed
20/12/2016	1.05	Section on Semicircular Rule added plus relevant text.
24/09/2017	1.06	Revised Minimum Fuel Requirement

Acknowledgements

Peter Dodds, is CEO of the CIX VFR Club, and a VATSIM P3 Rated pilot

Ken Greer is a QFI with the Club and is a VATSIM P3 ratied pilot and also holds a CIX VFR Club SEP rating.

Table of Contents

1 INTRODUCTION

The VATSIM Pilot Rating Program has several goals. First and foremost it is designed to promote the training of VATSIM pilots at all stages of experience using third party resources qualified and monitored by VATSIM. VATSIM has established the knowledge requirement and tasks to be carried out in order to qualify for a VATSIM pilot rating, after extended and detailed consultation with a steering group of interested members..

1.1 Authorized Training Organizations and Pilot Ratings

VATSIM has therefore established a number of Authorized Training Organizations (ATOs) to deliver the ratings. Cix VFR Club has been appointed as an ATO, and its established training system has been adapted where necessary to provide training for some, but not all, of the ratings.

The list of VATSIM ATOs may be found at the following website:

http://linksmanager.com/vatsimvas/authorised-training-organisation.html

There are planned to be nine distinct ratings for all pilots with room for additional ratings which may be identified over time.

P1: VATSIM Online Pilot

P2: VATSIM Flight Fundamentals

P3: VATSIM VFR Pilot

P4: VATSIM IFR Pilot

P5 :VATSIM Advanced IFR Pilot

P6: VATSIM International and Oceanic Pilot

P7: VATSIM Helicopter VFR and IFR Pilot

P8: VATSIM Military Special Operations Pilot

P9: VATSIM Pilot Flight Instructor

The P1 rating must be obtained before any other rating can be attempted, but other than that, no rating is a prerequisite of another and each stands alone.

The programme provides pilots with recognition for having achieved demonstrated success in online flying at several levels. By maintaining a consistent worldwide standard for each rating, the ATOs will ensure that the ratings awarded reflect the capabilities of the pilot and become a sign of achievement and professionalism that both new and experienced pilots will

desire to display. The ATOs will be audited at intervals in order to maintain the required standard of training.

The ratings are voluntary and the VATSIM founders have decreed that they shall remain so, because they recognise that not all pilots will have a desire to gain any ratings regardless of their experience. As a corollary, an ATO approved programme will be the only path through which ratings can be achieved. An expedited process will be available for veteran pilots to gain their ratings without undue training, so long as they are prepared to demonstrate their competence to an ATO. No ratings will be granted automatically without either examination or demonstration of skills.

1.2 Cix VFR Club Training Department

Cix VFR Club, being a VFR enthusiast organisation, has an active Training Department which offers training for the P1 and P2 ratings, and also for other General Aviation skills. These include courses modelled very closely on the real world Private Pilot Licence, Multi-engine Piston (MEP) and others. We have a team of four instructors who have all been very closely involved in real world aviation, most of them being, or having been, real world private pilots.

Although our principal interest is in VFR flight, we can carry out one to one Instrument Flight training if requested, as we do have suitably qualified instructors available. However, we do not carry out any training in aircraft outside the ICAO "Light" category (5,700kg Maximum All-Up Weight).

1.3 P1 and P2 Ratings Revision

VATSIM has authorised the Club to require that Members (not external students) should hold the P2 rating before being eligible to take the P3 written exam or flight. Make sure you are thoroughly familiar with the knowledge you gained with P1 and P2 Ratings. The P1 and P2 Rating Training Manuals are Adobe Acrobat documents which can be downloaded from the Club website.

The P3 Rating Examiner will expect you to be fully competent in the knowledge and skills demonstrated at P1 and P2 levels.

1.4 P3 Rating Knowledge Requirement and Skills Test

The P3 rating is defined by VATSIM as "VFR Pilot". The knowledge and skills required to fly VFR in the UK are the principle requirements of P3 and are set out in this document. The Club training for the P3 rating is a distance learning programme which follows the VATSIM P3 Syllabus using the written material referenced in this document via the hyperlinks. A pilot's knowledge and skill will be tested by both:

- A written examination in the form of web-based multiple choice questionnaires, and

- By a practical demonstration of the ability to fly the chosen aircraft at a level of competence which will enable the pilot to have fun, continue to learn, and to avoid him causing difficulties for othe VATSIM members.

The written test is a set of random questions covering all the information which a student ought to know about the regulations and practice of flying under Visual Flight Rules in the UK. Cix VFR Club does not teach or examine students who wish to gain their P3 rating on aircraft outside the Light (less than 5700Kg) Category.

The practical skills test will be carried out in FSX in a shared cockpit environment; student and instructor sharing the flight in one aircraft and communicating via TeamSpeak.

To obtain the P3 rating, a pilot must be competent in the following knowledge areas: -

1.4.1 What is VFR Flight?

- The definition of flight under Visual Flight Rules
- The UK Visual Flight Rules
- The differences from Instrument Flight Rules (IFR)
- Limitations of Flight Simulator for VFR flight
- VFR Flight on VATSIM

1.4.2 Weather

- TAF and METAR Decode
- Sources of weather information
- Differences between real world weather and VATSIM weather
- Decision making based on weather information.

Note: This subject was partially covered at P1 level. Revision is advised because knowledge of aviation weather will be re-examined in both the written and practical tests.

1.4.3 Charts for VFR Flying

- UK “Half-million” 1:500,000 scale aviation charts
- UK “Quarter-million” 1:250,000 scale aviation charts
- Computer based charts and flight planning tools such as Plan-G, Skyvector Lite and FSCommander.

The knowledge & skill requirements are set out in detail in this manual, with links to additional information as necessary to provide the student with the knowledge needed to satisfy those requirements.

1.4.4 Flight Planning

- Planning a VFR Flight
- Terrain Clearance.
- Avoiding Controlled Airspace or obtaining permission to fly in certain classes of controlled airspace.
- Waypoints, times and distances.

1.4.5 Navigation

- Flying a planned route
- Maintaining VFR flight - or not.
- Diversions to alternate aerodromes
- What to do if you get lost!

1.4.6 Air Traffic Control

- Air Traffic Services Outside Controlled Airspace (ATSOCAS)
- Procedures for VFR traffic within controlled airspace
- Special VFR

1.5 The Essential Software

1.5.1 Flight Simulator Version

As a holder of the prerequisite P1 and P2 Ratings, the student is expected to have all the necessary software in place to enable them to immediately commence any practical flight test connected to the VATSIM network, and communicate with ATC when required.

The student is expected to be familiar with the Flight Simulator default Cessna 172SP in FSX. Earlier versions of Flight Simulator, Prepar3D and X-Plane unfortunately cannot be accepted at present, because the Flight Test is conducted in Shared Cockpit, an FSX feature. The Club is working towards being able to offer VATSIM Pilot Ratings in X-Plane.

1.5.2 TeamSpeak 3

TeamSpeak Version 3 is used by the Club for voice communication during training and flight tests. It is not essential for logging into VATSIM or flying online, but it is essential for talking to other Club members during events or training sessions. TeamSpeak is a stand alone Voice-over-Internet application. Version 3 is the most recent version.

TeamSpeak 3 is used to log into the Club's private voice server, so that members can talk to each other during club flights in addition to talking to ATC through the pilot client software. Very rarely do the two applications

conflict, but for those using FSInn, it is important to disable the "Use TeamSpeak" option in the FSCopilot (traffic lights) application.

1.6 Training Documents for the P3 Rating

1.6.1 The Pilot Ratings Training Manual level P3

That is this document. It is the principle training resource for the P3 Rating. It is essentially a summary of all the P3 Rating training material with links to the relevant Club Training Manual Exercises for each P3 Rating syllabus topic.

1.6.2 The Cix VFR Club Flight Training Manual

There is also a wealth of information available in the club's original training manual initially built in 2005 and 2006. It is based closely on the UK Private Pilots Licence training course and comprises 23 separate Exercises. It has been completely revised and updated in 2012 in order to be suitable for use for the VATSIM Pilot Ratings.

2 FLIGHT RULES

Flight is conducted either under Visual Flight Rules (VFR) or Instrument Flight Rules (IFR). There are no exceptions in civil aviation. One current (2015-2016) difficulty is that the rules of aviation are in a state of flux while all European nations try to harmonise them. The European Airspace Agency (EASA) is carrying out this task, very slowly and with much confusion, as temporary arrangements are allowed, then superceded, then modified, seemingly almost constantly and differently in each country. To try and keep up, look at the UK AIP at frequent intervals, or subscribe to “Pilot” magazine!

2.1 Visual Flight

2.1.1 What is Visual Flight?

Very simply, a Visual Flight is a flight during which pilots use their eyes instead of the instruments for situational awareness. We walk everywhere using our eyes for "situational awareness" (a phrase much used in aviation which means simply "knowing where you are"). We see a lamppost and we avoid it. Similar rules exist in aviation, "See and avoid" being the major "saying" or principle of Visual Flight.

2.1.2 Visual Meteorological Conditions

Pilots flying under Visual Flight Rules (VFR) must fly at all times within sight of the surface, clear of cloud and with a horizontal visibility of 5 kilometres or more. If the aircraft speed is greater than 140 knots, then the clearance from cloud must be 1500 metres horizontally and 1000 feet

vertically. Slower aircraft must simply remain clear of cloud. These cloud and visibility limitations are called Visual Meteorological Conditions (VMC). It is worth mentioning that a horizontal visibility of 5Km or more is actually very poor visibility indeed. Comfortable, stress free, VFR flight requires a minimum of around 9Km.

The details of VFR weather are given in Section 3.

2.1.3 Visual Flight Rules

The Visual Flight Rules in the UK require an aircraft to be flown in accordance with the Visual Meteorological Conditions (VMC) minima appropriate to the classification of the airspace.

In addition, when flying in controlled airspace, the pilot must obtain ATC clearance, maintain a listening watch on the appropriate frequency and comply with any instructions given by ATC.

VFR flight is not permitted in certain classes of airspace. See Section 4 for airspace classification definitions.

2.1.4 UK Defined Weather Minima for VFR Flight

Within Controlled Airspace (Classes C to E)		
At and above FL 100	**Below FL100**	**At or Below 3000ft**
• 8 km flight visibility • 1500m horizontally from cloud • 1000ft vertically from cloud	• 5 km flight visibility • 1500m horizontally from cloud • 1000ft vertically from cloud	Fixed wing aircraft at more than 140 knots: - • 5 km flight visibility • 1500m horizontally from cloud • 1000ft vertically from cloud Fixed wing aircraft at 140 knots or less: - • 5 km flight visibility • Clear of cloud • In sight of the surface

Helicopters inside controlled airspace: - Clear of cloud and in sight of surface

Outside Controlled Airspace (Classes F and G)		
At and above FL 100	**Below FL100**	**At or Below 3000ft**
• 8 km flight visibility • 1500m horizontally from cloud • 1000ft vertically from cloud	• 5 km flight visibility • 1500m horizontally from cloud • 1000ft vertically from cloud	Fixed wing aircraft at more than 140 knots: - • 5 km flight visibility • Clear of cloud • In sight of the surface Fixed wing aircraft at 140 knots or less: - • 1500m flight visibility • Clear of cloud • In sight of the surface

Helicopters may operate at a speed which, having regard to the visibility, is reasonable: Clear of cloud and in sight of the surface

The UK and US Visual Flight Rules are also included in the Club Tutorial "Weather for VFR Pilots", on the Club website at

http://www.cixvfrclub.org.uk/training/tutorials/pdftutorials/Weather for VFR Pilots.pdf

2.1.5 The Semicircular Rule

The semicircular rule (also known as the hemispheric rule) applies, in slightly different versions, all over the world, including in the UK. It was originally defined for IFR traffic only, a different rule (the Quadrantal Rule) being used for VFR traffic, but this was discontinued in 2015.

The standard rule defines an East/West track split: Eastbound – Magnetic track 000° to 179° – fly at odd thousands of feet (1,000, 3000 etc. Westbound – Magnetic track 180° to 359° – fly at even thousands of feet (2,000, 4000 etc.).

In some countries, e.g. Spain, the rule uses a North/South track split – Northbound – Magnetic track 270° to 089° – fly at odd thousands of feet (1,000, 3000 etc. Southbound – Magnetic track 090° to 269° – fly at even

thousands of feet (2,000, 4000 etc.). To list every national variation would fill many pages, so for each country you fly in, so search the Internet for the correct form of the Rule for the region in which you intend to fly.

In the UK, one can immediately spot a problem, given that in winter, on a good flying day, cloudbase can be around 2000ft. Add to this the fact that over northern England, Wales and Scotland, the terrain can rise to over 3000ft, and complying with the semicircular rule becomes impossible.

To overcome this practical difficulty, the Semicircular rule is advisory only below the transition altitude, and only mandatory above the transition level. (See Section below for a full explanation of these terms).

2.1.6 Special VFR

Special VFR Flight in the UK is defined as: "A flight made at any time which would normally be conducted under IFR, such as in a control zone which is Class A airspace or any other control zone in IMC or at night, where the relevant air traffic control unit has given permission for the flight to be made in accordance with special instructions given by that unit. The pilot in command must comply with any instructions given by that unit and must remain at all times clear of cloud and within sight of the surface".

A pilot does not require a SVFR clearance in an Aerodrome Traffic Zone (ATZ).

SVFR is being phased out in the UK to comply with the European Airspace Harmonisation Programme

2.2 Instrument Flight

2.2.1 What is Instrument Flight

Instrument flight is defined internationally as flight by sole reference to the aircraft instruments. Whether or not he can see anything outside the cockpit, the pilot flies with his eyes glued to the instrument panel 99% of the time. The P3 rating does not cover instrument flight, but you very definitely need to know the difference between VFR and IFR.

2.2.2 Instrument Meteorological Conditions

Instrument Meteorological Conditions (IMC) is weather which is not VMC. That is the top and bottom of it.

2.2.3 Instrument Flight Rules

Instrument Flight Rules (IFR) permit an aircraft to operate in Instrument Meteorological Conditions (IMC). IMC is defined simply as conditions outside the limit of VMC (as described in Section 2.1.2 above). Flight in Class A Airspace is always conducted under IFR, unless, in certain circumstances, flight under Special VFR is permitted. Flight under IFR

requires both pilots and aircraft to be instrument equipped and rated. An Instrument Rated pilot must demonstrate competency in conducting a flight in IMC conditions, from take off to landing, while controlling the aircraft solely by reference to instruments.

All VATSIM pilots are assumed to be holders of an Instrument Rating (IR) when they join VATSIM. The VATSIM Pilot ratings programme is designed to improve pilot skills, but is not mandatory.

Commercial traffic is 99% flown under Instrument Flight Rules (IFR). IFR rules are actually very simple.

- Flight in Instrument Meteorological Conditions (IMC)
- Flight with sole reference to the aircraft's instruments.
- Separation by radar or position reports to ATC from terrain and other aircraft
- Flights which are unable to comply with Visual Flight Rules.

The last point is the "catch all" of course. If the weather isn't good enough for VFR, you must fly IFR or stay on the ground. That is why commercial traffic, which flies in almost all weathers, is conducted under IFR almost exclusively.

The definition of Instrument Meteorological Conditions is also a "catch-all". Effectively IMC is any weather which isn't VMC!!

The definitions of IFR and IMC are included here solely to help clarify the difference between IFR and VFR and are not further discussed in this manual.

2.3 Night Flight

Aviation has a definition for "Official Night" which is 30 minutes after sunset to 30 minutes before sunrise. Flight within that period is classed as a night flight, and real world pilots must have a Night Rating in order to be able to fly at night. On VATSIM, of course, pilots are deemd to have all the ratings they need to carry out any flight.

Until 17th September 2012, night flight in UK Airspace under VFR was prohibited. Since then, VFR flights at night are permitted, providing: -

The aircraft must:

1). not be flown at a height of less than 1,000 feet above the highest obstacle within a distance of 5 NM unless:

a) it is necessary for the aircraft to do so in order to take off or land;

b) the aircraft has been otherwise authorised by the competent authority in relation to the area over which the aircraft is flying; or

c) the aircraft flies at an altitude not exceeding 3,000 feet above mean sea level and remains clear of cloud and with the surface in sight; and

2). be flown in compliance with articles 45 and 46 of the Air Navigation Order (ANO) as though it were flying in circumstances where the commander is required to comply with the IFR.

Articles 45 and 46 of the ANO refer to mandatory two pilot operation of public transport flights and don't concern VATSIm pilots.

The P3 Flight test will not be conducted at night.

2.4 Patience and Understanding

So, you will encounter few "General Aviation" (GA) aircraft on VATSIM. You may well meet many "heavy" aircraft if you land at larger more popular airports such as Gatwick and Bristol. The golden rule is that Light aircraft give way to heavy aircraft. If there is a stream of inbound Airbuses and Boeings, you may find yourself orbiting (if inbound) or waiting at the hold 9if outbound) for some time. Please be patient. This is only a reflection of the real world situation at some airports.

Although Controller training on VATSIM is somewhat more rigorous than pilot training (although these courses are designed to address that), you may therefore come across controllers unfamiliar with handling VFR flights, because they so infrequently get VFR traffic. One of the rules of VATSIM, when one encounters someone unfamiliar with procedures, is to treat them with courtesy and patience. The Club is confident that you will.

Detailed procedures for flying VFR on VATSIM are dealt with in sections and of this manual; ATC communications for GA pilots is dealt with in Section .

3 WEATHER

This section is a revision and an expansion of the weather information the student will have learned at P1 level.

3.1 Sources of Weather Data

3.1.1 Internet Sources

Comprehensive weather information for aviation is available on the Internet in specially designed aviation weather bulletins for most major airports around the world. It comprises a number of types of bulletin, of which two principal types, forecasts, and observed weather at the current time, are normally the most important. "Normally" means that occasionally, one of the other types of weather bulletin may be so important as to override the

others, e.g. severe storms or extreme turbulence ("microbursts"), often broadcast as "Significant Meteorological Events" (SIGMET).

The two most commonly valuable bulletins are presented as: -

- Terminal Area Forecasts (TAFs), and
- Meteorological Actual Reports (METARS)

There are dozens of different ways to obtain aeronautical weather information, because every country is obliged to publish its basic aeronautical weather information free of charge, and most if not all do so on the Internet. The UK official source is the Meteorological Office, usually abbreviated to “Met. Office”.

http://www.metoffice.gov.uk/aviation/ga-briefing-services

The basic information: General synopsis, spot winds, TAFs and METARs are all free. Other services are subscription based.

A world-wide source is the U.S. National Oceanographic and Atmospheric Administration (NOAA) Aviation Weather Centre. As you might expect, the main focus of this site is the USA, but it does provide worldwide data, so don't be put off by the opening screen.

For Europe, the European Aviation Weather Centre is the simplest to use. It is so simple, it is confusing at first! There is a single box in which you enter the airport you are interested in, select METAR or TAF and the information required is immediately displayed. No bells or whistles at all on this site! Once you start to look around, though, there is a menu providing many more options - warnings, notices, aerodrome specific information (e.g. runways closed) etc.

Apart the one above for the UK Meteorological Office, links have not been included in this document, simply because they frequently change. Searching on the titles as shown above will (almost) always take you to the appropriate site, however.

3.1.2 FS Pilot Clients

The above two are of course real world sites, but many online pilots will always fly with the real weather. The two Pilot Clients, Squawkbox and FSInn themselves download real world weather METARs from the VATSIM servers every few minutes for nearby weather stations as you fly, plus the departure and destination airports once you have completed a flight plan. You can also obtain weather data for any airport entering its ICAO code.

Because the Pilot Client data comes from VATSIM, it follows that VATSIM itself has links to real world weather sites. The main VATSIM website can therefore provide “actuals” (the common pilot-name for METARS) directly on the following web page, if you know the airports ICAO identifier.

http://www.vatsim.net/data/search_metar.php

Squawkbox and FSInn will set the FS weather as closely as it can to the real world weather at the time of the flight by taking weather information from the VATSIM servers and setting the appropriate values in FS.

The new pilot client vPilot does not have a weather function. If you use vPilot, you have to obtain your weather data from elsewhere.

3.1.3 FS Specific Software

The most well known weather software for use with Flight Simulators is Active Sky available from HiFi Technologies.

http://www.hifitechinc.com/products/activeskynext

This tool takes real world weather but also replaces the FS default weather engine with a superior application which includes better clouds, weather phenomena such as wind shear, icing, thermals, different types of preciptitation etc. It is payware, but most users consider it very good value. The latest version is called Active Sky Next, often abbreviated to ASN on forums. Active Sky does not work with X-Plane.

Another application is FSRealWX, which is freeware.

http://www.fsrealwx.net/index.php

It is basically an easier to use weather generator than the FS in-built weather engine. It can interpret real world data and and translate it for FS use with VATSIM. There is a version which works with X-Plane called XPRealWX.

3.2 Decoding the Reports

The major aviation authorities have all produced weather bulltin decoding documents, and the link below takes you to the UK Met. Office version.

http://secure.metoffice.com/aviation/taf_decode.jsp (You will need to log in to the service after clicking this link).

The link below takes you to the US version, from the National Oceanic and Atmospheric Administration (NOAA).

http://aviationweather.gov/static/help/taf-decode.php

The following site is UK-based, and if you enter the text of a METAR, cut and pasted from a weather site, it will decode it for you.

http://www.ukweatherworld.co.uk/Pages/Metar-Decoder.aspx

3.3 Weather Minima for VFR Flight

For Flight Simulator purposes, some of the real world weather information may be superfluous, because native Flight Simulator cannot recreate it. If, however, you have the "Active Sky" application installed, this can do a far better job than FS of recreating real weather situations, including

turbulence, thermals and other "disturbances" to the air, plus much more realistic cloud structures.

The Club's " Weather for Virtual VFR Pilots" is a comprehensive document dealing with weather reports, interpretation of Terminal Area Forecasts (TAFs) and Meteorological Actual Reports (METARs) in detail, as they apply to Flight Simulator.

http://www.cixvfrclub.org.uk/training/tutorials/pdftutorials/Weather%20for%20VFR%20Pilots.pdf

It should be read by the P3 student in conjunction with this manual.

3.4 Weather Conditions Different from VATSIM

At times you may have different weather conditions displaying in your flight simulator than those you find on VATSIM. One limitation of FS is that the weather can change abruptly as it receives data from a new weather station which has come into range. A heavy overcast can suddenly clear, or worse, you can suddenly find yourself enshrouded in fog.

If you find you have weather different from that reported by real world sources, or perhaps from a controller you are working with, simply inform the relevant controller of this after you make your initial call. If the weather is too difficult for your skill level to be able to fly, then you can legitimately clear all weather in FS, and fly in nice fine conditions with little cloud and good visibility. If you choose to do this though, you must inform any controller you are working with, so that he can take this into account when giving you instructions.

Don't forget that weather changes may result in a change of barometric pressure (QNH) – so you may need to reset your altimeter. In addition, you should still use the real world wind direction to select the active runway when there is no controller on line.

In contrast, if you decide to continue with the reported weather, you can request from the controller a runway that suits you, if the published runway makes an approach difficult, e.g. has a strong crosswind. Controllers can refuse such a request if they are busy, so be prepared to divert in that case.

3.5 Using the Information

Weather information is used in two ways on VATSIM.

The pilot uses it for flight planning purposes. Cloud and visibility information will determine whether a VFR flight may be made, or whether he should consider flying IFR. With cloud information, he can determine a safe altitude to fly, also having regard to terrain clearance and controlled airspace. With wind information, he can determine his en route

groundspeed for each leg of the flight, and thus calculate the leg times, and from that his fuel requirement.

Wind information is also used for selecting the most into-wind runway for departure and arrival at an aerodrome if ATC is not present. If ATC is active, the controller will determine the correct runway for departure or arrival. The crosswind take off and landing limits of the aircraft must also be taken into consideration. This is covered in detail in the Club's " Weather for Virtual VFR Pilots".

http://www.cixvfrclub.org.uk/training/tutorials/pdftutorials/Weather for Virtual VFR Pilots.pdf

An important consideration when flying in relatively poor weather is that of a lowering cloud base. You may set off towards an area where the terrain rises to 2,000ft or so, and the cloud base is over 3,000ft, but as you fly towards an area with lower atmospheric pressure, or lower air temperature, the cloud base will lower, and you could find yourself trying to stay below a 2,000ft cloud base and above a 2,000ft hill!

If you have read this section carefully to this point, you will now realise the importance of obtaining not only your departure weather, but also the en-route and destination weather BEFORE setting off!

3.6 To Fly or Not to Fly

Weather is clearly more important for low level VFR flight than for high altitude IFR. The main questions VFR pilots have to ask themselves about weather are: -

- Is the wind in the right direction to take off and land?
- Is the wind too strong (out of limits) for the aircraft?
- Is the cloud base high enough to allow flight below it and clear terrain by at least 500ft?
- Is the horizontal visibility acceptable for VFR flight?

If you want to be ultra-realistic in your simulated flying, you will not take off for a VFR flight if the weather is unsuitable. However, most of us will want to continue and there are four ways of doing so.

a) Carry on regardless - because you are not risking your life or that of any passengers, or,

b) Re-file the flight as an IFR flight and fly in accordance with Instrument Flight Rules.

c) Consider flying to an alternative destination, or, if the conditions deteriorate during the flight, diverting to an aerodrome with suitable weather.

d) Turn off the flight simulator weather and fly with nil wind, blue skies and sunshine.

It is your choice! The purist would probably select either option b) or c).

Outside the scope of the P3 rating syllabus, option b) is straightforward for those pilots with instrument flying skills. Instrument flight makes an interesting alternative to VFR and is considerably more challenging in a hand-flown light aircraft than in an autopilot equipped transport aircraft flying at 34,000ft!

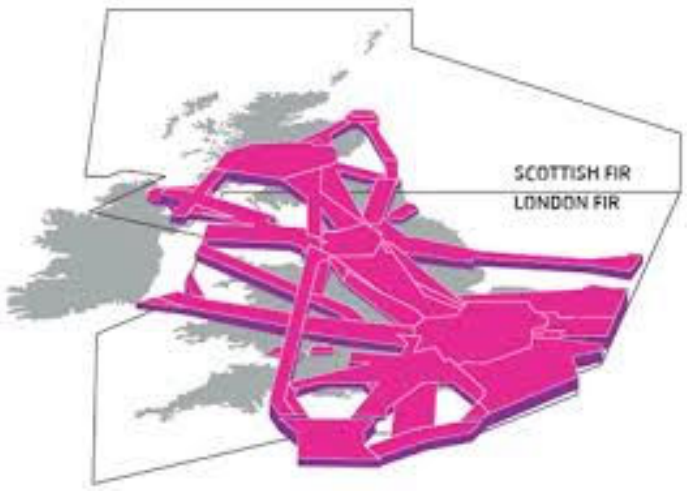
4 AIRSPACE

4.1 Airspace Classification

There are seven classes of airspace in international air law. These are designated as classes A to G. These classes of airspace are designed to meet the differing needs of the aircraft and the level of control that is required for safe flight within them.

Within the UK and its surrounding waters, from the surface and up to 24,500 feet (FL245), the airspace is divided geographically into two Flight Information Regions (FIRs); the London FIR and the Scottish FIR. In addition, airspace is divided vertically into Lower Airspace, defined as that airspace up to Flight Level 95 (FL95); Middle Airspace is between FL100 and FL195 and Upper Airspace is deemed as that above FL195 up to FL245. The airspace above these regions, that is, above FL245, is known as the Upper Flight Information Region (UIR).

We VFR pilots don't need to worry about the UIR, and knowing about it is isn't required for the P3 rating. Much of the UK is covered by controlled airspace protecting our several regional air[orts, and the opportunately to fly VFR above FL100 is limited to Cornwall, parts of Wales and East Anglia, and the north of Scotland. The airspace within the two FIRs is further divided into different types of airspace by the International Civil Aviation Organisation (ICAO), and known as the Airspace Classification System.



There are few areas of the UK where there is no controlled airspace at all, and where VFR pilots can fly as high as they wish, subject to the limitations of their aircraft.

(Real world UK pilots are also limited by the rule that they must not fly above FL100 without supplementary oxygen).

Some of the Classes of Airspace are designed as Controlled Airspace (A,C, & D) and "the rest" (Classes F & G) are Uncontrolled Airspace. In the UK, there is no Class B airspace and Class E airspace is not widely used. The Belfast Terminal Control Area (TCA) and the Scottish Terminal Manoeuvring Area (TMA) are the only Class E airspace.

Class F airspace is being phased out from November 13th 2014 and either replaced by Class E "airways", designated as Transponder Mandatory Zones, (TMZs) or downgraded to uncontrolled Class G airspace.

So, for the VATSIM VFR pilot in the UK, for all practical purposes, the following are the relevant Classes of Airspace.

Class A — VFR flight is not permitted in Class A airspace under any circumstances. Heathrow Airport Control Zone is Class A airspace.

Class D — This is airspace around the larger aerodromes and airports in which VFR traffic is not permitted without specific clearance from ATC. A VFR clearance may be granted within Class D airspace, if the VFR minima can be met.

The VFR minima for Class D airspace are an in flight visibility is 5km or more and 1000 feet vertically and 1500 metres horizontally clear of cloud. However, in respect of the latter, for aircraft below 3000 feet and at 140 knots or less, to be simply clear of cloud is sufficient.

If VFR conditions cannot be met, a Special VFR clearance may be granted. See section 2.1.6 for details of Special VFR Flight.

Many regional airports such as Manchester, Birmingham and Liverpool have Class D airspace around them.

Note: Pilots flying under VFR MUST NOT ENTER Class D airspace without permission and a specific clearance from the ATC unit, and must obey instructions from ATC.

Class G — Class G is uncontrolled airspace. This means that any aircraft may make use of it and an air traffic service may be available from ATC but it is not a requirement to have one. Please note that below 19,500 feet (FL195) large areas of this airspace is available to both military and General Aviation aircraft. Above 19,500ft, VFR flights are not permitted in the UK. Most airspace outside Classes A & D below 19,500 feet is Class G with some Class E. For full details of Class G airspace see section 4.3 below.

Class E Airspace has very similar rules to Class D. The difference, for the VFR pilot, is that in Class D airspace, he will receive a "Control Service", that is, instructions from ATC, whereas in Class E airspace, he won't and is

responsible for his own navigation and altitude within the airspace., although he will be tracked on radar by the ATS unit which supervises that airspace. When in Uncontrolled Airspace a pilot takes full responsibility for their own actions, although they can ask for help.

4.2 Other Controlled Airspace

The large airports have a significant area of country embraced by controlled airspace which falls into four categories. These three-dimensional blocks of the atmosphere, several cubic miles in size and with, of course, entirely invisible boundaries become so engrained in the pilot's thinking that they might as well have brick walls, floors and ceilings!

4.2.1 Terminal Manoeuvring Areas

Terminal Manoeuvring Areas (TMAs) are large areas of controlled airspace, covering one or two counties or more, and with the exception of the Scottish TMA, are Class A airspace. They are used for arriving and departing commercial traffic flying entirely under Instrument Flight Rules (IFR). VFR traffic is prohibited from Class A airspace of course, but fortunately the London and Manchester TMAs have a base level of a few thousand feet so that General Aviation traffic does not have to go round them, but can go underneath them. There are three in the UK: -

- London TMA Class A – Base level 2500-4500 feet (varies)
- Manchester TMA Class A – Base level 3500 feet
- Scottish TMA Class E – Base level 2500 - 4000 feet (varies)

The Scottish TMA is Class E Airspace, which extends from west of Glasgow to east of Edinburgh. For the VATSIM VFR pilot means he will be responsible for his own navigation in VMC. If the weather is outside VMC, he can request a Special VFR clearance to fly through the Scottish TMA. This is just as well, because the Scottish TMA would otherwise be quite a barrier to north-south travelling GA traffic, and to the south of the area, high terrain can preclude flying beneath it. .

4.2.2 Control Areas

Control Areas (CTAs) are smaller than TMAs and they cover the arrival and departure routes of the smaller regional airports such as Luton, East Midlands and Birmingham. Heathrow CTA alone is Class A and the rest are Class D. The base level of a CTA is some thousands of feet above the ground as they are protecting inbound and outbound traffic which is already airborne. The top of a CTA usually coincides with the base levels of the airways network which is all Class A airspace. VFR pilots may of course transit Class D CTAs with ATC permission.

4.2.3 Control Zones

Control Zones (CTRs) are the next layer in from the CTA, and are smaller than CTAs. They are used to control and guide aircraft which are either approaching on the ILS landing system or departing on a Standard Instrument Departure (SID). All CTRs in the UK are Class D airspace, except for London Heathrow, which as you may well imagine is definitely not Cessna 172 friendly and is Class A, (i.e. no VFR traffic permitted!!). CTRs extend from the surface of the ground up to (usually) the base of the airport's CTA. Being Class D airspace, VFR traffic wishing to land at an airport may request a VFR clearance to enter the Control Zone in order to do so.

With regard to the London Heathrow CTR it is important to note that a Special VFR clearance to transit the zone may be granted but it is wise to be aware of one's position in respect of a planned transit or when requesting vectors to transit the zone. Helicopter traffic regularly travels within the zone via designated routes.

4.2.4 Aerodrome Traffic Zones

Aerodrome Traffic Zones (ATZs) are a special little area of controlled airspace which surround all **Licensed** Airfields other than those controlled by CTRs etc. Unlike the other types of Airfield protection airspace, which may be any shape, depending on traffic requirements, ATZs are circular with a radius of 2 nautical miles (nm), unless the runway is 1850 metres in length or more, in which case the ATZ is 2.5nm in radius.

An aircraft should enter an ATZ only with the permission of the Air Traffic Controller and on VATSIM this may well be the controller in charge of the surrounding TMA. Remember VATSIM works a Top Down principle which means that in the absence of a local controller you may well have to speak to someone at a higher level of control.

Very occasionally, a VATSIM controller may choose to man a small aerodrome for some special event. ATC at these small aerodromes may be full control, an Air/Ground (A/G) radio service, or an Aerodrome Flight Information Service (AFIS). The appropriate dialogue for A/G and AFIS controllers is included in the Club's "Air Traffic Control Manual for VATSIM VFR Pilots", downloadable from the website.

On VATSIM all aerodromes are deemed to require permission to land. In real world parlance the term "Prior Permission Required" (PPR) is used, though this term is not used on VATSIM. Permission is deemed to be granted when the controller acknowledges the pilot's initial request for "joining instructions" and passes back the information required for landing. Permission to land may be refused for any reason.

4.2.5 Military Aerodrome Traffic Zones

The final type of aerodrome protective airspace is the Military Aerodrome Traffic Zone, or MATZ (pronounced “mats”). Surprisingly perhaps, it is not mandatory to request permission from the ATCO at the military aerodrome to transit a MATZ, but it is ALWAYS good airmanship to do so. There is a standard radio procedure for this outlined in in the Club's "Air Traffic Control Manual for VATSIM VFR Pilots", downloadable from the website.

4.2.6 Restricted Areas and Danger Areas.

These are identified on the CAA 1:500,000 Aeronautical Charts, and sometimes, though not always on the software equivalents such as Plan-G or Skyvector as a pink shaded area.

In real world flying a NOTAM would identify the times that these areas are 'active'. When planning a flight on VATSIM, it is good airmanship and a courtesy to controllers to route around these areas.

4.2.7 Parachute Dropping Zones, Gliding Sites and Bird Sanctuaries.

These are also identified on the CAA 1:500,000 Aeronautical Charts, and sometimes, though not always on the software equivalents such as Plan-G or Skyvector. If you see a pink shaded area on your chart or software, it is good flight planning to avoid these areas also.

4.2.8 Areas of Intense Aerial Activity. (AIAAs)

There are several Military "Virtual Airlines" (VAs) within VATSIM and it is possible to encounter several Fast Jets or Transport aircraft flying within these areas. It is best to be very wary and keep a sharp lookout when flying within them.

If you use Plan-G, switching on RPDM Airspace and Special Use Airspace on the Map ribbon, will display most of these last four types of restricted airspace.

4.3 Uncontrolled Airspace

In the UK all geographic areas “outside controlled airspace” up to an altitude of 19,500 feet are either Class F or Class G, and the pilot has more freedom of choice about where to go, who to talk to and when. It is also known as “the Open Flight Information Region” or "Open FIR". Pilots may fly VFR in the open FIR with few restrictions.

Class F — Only “Notified routes” are Class F airspace. These are special areas of uncontrolled airspace where aircraft are permitted to fly VFR without being in contact with an ATS unit, but are required to navigate within certain constraints laterally and vertically because of the proximity of controlled airspace. They exist where navigation past or round the adjacent controlled

airspace would require a significant diversion or extension – effectively the controlled airspace would otherwise virtually prevent VFR navigation in or past a large area. However, Class F airspace is being phased out and replaced with Transponder Mandatory Zones (TMZs) from 2014.

Class G — In the UK, most airspace outside Class A & D below 19,500 feet is Class G Classes F & G airspace are collectively known as "The Open FIR" (Flight Information Region). VFR flight is permitted in the Open FIR for any aircraft, whether radio equipped or not. In the real world there is no requirement for aircraft flying under VFR to establish or maintain radio communication with any station.

4.4 Height, Altitude and Level

These words have precise definitions in aviation.

Height is the elevation of the aircraft or obstacle measured from ground level. Most commonly used with the altimeter set at zero when the aircraft is on the ground (i.e. with the QFE set on the Kohlsmann scale) before flying circuits at 1000ft height.

Altitude is the elevation of the aircraft or obstacle relative to sea level, i.e. the altimeter reading with the QNH set on the Kohlsmann scale.

There is a specified altitude at which a pilot changes from declaring (to ATC) his altitude in feet to declaring it as a Flight Level. In the UK, that "Transition Altitude" is is 3000ft above sea level. Confusingly, it is also known as the "Transition Level" if the altimeter is set with a QNH value of 1013 hectopascals on the Kohlsmann scale. Unless the actual barometric pressure on the day is 1013, the Transition Altitude and the Transition Level will be different by anything up to 500 feet. It is good airmanship to avoid flying at 3000ft, regardless of the QNH set, to avoid any confusion between controllers and pilots.

If an aircraft flies at 4,000ft with a QNH value of 1013 hectopascals set on the Kohlsmann scale, then his Flight level is 40, reported to ATC as "Flight level four zero", not "forty". At 10,000ft it would be flight level one hundred and so on. You will have gathered that Flight Level is altitude with the last two zeros knocked off, **provided always** that it is measured with a QNH value of 1013 hectopascals set on the Kohlsmann scale.

There are areas of airspace surrounding airports where the Transition Altitude differs and these differences are shown on airport charts. It is usually at an altitude of 6000 feet where the change to flight levels takes place around airports.

This can be a tricky concept to understand at first, but practice makes perfect. Just avoid flying at 3,000ft! There is more on this subject in the Club's Training Manual Exercise 18a; Navigation Theory.

4.5 Airspace Summary

The following is a summary of airspace rules. Remember though, that on VATSIM, it is a REQUIREMENT, that ALL traffic uses any relevant ATS unit which is on line. As a general rule, this means contacting ATC approximately 10 nautical miles (nm) from the boundary of any controlled airspace you wish to enter, or, if not entering controlled airspace, as a rule of thumb, an air traffic service may be requested up to approximately 40 nm from the ATS unit.

Class A

- IFR flights only are permitted .
- All flights are provided with air traffic control service and are separated from each other.

Class C

- IFR and VFR flights are permitted.
- All flights are provided with air traffic control service.
- IFR flights are separated from other IFR flights and from VFR flights.

Class D

- IFR and VFR flights are permitted.
- All flights are provided with air traffic control service.
- IFR flights are separated from other IFR flights and receive traffic information in respect of VFR flights .
- VFR flights receive traffic information in respect of all other flights.

Class E

- IFR and VFR flights are permitted
- IFR flights are provided with air traffic control service and are separated from other IFR flights.
- All flights receive traffic information as far as is practical.
- Class E is not used for control zones.

Class F

- Uncontrolled.
- IFR and VFR flights are permitted
- IFR flights are permitted and participating flights must maintain a listening watch on an appropriate radar frequency.
- VFR flights are permitted and can receive an ATSOCAS service if requested (see Section 7.4 below).

Class G

- Uncontrolled.

- IFR flights are permitted and participating flights must maintain a listening watch on an appropriate radar frequency.
- VFR flights are permitted and can receive an ATSOCAS service if requested (see Section 7.4 below).

5 CHARTS FOR VFR FLYING

You cannot fly without a chart. This obvious statement is enshrined in aviation law as well as being common sense. There are no road signs in the air! Aviation Law requires real world pilots to always carry the current chart on every flight. Real world VFR charts are updated frequently, in the UK at least - annually, so the word "current" is important.

However in our flight simulator world we are frozen in time. FSX navigational information was current in 2006. Since them airports have closed radio navigation aids have closed or had frequency changes, airspace boundaries have changed.

Surprisongly perhaps, this time freeze doesn't spoil the hobby. Every serious simmer knows the score, pilot and controller alike, and they work with the limitations.

But you still must have a chart - perhaps a real world version from 2006, perhaps one of the several online chart sources (although these will be the latest ones), or one of the excellent Flight Simulator purpose-designed navigation systems which can be used instead of paper charts.

VATSIM itself is a reliable source of charts. Each world region web site, e.g. VATSIM-UK, VATCAN (Canada) and VATUSA (you guessed!), have sections devoted to the information needed by both pilots and controllers. The pilot sections contain links to airport diagrams, en route charts, aerodrome layouts, terminal areas and the like. Follow this link to start looking for VATSIM sources.

5.1 Free Charts

In the UK, almost all the information is available on the National Air Traffic Services (NATS) website. This isn't the easiest site to find your way about, because a lot of it is formal official real world information constructed in a legalistic framework, rather than a user friendly framework. On this site, under the main menu item “IAIP” you will find all the available information for airport diagrams, en route charts, aerodrome layouts, terminal areas, instrument approach and departure diagrams (SIDs and STARs). Because this information is freely available to anyone, the VATSIM-UK website doesn't reproduce it, but simply provides a link to the NATS website.

VATSIM-UK also supports the VATSIM worldwide Chart Centre, where charts for many other countries may be obtained, or links provided to those National Aeronautical Information websites whose content is publicly available.

5.2 Payware Charts

The one thing you won't find on the Internet is the UK “half million” charts, (in the USA and Canada called “Sectionals”) because these are only available at a cost from various suppliers. Canada too charges for these charts, but in the USA they are free downloads (although paper versions of the same ones cost money).

Of course for VFR flight, these “half million” charts are really very useful, in fact almost essential for serious flightsimming, so it is worth trying to get hold of them. They are published at a scale of 1:500,000 (hence the name “half million”) and three sheets cover the whole UK, each costing somewhat less than £20.00, or you can buy electronic versions which can be used in tools such as Memory Map on laptops, tablets or mobile phones, but these are more expensive.

You can also obtain 1:250,000 scale (“quarter million”) charts. These cost a similar amount each, but you need eight of them to cover the UK. They are designed for visual navigation below 5,000 feet, and are based on the Ordnance Survey "Landranger" series of maps with similar surface topographical detail. They are more popular with gliders and microlights than with the general powered aviation community.

5.3 Superceded Versions

If money is tight, a good source of half million charts is your local aerodrome. Because charts are republished each year, and because real world pilots are required to have up-to-date charts, old ones are very often available for the asking if you visit at the right time of year. The Southern England chart is published every March, the Northern England is published each May, and the Scotland chart is published each July. Last year’s charts are perfectly adequate for flightsimming.

5.4 Chart and Navigation Software

One of the Club's founder members, Tim Arnot, has produced a remarkable VFR navigation tool called Plan-G, which at its most basic, overlays all the flight simulator airspace data over a freeware online map base. Never mind the route planning, tracking and all the very clever stuff it does, it can be used just as a chart when opened, preferably, on a second monitor alongside FS.

This is not the document to explain how Plan-G works - it has its own comprehensive manual, but it will not be a surprise to know that the Club strongly supports the use of Plan-G by its members, and almost all do, as do over 45,000 other flight simmers world-wide.

Secondly, there is an online tool called SkyVector. SkyVector.com was founded in 2005 by a web developer who was learning to fly. Since then it has grown in popularity to become the number one internet destination for

aeronautical charts. It was created for real world pilots but is equally useable by the FS community. It is free to use. It is based on the Jeppesen series of aviation charts, which have slightly different symbology than the UK ones, but the most common symbols are the same. SkyVector also includes full real world data about most aerodromes in the world, listed by country. You can also obtain aviation weather from SkyVector. Unlike Plan-G, its data is up to date, and, as explained above, this may or may not be an advantage to simmers.

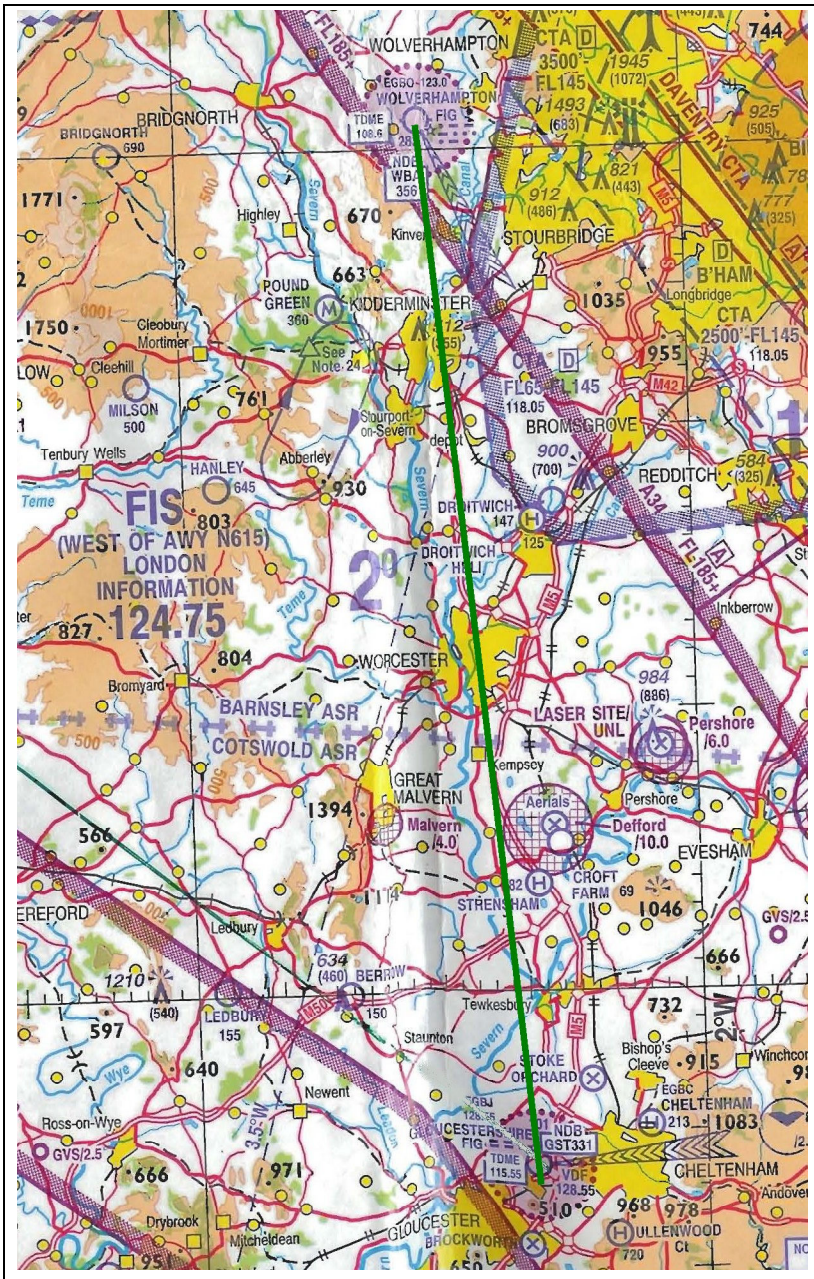
FSCommander is a similar tool, geared perhaps more to heavy metal flight. It includes a function to fly the aircraft for you, which isn't quite what CIX VFR Club members would regard as "cricket"! It also costs money, so it is third in the list of options.

There is also a web-based planner and chart facility called Skyvector which is somewhat simpler than Plan-G or FSCommander.

http://skyvector.com/

5.5 Reading a VFR Chart

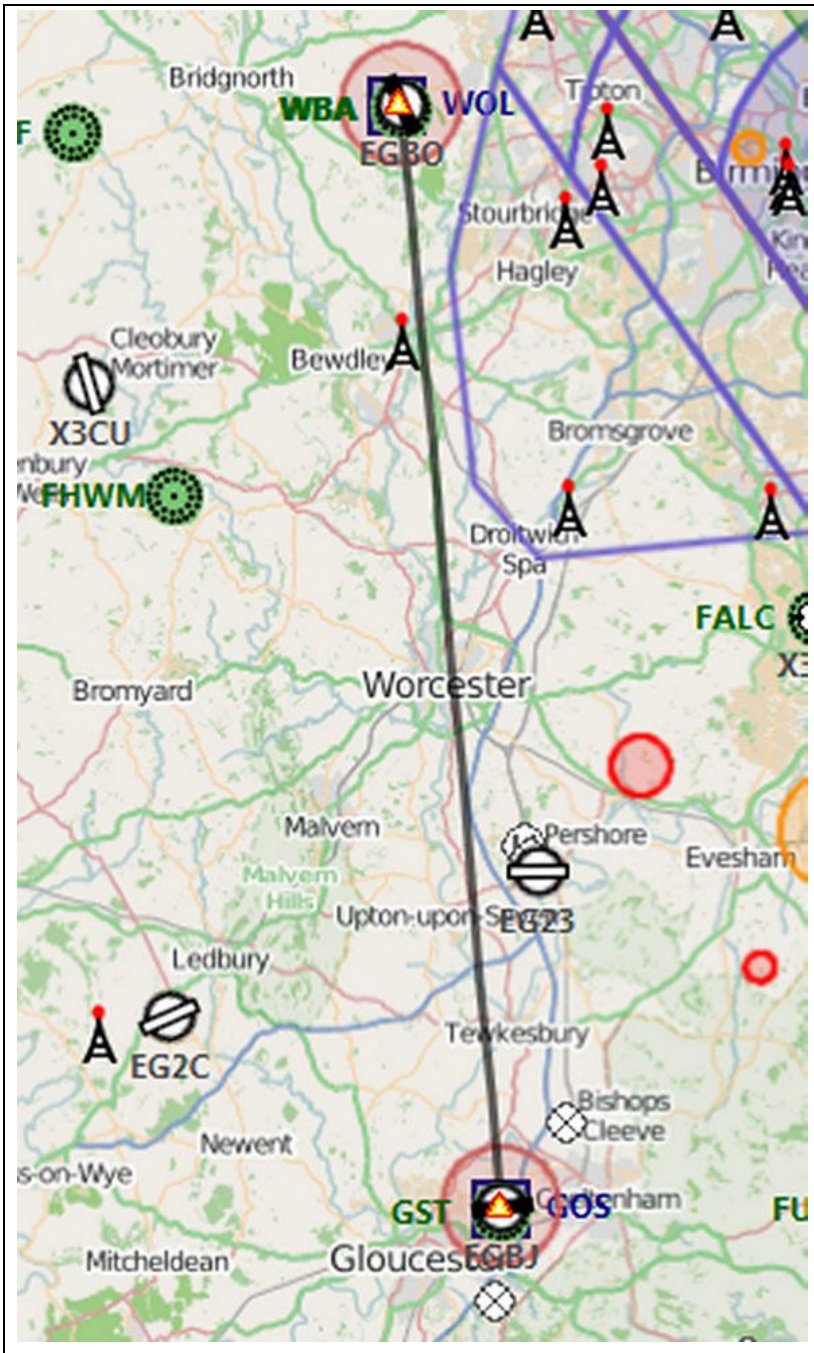
Most commonly, what you want to know from your chart is the location of your departure and destination airfields, the distance between them and what lies along the route. Most short A to B flights will be flown in a straight line. Longer flights may need to avoid an obstacle of some kind on the way, so will comprise two or more straight line "legs". You also need to know what the ground is doing en route. Does it rise to a height that you can't fly over, or is it relatively flat.



Here is a snippet of the Southern UK half million chart. It shows a flight from Wolverhampton (EGBO) to Gloucestershire (EGBJ).

Surrounding each aerodrome is a mauve circle which is its ATZ. Look carefully at EGBO. You can see the radio frequency, its height above sea level (282ft) its NDB and TDME frequencies (356 and 106.5). The approach path is shown for runway 34. It lies beneath Airway A34 which is airspace from flight level (FL) 185 and upwards. It is just outside a Control Area, (Birmingham in fact) which is Class D airspace from FL65 to FL145. The ground elevation 3 miles to the southwest near Kinver is 670ft above sea level.

All that in about one square inch of chart! Aeronautical charts need careful study. They are packed with information.



This is the same route in Plan-G. The map is far less cluttered, because the information is contained in pop-up windows as you move the mouse around the computer screen. Notice that terrain is not shown. There is a way to display terrain in Plan-G (Read the Plan-G manual). The aerodrome ATZs are still shown, and the nearby Birmingham CTA boundary in blue. The town shown as Kidderminster on the half million, is Bewdley in Plan-G (the two towns actually lie either side of the River Severn), and the navigation obstacle - a small black tower with a red knob on top in Plan-G, and a tent-like blue inverted V on the chart.

So yes, there are differences. You just have to learn the symbology of the chart or Plan-G to interpret what you see.

The Plan-G illustration above is slightly blurred as it was significantly enlarged to make it the same scale as the chart fragment above.

The chart has a "Legend" on its bottom border to tell you what all the symbols mean. In Plan-G it is in the manual.

There is one more very important function of a chart, which is to tell you, as you fly, where you are now, or where you should be. With an

appropriate scale rule (or, in Plan-G use the QDM function), measure the distance from Wolverhampton to Worcester. It is 19 nautical miles. If we are flying at 100 knots, and we departed from the overhead at Wolverhampton, then we should reach Worcester 60/100 x 19 minutes later. (60/100 is how long it takes to fly 1 nautical mile (Nm). At 120 knots, you can easily see that it would take 60/120 or half a minute per Nm). So, it will take 11.4 minutes to fly the 19Nm at 100 knots in nil wind. So, if, after 11.4 minutes, you are not over a large town with a river flowing through the middle north-south with a racecourse on its east bank (a little black oval shape on the chart, not shown in Plan-G) and a motorway skirting its easterly boundary, then you are not over Worcester. What to do in that situation is covered in section 9 below.

What is needed next is to use the chart to plan a flight. This is dealt with in Section 6 below.

6 VFR FLIGHT PLANNING

Good planning before a flight ensures not only a good flight but eases your workload in the cockpit. By giving careful consideration to the flight plan on the 'ground', the more likely your flight will be flown with ease, confidence and pleasure. Remember that as a simulator pilot you will be acting as Pilot, Navigator and Radio operator. There is nothing more likely to cause you confusion than when you are trying to work out where you are and a VATSIM controller calls you and asks for a position report or tells you to divert to another aerodrome. It is not easy to measure bearings and distances on your chart whilst flying. It is therefore important to have prepared all that in advance and keep any cockpit navigation to a minimum. The more thorough the flight planning, the easier this is to do.

This manual expands what you have already covered at P1 and P2 level and in these pages you may be referred back to material you are already familiar with. The objective is to reinforce what you have already learned and at the same time, introduce a deeper knowledge of flight planning.

6.1 Units of Measure

Before we even get to the planning stage it is important to realise that in the real world, whatever country a pilot flies in, different units of measure are used. The USA and the UK use knots for airspeed, feet for altitude, metres for runway lengths, and nautical miles for distance. Many countries use kilometres/hour for airspeed, metres for altitude and runway length, and kilometres for distance. It can be very confusing, and it is a good rule to always use the same units that your country of residence uses, because you should be reasonably familiar with them.

One knot is one nautical mile per hour. In the olden days, one nautical mile was one minute of arc measured along a line of latitude, but this was considered not sufficiently precise, so in 1929 the nautical mile was

redefined at an international conference held in Monaco. It is now exactly 1.852 kilomtres (about 6,076.11549 feet or 1.1508 statute miles). The United States did not change over to the new international nautical mile until 1954.

6.2 Planning a Flight

When planning a flight, we will need to take into account many different factors. The first and most obvious is where are we departing from and where are we going to. VFR pilots normally plan a route that covers the shortest distance, taking into account controlled airspace en-route, altitude required for safety clearances, good visual waypoints, weather en-route and an alternate airfield should the landing destination be unreachable for any reason.

6.3 Aerodromes

The main source of information regarding aerodromes in the UK is the UK AIP AD. It is well worth browsing this site as it has a wealth of information for the virtual pilot. You will find not only aerodrome charts, but also the textual data that informs a pilot of local flying regulations, circuit direction and heights and much more, and you do need this information before flying.

The Aerodrome Specific page of the NATS website contains all the information you need for the aerodromes you are flying from and to, including any alternates required.

http://www.nats-uk.ead-it.com/public/index.php%3Foption=com_content&task=blogcategory&id=6&Itemid=13.html"Itemid=13.html

6.4 Airspace Restrictions

At this point in the initial flight planning stage it is vital to take note of any controlled airspace you may encounter en-route. Again, the software or a paper chart will show controlled airspace boundaries. Remember also that on the day of your flight air temperature and pressure will affect the aircraft's altitude. It is essential to keep the atmospheric pressure (QNH) updated on the altimeter to maintain the correct altitude in controlled airspace, (or when avoiding it by flying above or below it!). If there is ATC online during your flight, they will advise you of en-route QNH as appropriate. A pilot should usually plan to either fly under, over or go around any controlled or restricted airspace unless landing at an aerodrome within that airspace.

Flights crossing controlled airspace surrounding an aerodrome ("transits") may be permitted, depending on circumstances. Transits must be requested of an ATS unit if it is online. If there is no ATS unit online, then

if you must transit that airspace, do so at no more that 1,500ft above the runway elevation and directly across the downwind threshold of the runway in use, e.g. if runway 27 is in use, transit via the 27 numbers.

A very useful airspace guide is: -
http://www.caa.co.uk/docs/64/VFR_Guide_2011_update.pdf

6.5 Route selection

As a virtual pilot, you have certain advantages over a real world pilot. A real world local flying club pilot may only have access to a club Cessna 152 or at best a Piper Warrior or similar type of aircraft. You, on the other hand, can fly a King Air, Jetstream41, 737 or Airbus. Okay, you might not fly a 737 or Airbus under VFR conditions, but when planning your flight, choose an aircraft from your hangar that will make the flight realistic. If you are considering flying from Stornoway to Shoreham you may not choose a Cessna172 if you wish to do it after work and before bedtime. If you do want to fly it in a Cessna 172 then you will have to carefully plan your route and include stop-over airfields.

When planning your route, take into account the terrain that you will encounter en-route. It may be better to fly a slightly longer route along a coastline, rather than venture across rugged, mountainous country. The possibility of a low cloud base and rising hillsides can quickly create a problem for a light aircraft pilot flying under VFR conditions.

6.5.1 Airspace.

You can't fly just anywhere you like in the real world, so to make your simulated flight realistic, you must take into account such things as:-

- Controlled Airspace
- Airport Control Zones
- Entry/Exit Access Lanes and Low Level Routes
- Prohibited, Restricted and Danger Areas
- Areas of Intense Aerial Activity and Aerial Tactics Areas (low flying, fast jets)
- Altimeter Setting Region boundaries

All of these areas are shown on aeronautical charts. It is very satisfying to be able to plan your flight, realistically taking into account all aspects of the airspace you are going to be flying through.

6.5.2 Hazards.

There are many areas and obstacles that can be hazardous to aviation and should be taken into account at the planning stage. A list of these will include:-

- High terrain
- Radio masts
- High intensity radio transmission areas
- Parachuting and gliding areas
- Wild life conservation areas and bird reserves

You may be saying now that it is only a simulator, but it shows good pilotage skills to take such things into account.

6.5.3 Waypoints.

Try to plan a route that follows easily identifiable landmarks. It is worth flying a longer flight leg where you can pinpoint your position easily than flying a shorter leg where there is a chance of straying off-course because of lack of features. Good visual checkpoints for VFR flying are items such as these:-

- Prominent mountain tops and associated valleys
- Coastlines, river estuaries and bays and prominent headlands
- Railway lines, major roads, crossroads, motorway junctions and Services
- Large towns with easy identifiable features, racecourses, cathedrals etc.
- Combinations of all of these landmarks, especially where rivers and towns meet, or a railway track crosses a river for example.

6.5.4 Alternate aerodromes.

Good airmanship dictates that at least one alternate airfield should be plotted on the chart, if possible, have a choice of two. Weather conditions may dictate a diversion at short notice, and it is better to have an alternate already planned in such a scenario. It is good practice to have the frequencies of your alternate's radio navaids and communications already noted in your PLOG. If the weather does deteriorate then it is a simple case of tuning and tracking a beacon you already have planned than to have to scramble with a chart whilst flying the aircraft.

Note. If you are using flight planning software such as Plan-G then it may be worthwhile printing off a screenshot or two of your planned route, especially if you are using real world photographic scenery. A paper copy of the route will allow you to pencil in distance marks, headings and times, wind vectors etc.

6.5.5 Using Charts

Now that you have taken into account all of the factors regarding your choice of route, it is now time to lay it down on the chart. The same techniques will apply whether it is a paper chart or a digital on-screen chart. This is also the point at which you start to enter in the flight plan data to your PLOG. By ensuring that your chart work is accurate and your calculations are correct, you will save yourself some anxiety in the cockpit. Digital chart software will make life simpler for you by measuring the distance and heading from one point to another. This usually consists of clicking the mouse on a position and dragging out to the next desired position. The distance and heading will be shown. On a paper chart a plotter or protractor will be required to do this.

If you are using a paper chart, it is good practice to place a tick mark every 10 nautical miles along the track line of your route. An approach which works with digital charts is to divide the flight legs up into four. This works well if the distances coincide with a known landmark you have selected. Some pilots use a time interval of say ten minutes flying time and then place a marker on the chart at that location. Bear in mind though that the effect of wind on the aircraft means that it may not be where you expect it to be after ten minutes, whereas distances and locations are constant.

6.6 Bearings, Tracks, and Headings

A Bearing is the angle measured on a chart between two points. It may be a "true bearing" - measured relative to true North, or a "magnetic bearing" measured relative to Magnetic North. Magnetic north changes constantly at about 0.5º a year in the UK, and in some parts of the world can be 30º or more different from True North. Because aircraft fly by the reading on a magnetic compass, which is an absolute indicator (always correct) repeated on the gyroscopic Direction Indicator which is set by the pilot to match the compass, then magnetic bearings are generally of more use than true bearings.

A flight Track is the direction your aircraft travels relative to the ground. It may be a true track, or a magnetic track. Again, magnetic track is of more value to pilots.

A Flight Heading is the direction in which the aircraft points in order travel “on track”. The heading, true or magnetic again, depends on the wind speed and direction. in nil wind, track and geading are tthe same.

6.6.1 The Wind Triangle

A calculation for the effect of wind speed and direction can also be made at this time. This is known as the Wind Triangle, and uses a mathematical device called the Triangle of Velocities.

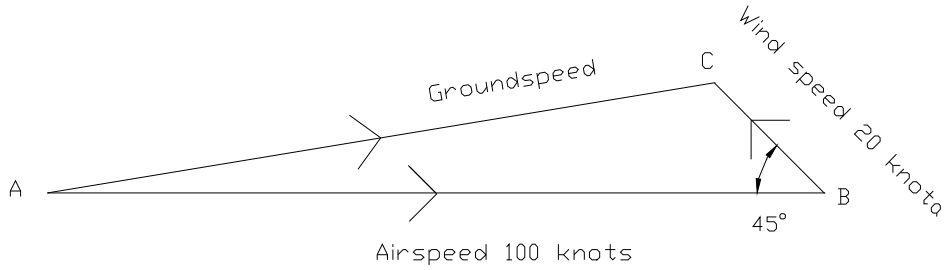
The Club Training document Exercise 18a Navigation Theory includes a section on calculating headings given the aircraft's airspeed and the wind speed and direction. Fortunately, for VFR pilots, most flight planning software, including the excellent Plan-G does these calculations for you.

Let us assume an aircraft is flying at 100 knots in an easterly direction (090 degrees) and the wind is blowing at 20 knots towards the aircraft but at 135 degrees, (which is 45 degrees from the right and front relative to the aircraft). With this information, we can draw the triangle of velocities to find the groundspeed. In the diagram above, we first draw a line A – B at 90 degrees relative to North (i.e. horizontal) to represent the aircraft's direction, and make it 10 inches long to represent the aircraft's *speed*.

We then draw another line at 135 degrees to represent the wind direction and make it intersect the right hand end of the airspeed line. Then to make it represent wind speed measure 2 inches along it from the intersection and make a mark – position C. Now draw a line A – C to complete the triangle. Measure the length of this line. It is 8.6 inches long (8.58557 to be precise). We represented 100 knots by 10 inches, and 20 knots by 2 inches, so 8.6 inches represents 86 knots - the groundspeed is 86 knots.

In possibly one tenth of the time it took to explain this, you can draw the triangle. In about the same time, if you can remember your trigonometry from school, and have a calculator, you can calculate that the groundspeed is

Groundspeed = airspeed ± windspeed x cosine (relative wind direction)



The Triangle of Velocities

In the real world there are specially designed circular slide rules for aviation with a graphical tablet on one side on which the triangle of velocities can be very quickly drawn, or nowadays, calculators are available with the correct aviation functions built in. In the Cix VFR Club, since we are sitting at a computer, we have a handy and sophisticated spreadsheet programme which we can use to do these calculations painlessly. Or, as

mentioned above, use flight panning software which does the calculation for you.

6.6.2 Track Guides

When it comes to flying the track that you have marked on the chart, you will find that it never quite works out right. This is due of course to the wind being different from that you expected. You may find you are being blown to left or right of your expected course. To simplify getting back on track, it is good practice to use track guides. These are lines drawn on the chart, 10 degrees either side of your desired track and fanning out, both from your departure point and your arrival point. If you notice that you are off track then these track guides will make it easier to estimate the actual Track Error and the Closing Angle you will need to fly to get back on track.

6.6.3 Avoiding Obstacles

In VFR flight, an obstacle could be defined simply as "something which is in the way of my planned route". This can be high terrain, low cloud, controlled airspace, an "Air Navigation Obstacle" (ANO) such as a 2000ft high TV mast, or a tethered balloon. In life, we tend to go round obstacles. Aviation is no different.

6.6.4 Calculations

Once we have all the necessary information to hand we can calculate our flight time and fuel required for each flight leg" or segment from waypoint to waypoint. These are entered on the Pilots Log and the distances and times between these points are calculated. This provides the basis for the fuel calculations, an example of which is shown at Section 6.8.2 below..

Wind speed and direction directly affect flight times, and hence the fuel consumption, but it is wise to consider other aspects of the weather too. In the real world, the air temperature affects the efficiency and therefore also the fuel consumption of aircraft engines, and some advanced addon aircraft for the simulator model this behaviour.

6.6.5 Revision

Now that you have done your chart work, it is time to carefully study and examine your route. Work along it both from the departure airfield and the intended arrival point. Make sure that you have taken into account all of the points noted in the previous sections. Form a mental picture of what you will be seeing en-route, river bends, major roads, towns etc. Double check the location of your selected alternate airfield. Write down the radio frequencies you will be using and the name of any ATC service you will use e.g. London Control, Shoreham Approach, Thames Radar etc.

6.7 Vertical Navigation Planning

There is no point planning to fly at 2,000 feet if there is a 3,000ft mountain along your planned route. There is no point planning to fly past the eastern side of London from the North at 3000 feet because there is Class A airspace down to 2,500ft all around London. There is no point planning to fly at 2,500ft if the weather forecast indicates OVC015.

In short, you need to plan the altitude at which you will fly each leg of your flight. You may be able to fly at the same altitude throughout, or you may need to climb to clear obstacles or descend to clear cloud. If you plan to fly in controlled airspace, there will be an altitude at which you must fly, either defined by ATC, or displayed on charts.

Outside Controlled Airspace, you have to think about the Semicircular Rule (See section above). Very often you may not be able to obey this rule if cloud and terrain prevent it as described in section , but the general rule of thumb is “if you can, do!”.

Remember always that under Visual Flight Rules, you must at all times fly at least 500ft above the ground, or any fixed obstacle, and below 3,000ft, clear of cloud and in sight of the surface, and above 3,000ft, 1,000ft vertically and 2km horizontally clear of cloud and at least 1,000ft above the ground, or any fixed obstacle.

Then, having decided on the altitude for each leg, you must enter these altitudes on your Pilot's log. On the Flight Plan, you normally only enter one altitude, the "cruising altitude" so it should be the altitude at which you will fly the greatest overall distance.

6.8 Fuel Management

When planning and executing any powered flight, from a microlight aircraft to an Airbus A380 or Boeing 747 it is essential that the fuel required for the flight is properly managed. This involves a fuel calculation at the planning stage, and monitoring throughout the flight. (It is part of standard checklists).

Similarly, pilots will fuel-up their aircraft using a particular unit of measure. Light aircraft tend to use volumetric measure; US gallons or litres, Imperial gallons are not commonly used because most light aircraft are built outside the UK.) Larger aircraft tend to use weight measure; pounds or kilograms depending on country again. It is important to be clear about the units you intend to use. In the UK, litres are most commonly used since the national conversion to metric units.

The fuel quantity is used to calculate how far you can fly. You also need to know the weight of the fuel to ensure that your aircraft when loaded with passengers, luggage and fuel is not overweight. It is important to know

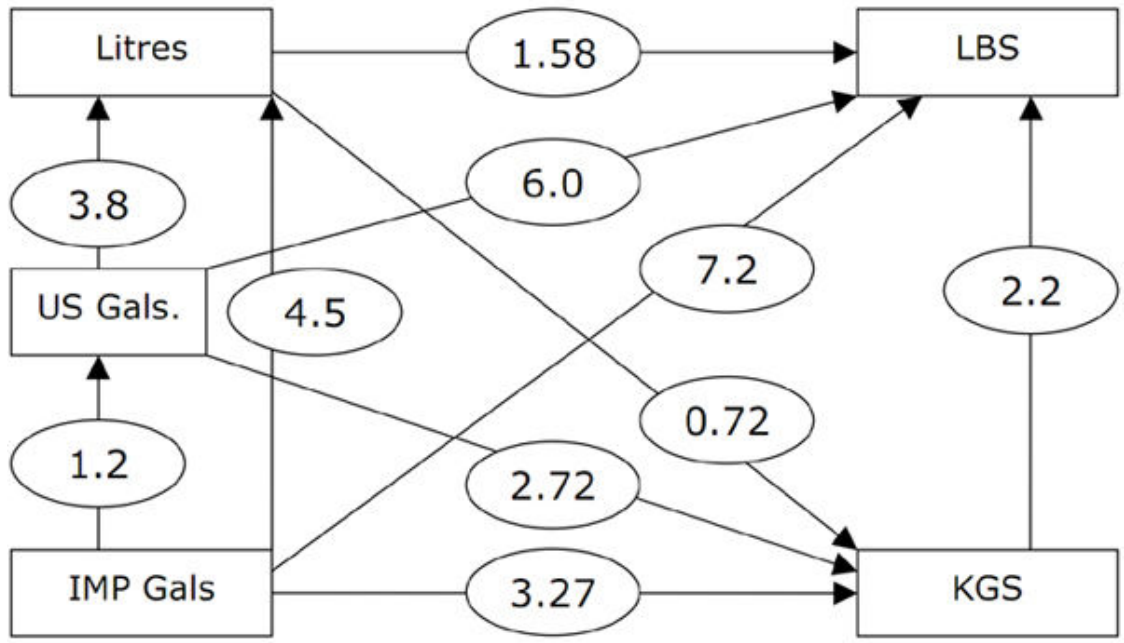
what measurement is used in the cockpit fuel gauges and how to do a conversion from one quantity to another.

There is a very handy conversion table on the Internet at: -

http://www.streamline-ops.com/en/info/fuel_weight_conversion_tables/

part of which is reproduced below.

AVGAS



To convert from one measurement unit to another, multiply by the factor in the balloon when moving in the direction of the arrow, or divide by that factor if converting in the opposite direction.

The Specific Gravity (SG) of aviation gasoline (AVGAS) is 0.72 kilograms per litre, equivalent to 6.0 pounds per US gallon, or 7.2 pounds per Imperial gallon. You can see that from the diagram above. This is accurate only at sea level and at 15° Celcius. It is approximate for other heights and temperatures, but the difference can be ignored for the quantities involved with light aircraft fueling and in Flight Simulator.

6.8.1 Definitions and Data

There are three definitions of Aircraft Fuel capacity;

- Total fuel,
- Useable fuel, and

- Reserve fuel.

The Total fuel and Useable fuel values are always included in the Pilots Operation Handbook (POH) for the aircraft. The useable fuel is the total fuel capacity, minus what is left in the tanks when the aircraft engine(s) stop(s).

The total fuel capacity of the FSX default Cessna 172, which is the Club's basic trainer, is 212 litres. Microsoft only give the range of 638 nm and the total fuel capacity in their Pilot notes. So the other figures are calculated from those values. At 2,300rpm and 105 knots the aircraft can theoretically fly for 6 hours and 4.5 minutes, (638/105). If the useable fuel is assumed to be 206 litres, then the fuel burn is 206 litres in 6 hours and 4.5 minutes, or very close to 34 litres per hour. If you hadn't realised already, flying is a very mathematical activity!

The "reserve fuel" is usable fuel in the tanks that you should NEVER plan on using; think of it as being there for emergencies. A reasonable fixed reserve for most light aircraft is that which is sufficient for 45 minutes flight time. To be extra safe this is commonly rounded up to one hour, calculated at the cruise rate of consumption. This is over and above the fuel required for the flight. It provides a margin of error for such things as changed weather, navigation errors or short diversions.

The term "Endurance" means the maximum time the useable fuel will last; how long the aircraft can remain airborne. Endurance includes the reserve, so be careful. Various factors affect the amount of fuel used in a given time, including airspeed, aircraft weight, altitude and weather on the day. "Range" is the maximum distance an aircraft can fly starting with full fuel.

6.8.2 How Much Do I Need?

The amount of fuel "uplifted" (aviation term for "filled up") is vitally important. Many light aircraft pilots simply make a habit of not making a flight without starting with full tanks. This is perfectly acceptable and in a flight-sim environment many simulator pilots do that anyway. However, it is immensely satisfying to be able to calculate the amount of fuel required for each segment of your flight. A flight is composed of several component parts: -

- **Start-up and taxi**: What is the expected taxi time/fuel burn at the departure airfield? Might you expect delays. Heavy aircraft have priority for take off and landing. If there is a lot of heavy traffic you could be sat at the hold for anything up to an hour (it has happened real world, I assure you).).
- **Take-off and climb-out to altitude:** Thought must be given to the departure from the 'field and our initial altitude. How much fuel will be burned during the climb phase? Again, the aircraft handbook will have tables or a search online will produce some figures

- **Cruise:** What is our cruising airspeed? What is the weather at cruise altitude? What is the time/burn between waypoints? Remember also to correctly lean the mixture as required. Leaning the mixture correctly can reduce fuel consumption by up to 20%
- **Diversion to an alternate airfield:** Calculate the distance and time to an alternate airfield, and apply the cruise fuel burn value, remembering correct mixture control.
- **Landing and taxi to parking:** What is the expected taxi time/fuel burn at the arrival airfield? Might you expect delays (heavy aircraft have priority on taxiways).
- **Reserve:** How much fuel should the aircraft still have remaining after landing? See below.

The minimum fuel required on departure is the amount needed for each of those elements, with the reserve fuel intact on shutdown.

The rules on reserve fuel were revised in 2016: -

For general aviation, ICAO Annex 6 Part II, section 2.2.3.6 "Fuel and oil supply" requires: For IFR, enough fuel to reach destination, then alternate (if required), plus 45 minutes. For day VFR, enough fuel to reach destination plus 30 minutes. For night VFR, enough fuel to reach destination plus 45 minutes.

EASA NCC.OP.130 2016-06 states much the same thing, but expands it somewhat to include additional contingency factors such as weather, ATC routing, etc.

Most UK flying schools still recommend the old rules which required 45minutes reserve fuel, day or night, after including an amount for flight to an alternate aerodrome if the intended landing aerodrome is unavailable.

CIX VFR Club recommends adopting the UK Flying Schools criteria, but for P3 Flight Tests, the new rules will be applied. i.e. 30 minutes fuel remaining after landing (all P3 tests are conducted in daylight), with no allowance for an alternate.

So you can see that fuel planning must form an essential part of any flight plan. Questions must be asked regarding the weather, routeing, alternate airfields, expected delays and aircraft safety limits. The flight is split into different elements: -

Let's take two worked examples - a simple flight from Gloucestershire to Wolverhampton in nil wind, calculated under both new and old criteria. This would be flown as a single leg of 38 nautical miles. The sums are set out in the table below. Calculated values are rounded up to the next whole number.

New Rules

Element	Time (minutes)
Start-up and Taxi	5
Take off and climb to altitude	5
Cruise 38nm at 105 knots	38/105 x 60 = 22
Landing and taxi to parking	5
Reserve	30
Total	**67**
Fuel required at 34 litres/hour	34 x 67/60 = **38 litres**

Old Rules

Element	Time (minutes)
Start-up and Taxi	5
Take off and climb to altitude	5
Cruise 38nm at 105 knots	38/105 x 60 = 22
Alternate 8nm at 105 knots	5
Landing and taxi to parking	5
Reserve	45
Total	87
Fuel required at 34 litres/hour	34 x 87/60 = **49 litres**

If we factor in a 15 knot headwind, what effect does that have? The airspeed will remain at 105 knots, but the ground speed will be only 90 knots

Cruise 38nm at 90 knots groundspeed	38/90 x 60 = 26

So the flight will take 4 minutes longer and require another 2.5 litres of fuel. Not significant you may say, but if the flight were 250nm, then it clearly would be.

6.8.3 Safety Margin

You may think that a 30 minutes reserve is an adequate safety margin. Remember though that a prudent pilot will land with his total reserve fuel unused. So to allow for other variables on the flight, it is good practise to add a safety margin, usually 10% of total trip time. This figure is not a legal requirement, and not all pilots will add anything for short trips. It can be likened to adding another spoon of tea 'for the pot', just to make sure that the tea is good and strong. On a good clear day and a straightforward flight with no delays/diversions expected, 5% may be considered adequate. The safety margin is for those unexpected 'contingencies' that may arise without warning.

Always remember when doing your fuel calculations that too much is better than too little!! Indeed to save a few minutes of planning time, if your flight is well inside the maximum range of the aircraft, you could simply depart with full tanks, and no heartache.

6.8.4 Fuel Weight

This is discussed in section 6.9.1 below.

6.9 Weight and Balance

The effect of cargo, passengers, and fuel distribution (the Payload) has to be calculated before every flight. Flight Simulator does this for you, so the mathematical procedure required in the real world can be avoided. However, you should really understand the theory behind the automation. X-Plane may not be so accommodating and require you to do the maths.

6.9.1 Weight

The safe way to avoid running out of fuel is to fill the tanks completely and fly no more than 3-4 hours, say, but that isn't the whole story. Fuel is heavy, so you need to ensure that the aircraft does not exceed its maximum All-Up Weight (MAUW) on take off, and, in larger aircraft, below the maximum landing weight at the end of the flight. In the sim it is not that critical of course, although you can still adjust the payload and fuel to your requirements to improve the realism of your planning.

A weight calculation must be done real world before every flight, and also in FS, if you want to do things properly. So if you are more than 2-up in a Cessna 172, you should do the maths. The humble 172 is not a load carrier. The seven hours theoretical endurance is probably only possible with no pilot!

If you wish to take four 15 stone adults and their luggage on a 4 hour trip to the south of France, you might find that you can't, because if you uplift enough fuel for the trip, the aircraft will be too heavy to take off safely.

Let's do the sums – add up all the component weights.

Firstly, what is the calculation with full fuel?

Item	US Units	Metric
Aircraft basic empty weight (BEW)	1665lbs	757Kg
Four 15 stone adults	840lbs	382Kg
Luggage	80lbs	36Kg
Full fuel	336lbs	153Kg
Total	2921lbs	1328Kg
Maximum All-up Weight (MAUW)	2550lbs	1159Kg
Overweight	371lbs	169Kg

So let's see if we can still go if we uplift less fuel. The aircraft is overweight by 371lbs and full fuel weighs 336lbs. A moment's thought reveals that the aircraft is too heavy, even with NO fuel! You will have to draw lots as to who you leave behind.

Three 15 stone adults and their luggage weigh 690 lbs. That looks more promising. Also, you have calculated that the trip will take three and a half hours. So you only need upload four and a quarter hours-worth of fuel.

Item	US Units	Metric
Aircraft basic empty weight (BEW)	1665lbs	757Kg
Three 15 stone adults	630lbs	286Kg
Luggage	60lbs	27Kg
Fuel for 4.25 hours @8 gals/hr*	196lbs	89Kg
Total	2551lbs	1159Kg
Maximum All-up Weight (MAUW)	2550lbs	1159Kg
Within limits by	-1lbs	0Kg

**Aviation gasoline (AVGAS) weighs 5.76lbs per US gallon, so you need 4.25 x 8 x 5.76 lbs of fuel = 219lbs*

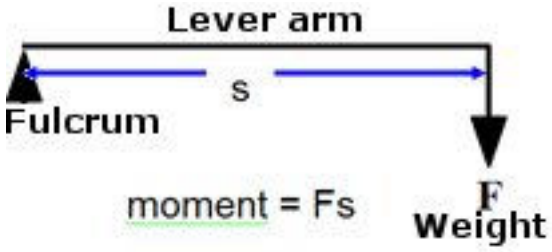
Rounding errors result in the pounds to kilograms conversion not being exactly accurate. Anyway, you will normally only work in one set of units, depending on your preference. Using the pounds column, you can see that you would be 1lb overweight, but that will be burned while taxying, so that's OK.

Where did the fuel consumption figure of 8 gallons/hour come from? FS doesn't mention this anywhere, but there are many references to the real

world aircraft on the Internet which provide such data. One has to assume that a similar value is correct within FS.

6.9.2 Balance

The other loading factor which affects an aircraft's performance is where the loads are placed. You can easily imagine that if all the heavyweights were in the back with their luggage, the aircraft would want to pitch up and flight would be difficult if not impossible. This is due to the principle of "moments". A moment is a turning force created by a weight F acting at the end of a "lever arm" S about a fixed "fulcrum". Calculating moments is important in maintaining an aircrafts longitudinal stability.



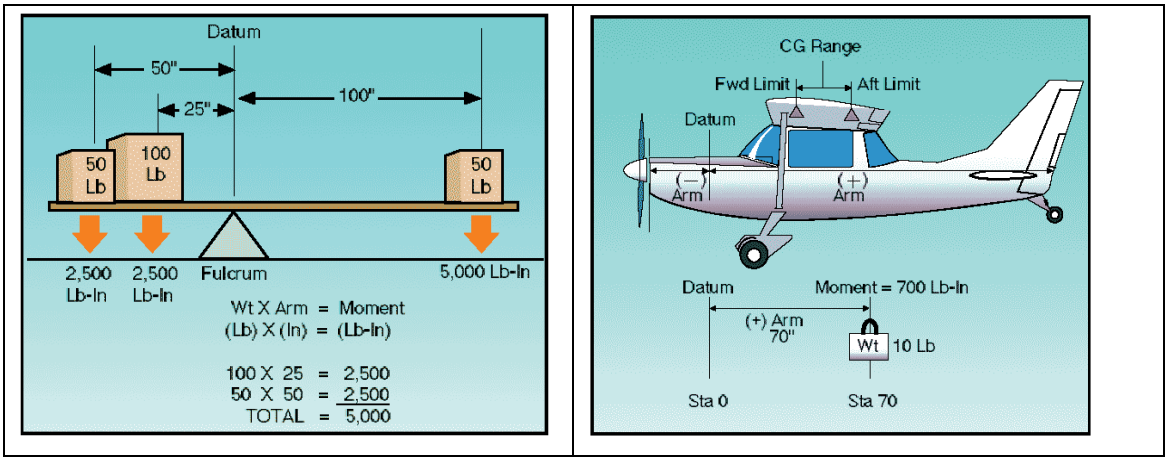
Every moment due to an element of the weight of an aircraft has to be balanced, within certain limits, by an equal and opposite moment on the other side of the centre of gravity if the aircraft is to remain with its longitudinal axis horizontal in cruising flight. It must be neither nose heavy nor tail heavy. (Actually, it needs to be a tiny bit nose heavy for reasons we don't need to go into.)

An empty aircraft is designed with that longitudinal stability. The weight of the aircraft body and engine forward of the Centre of Gravity (CofG), must be balanced by the weight of the fuselage and empennage aft of the CofG. The aircraft structure aft of the CofG, however, is much lighter than the aircraft structure and engine forward of the CofG. To maintain the necessary balance, the tailplane exerts a downward acting lift force as shown in the diagram below. The wings and fuel tanks in the wings are positioned at the CofG, so do not affect the longitudinal stability. However, adding payload – fuel, passengers and luggage, DOES affect that stability.

For any element of the aircraft, the moment due to that element is its weight multiplied by its distance (the lever arm) from the "Datum" (which, in the case of the Cessna 172, is the firewall between the engine compartment and the cabin.

In the diagram below left, the moments due to the weights on the left of the fulcrum must be in balance with the moments due to the weight on the right of the fulcrum. In the diagram below right, the principle is applied to an aircraft. The 10lb weight, 70 inches from the aircraft's datum exerts a

moment of 10 x 70 = 700 lb-in about the aircraft's Datum – the fulcrum. The commonly used imperial unit of measurement for moments in weight and balance calculations is "pounds inches" symbolised as lb-in. In metric units it is kilogram-metres.



We need to calculate the moment of each element (taking the empty aircraft with no fuel as one element) from the datum and add them all together. Then we divide the total moment by the total weight, to get the "resultant" lever arm. This lever arm length – measured from the Datum, defines where the overall centre of gravity of the **loaded** aircraft lies, and it **must** lie within the forward and aft "C of G limits"

Simple aircraft with fuel tanks only in the wings are designed so that the centre of gravity of the fuel tanks, at any stage of emptiness, is coincident with the centre of gravity of the whole aircraft. The pilot and front seat passenger are also designed to be coincident with the centre of gravity. So what we are concerned with in our balance calculation is actually only the rear seat passengers and the luggage.

6.9.3 Why Is This All So Important?

Any item aboard the aircraft which increases its weight degrades performance. An overloaded aircraft may not be able to leave the ground, or if it does become airborne, it may exhibit unexpected and unusually poor flight characteristics, and the initial indication of poor performance usually takes place during takeoff – just when you don't want it.

An overloaded or badly loaded aircraft will suffer:

- Higher takeoff speed,
- Longer takeoff run,
- Reduced rate and angle of climb,
- Lower maximum altitude,

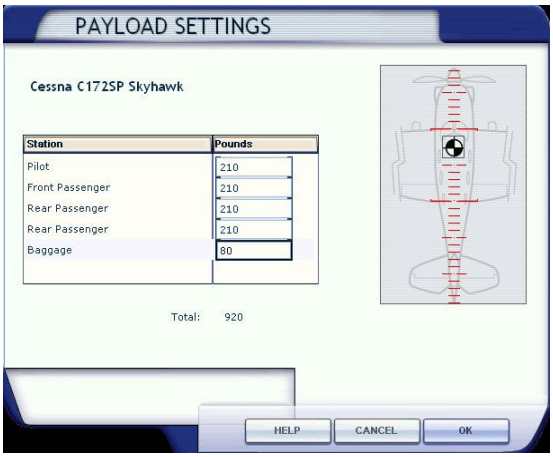
- Shorter range,
- Reduced cruising speed,
- Reduced maneuverability,
- Higher stalling speed,
- Higher approach and landing speed,
- Longer landing roll,
- Excessive weight on the nosewheel or tailwheel.

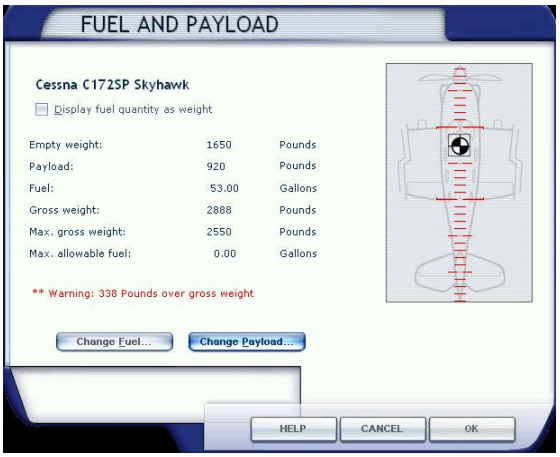
6.9.4 Off the Hook

Having taken you through the whole issue of weight and balance, and strained your rusty maths to the limit, there are two pieces of good news.

1). It is almost impossible to load a Cessna 172 such that its centre of gravity is out of limits. That is one of the reasons why it is the safest aircraft in the world.

2). Flight Simulator does the weight and balance calculations for you. Open the Aircraft/Fuel and Payload section of FS, enter the loads you wish to carry and it will tell you whether you are too heavy, whether the C of G is out of limits, or both.





The two illustrations above show the effect in FSX of our four 15 stone passengers and their luggage with full fuel tanks. Note that although significantly overweight, the centre of gravity remains well within limits.

Remember – for good practice in Flight Simulator, don't overload the aircraft and don't run out of fuel.

6.10 What You Can't Plan

As the pilot, it is you who initiates the flight plan. It is you who decides where you wish to fly. You take responsibility for altitude, terrain clearance, positioning, fuel, timing and all the other things that make up a

successful flight. The one thing you cannot control is the weather, unless of course, you turn it off in the sim!! In order to get the very best flightsim environment, many simmers use a weather generating program coupled with a weather environment graphic programme. When these programs are linked with the real world weather option in the sim, then 'the weather' becomes a very real part of flight planning and of the flight itself. There are also weather radar gauges which can be installed into the cockpit panel thus giving the very best simulation experience.

Weather is dealt with in detail in the Club document Weather for VFR Pilots", obtainable from the Club website http://www.cixvfrclub.org.uk/training/tutorials/pdftutorials/Weather%20for%20VFR%20Pilots.pdf.

6.11 Putting It All Together

There are two documents which put all this work into a summary form which provides the infomation required in a succinct form.

e) The Flight Plan, which is sent to VATSIM Air Traffic Service units via the VATSIM Pilot Client software, and

f) The Pilot's Log, widely abbreviated to PLOG, the purpose of which is to aid you the pilot by providing a framework in which to record actual progress against intended progress, and other valuable information needed during flight

You also need to rehearse the ATC dialogue that you will use for departure, en route and on arrival.

6.11.1 The Flight Plan

You "File" a Flight Plan on the VATSIM network in one of two ways - either using the flight plan form built into the Pilot Client software, or via the VATSIM "Prefile" option which, when you log on to VATSIM will be already held on the system for you. Prefiling is normally only used by IFR heavy transport aircraft, but anyone can use the facility.

Unlike the real world, where VFR flights do not require a flight plan if flying outside controlled airspace, ALL VATSIM flights require a flight plan to be filed. The information in the Flight Plan is only a summary of all the work done in planning the flight, but it is sufficient for its purpose - to tell any VATSIM Controller you contact, or spots you on his Radar screen, what you are intending to do in his airspace. This will range from his monitoring your flight only (Visual Flights) to providing a full control service (Instrument Flights).

The first requirement is to tell the system who you are. Your name and VATSIM ID will be passed by the pilot client software. It may also pre-load your aircraft registration and type , but if not you can enter it manually. A

list of the approved ICAO "Aircraft Type Designators" can be downloaded from the web. One source is:-

https://en.wikipedia.org/wiki/List_of_ICAO_aircraft_type_designators

Obviously the departure and arrival airfields are required, plus the alternate airfield at which you will land if for any reason you cannot land at your planned destination. Only the ICAO four-letter code is entered.

You then need to enter your route, including any radio navigation aids you plan to use, your planned cruising altitude, the fuel carried (entered as hours and minutes endurance), any comments regarding navigation equipment on board the aircraft, and your communication method (voice or text).

The route can be problematic for VFR flights, because visual waypoints which you choose to use are not usually recognised as official waypoints, as these are designed for use in Instrument Flight. If you plan to fly from one radio navigation aid to another along the whole route, then the route section of the flight plan may look like the following.

DCS DCT WAL DCT SWB

which translates as "via Dean Cross VOR, then Wallasey VOR then Shawbury VOR" Note that the departure and arrival airfields are not repeated, and "DCT" stands for "direct" meaning direct track from one point to the next.

However, if you are flying via visual waypoints, then "via Bassenthwaite Lake, Blackpool tower, West Kirby, Ellesmere" is rather clumsy, and it would be better to include at least the Wallasey VOR in your plan, so that the route section could be "VFR south to WAL then south-east". A simpler way still is to simply enter "VFR". In the remarks section, as well as entering "CIX VFR Club" (a Club requirement not a VATSIM requirement), you can enter REMOCAS, which is shorthand for "remaining outside controlled airspace (if indeed that is your intention. Any VATSIM controller seeing this, if he is busy with IFR traffic, may well ignore you. This is not being rude - he is busy with traffic which needs to be kept safely separated, and you are almost certainly (if you are a good VATSIM and Club pilot) not going to get in the way of that traffic, or create a (virtual) dangerous situation.

Any controller you encounter can, if he so wishes, then inquire your "present position and intentions" on first contact, and you simply give a position report in your first reply "Borton Radar G-GYAV, Cessna 172 en route Ayeminster to Beeton, passing Ceeville lake heading 175 degrees, 2000ft QNH 1009". In real world VFR flight, where a flight plan is not a requirement outside controlled airspace, as mentioned aabove, on first contact with a controller it is standard procedure to give a position report.

You need to enter a summary of your fuel planning, generally just the total fuel carried and Estimated Time En route (ETE) from departure to landing.

There is a VATSIM document which can be read in conjunction with this document at https://www.vatsim.net/pilots/file-flightplan which also has an illustration of the VATSIM Pre-filing Flight Plan form.

6.11.2 The Pilot's Log

It is usual to maintain a Pilot's Log, commonly called a **PLOG**, as you fly. This is where the details of the actual flight are entered, both that which is planned and that which is actually achieved. Items include the Departure and Arrival airfields and also an alternate airfield in case a diversion is required. The various legs or segments from waypoint to waypoint are also entered and the planned distances and times between these points are calculated. The actual times of arrival at each waypoint are entered alongside these as you fly.

You may find it useful to have a blank PLOG beside you as we work our way through the various aspects of flight planning. There are several versions available for download on the club website at http://www.cixvfrclub.org.uk/downloads/6d_miscellaneous.php

There are five versions to choose from, so choose one which works for you.

You will also find it useful to have to hand a copy of the Morse Code. This is essential for IDENTing any radio navaids you may wish to use, to confirm that you are tuned to the correct one. In the real world, this is also essential for making sure it is not out of operation, e.g. for maintenance, something which does not happen in Flight Simulator.

Instructions on how to build a Pilot's Log and use it during flight can be found in the following document on the Club website. Sections 5 and 6 are the relevant sections.

http://www.cixvfrclub.org.uk/training/TrainingManual/Exercise_18D.pdf

When filling in the flight plan information in your PLOG you should include the relevant communication frequencies for the aerodromes you intend to use. These frequencies can be found both in the digital flight planning software mentioned previously and on the paper charts. Further information is available in the UK AIP in the "Aerodrome Specific" section. http://www.nats-uk.ead-it.com/public/index.php%3Foption=com_content&task=blogcategory&id=6&Itemid=13.html.

It is worth noting here that when filling in the data for the aerodrome frequencies, these should include not only the voice frequencies; Ground, Tower and Approach/Radar or Control/Centre but also the frequencies for any Automated Terminal Information Service (ATIS). This will give you the departure/arrival weather information. Any aerodrome and en-route radio navaid frequencies should also be entered at this point along with their IDENTs.

7 COMMUNICATIONS

7.1 General

ATC communications are designed to assist in the smooth operation of IFR and VFR traffic in the same airspace. IFR traffic is handled differently from VFR traffic, and IFR traffic has priority in almost every situation. IFR traffic normally flies within controlled airspace at all times; is almost always under radar observation, and is controlled from brakes off to brakes on. VFR traffic is controlled within the controlled airspace in which it is permitted to fly (Classes, C, D & E), and will be pretty much left on its own outside controlled airspace (airspace classes F & G). This is the case both real world and on VATSIM - more so on VATSIM because the number of ATS available is only a fraction of those available RW. **Note:** Class C airspace in the UK is at flight level 195 and above, so is effectively not available for the light aircraft which the Club flies.

7.2 ATS Within Controlled Airspace

The first rule of Controlled Airspace (CAS) is that all aircraft need permission to enter it, fly in it and leave it. The most common situations pilots will encounter on VATSIM are departure and arrival at aerodromes (airports) surrounded by CAS.

Within Controlled Airspace (CAS), ATC has the responsibility for aircraft separation, a term we met in Section 2.2 above. Part of the separation requirement is that IFR traffic should be separated from VFR traffic by not less than 1000ft vertically and 5 nautical miles horizontally. There are other separation rules, but for the VFR pilot, what this means in practice, because you do not have eyes in the back or the top of your head, and ATC has Radar, you MUST obey any ATC instruction. In the real world this is true "except where the safety of the aircraft may be compromised". On VATSIM, in practice (it's a hobby, remember) this really doesn't apply. If things go really pear-shaped - disconnect from VATSIM. Simple.

En-route, VFR pilots can choose to plan their flight through Class D and E airspace to shorten distances or avoid adverse terrain etc. In each of these and other situations, if an ATS service is available, a pilot MUST make contact and abide by the ATC instructions. These may include the instruction to “remain outside controlled airspace”, typically if the controller is handling a very large amount of IFR traffic. If a service is not available, the VFR pilot can fly through the CAS, but in the interests of good airmanship and VATSIM membership, he should proceed as if ATC is available, obeying height and track restrictions, authorised VFR routes etc.

7.3 UK Air Traffic Services

There are three basic types of Air Traffic Service in the UK.

d) Air/Ground Communication Service (AGCS)

e) Aerodrome Flight Information Service (AFIS)

f) Air Traffic Control (ATC)

The difference between a, b, and c is one of the level of instruction given to pilots.

AGCS is used at most small General Aviation (GA) airfields and provides **information** only to pilots who must make their own decisions based on the information given.

An AFIS service is something of a hybrid between ATC and AGCS. It is used at slightly busier aerodromes. Under an AFIS, pilots are given information and **advice** while airborne, taking off and landing, but **instructions** for manoeuvring on the ground.

With certain exceptions, Air Traffic Control provides pilots with **instructions** both on the ground and while airborne, taking off and landing. This may include an aircraft being instructed to fly at particular altitudes and on particular headings in order to comply with instrument flight procedures or to avoid traffic confliction; a procedure known as Radar Vectoring, which is mostly applicable to Instrument Flight.

The Club has several manuals dealing with Air Traffic Control Services. The main one, which covers comprehensively the Air Traffic Control information required for VATSIM flights is Air Traffic Control for VATSIM VFR Pilots on the Club website. The AGO and AFIS training manuals can also be found in the Training Manual section of our website.

7.4 ATSOCAS

Aviation is full of strange mnemonics and ATSOCAS is one of them. "Air Traffic Services Outside Controlled Airspace" is what it means.

The UK's Air Traffic Services Outside Controlled Airspace offer four levels of service; Basic Service, Traffic Service, Deconfliction Service and Procedural Service. In practice, VFR pilots on VATSIM really only need to think about Basic and Traffic services - ask for a Basic Service if things are quiet in your area, or a Traffic Service if you want to know where other aircraft are when it's busy.

Basic Service is intended to offer the pilot maximum autonomy and the avoidance of other traffic is solely the pilot's responsibility. The controller/FISO will pass information pertinent to the safe and efficient conduct of flight. This can include weather, changes of serviceability of facilities, conditions at aerodromes and general activity information within a unit's area of responsibility.

Traffic Service provides the pilot with surveillance derived traffic information on conflicting aircraft. No deconfliction advice is passed and the pilot is responsible for collision avoidance. A Traffic Service contains the information available in a Basic Service. In addition, controllers provide surveillance derived traffic information on relevant conflicting traffic. Headings and/or levels may also be issued for positioning and/or sequencing.

Deconfliction Service provides the pilot with traffic information and deconfliction advice on conflicting aircraft. However, the avoidance of other aircraft is ultimately the pilot's responsibility. A Deconfliction Service contains the information available in a Basic Service. In addition, controllers shall aim to assist the pilot with his responsibility for the safety of the aircraft by passing traffic information and deconfliction advice. Headings and/or levels will also be issued for positioning, sequencing and/or deconfliction advice.

Procedural Service is a non-surveillance service in which deconfliction advice is provided against other aircraft in receipt of a Procedural Service from the same controller. The avoidance of other aircraft is the pilot's responsibility.

Within Controlled Airspace (CAS), ATC has the responsibility for aircraft separation, a term we met in Section 2.2 above. Part of the separation requirement is that IFR traffic should be separated from VFR traffic by not less than 1000ft vertically and 5 nautical miles horizontally. There are other separation rules, but for the VFR pilot, what this means in practice, because you do not have eyes in the back or the top of your head, and ATC has Radar, you MUST obey any ATC instruction. In the real world this is true "except where the safety of the aircraft may be compromised". On VATSIM, in practice (it's a hobby, remember) this really doesn't apply. If things go really pear-shaped - disconnect from VATSIM. Simple.

7.5 ATC Dialogue En Route

You can plan your flight to remain outside controlled airspace. Outside controlled airspace, you the pilot have the freedom to select the altitudes and headings at which you wish to fly. In the real world you can even fly without a radio if you wish, though on VATSIM this is not really allowed.

However, an ATC service may not always be available. It depends on who is online in your vicinity, and how busy they are. So VATSIM VFR pilots often fly without any contact with ATC. They can sometimes obtain a "Basic Service" from an approach or radar controller, if they are passing within 40 nautical miles (the normal maximum "range" of an approach controller), but if that controller is busy with IFR traffic, he may respond "Monitor Unicom 122.80", which means, effectively, "continue on your own." He may also tell you to remain outside controlled airspace, which usually means he is very busy with IFR traffic.

If you choose to connect to VATSIM whilst en route, you should make a position report shortly after logging on. This may be on Unicom, as a simple text message like "En route X to Y, currently passing Z", or if near a controlled position, but outside controlled airspace, "Borton radar, G-ABCD, request Basic service. The controller will reply "G-ABCD, Borton Radar, pass your message". You then give the standard CEPHACER call (see http://www.cixvfrclub.org.uk/training/TrainingManual/cephacer.php) after which the controller should respond, either giving you a service, or asking you to use Unicom. It is a bad idea to log on while within controlled airspace if there is a controller covering the airspace. Such "pop-up" traffic that he sees on his radar will not be welcome.

In the real world, there is a non-radar service called London Information which VFR pilots can use en route. Because London Information is a non-radar service, pilots give position reports and ETAs to "next waypoint" so that the controller can monitor their progress. It's use is not mandatory. Unfortunately for VFR pilots, unlike the real world, VATSIM UK rarely offers the London Information service.

The Club's ATC Manual contains all the communication dialogue required whilst en route. All the rules and procedures which dictate what is said when and where is also contained in that manual.

7.6 Voice or Text?

Wherever possible, pilots should communicate with ATC using voice, via a headset with microphone plugged into their computer. The VATSIM pilot client software includes the necessary protocols to enable this transparently to the user. Simply select the correct frequency, press your selected PTT (Push To talk) key and speak. It is often a surprise to new VATSIM members when their initial faltering "Borton Tower, Golf Charlie India X-Ray Alpha, request radio check" elicits a response " Golf Charlie India X-Ray Alpha, Borton Tower, Reading you strength five".

However, if you do not have a suitable headset, the pilot client software includes a text biox for typing your requests and acknowledgements. You can also use a hybrid system, where ATC communicates with using voice, and you respind using text. It is useful to add a comment in your flight plan to indicate whether you are using voice (/v/) or text (/t/).

7.7 UNICOM

In the UK there no uncontrolled aerodromes like the US model, although there many small private farm strips which have no radio facilities at all. All licenced aerodromes have a manned Air Traffic Service.

On Unicom, you simply report your actions, your position and your intentions at the salient points in your flight. When you type a message into the pilot client message box, your callsign is automatically added so the world know who you are.

Typical sequence of Unicom messages might be: -

Taxying to hold Alpha EGLC for runway 27 departure

Holding at Alpha EGLC for inbound traffic

Taking off runway 27 EGLC

En route EGLC to EGNJ 2000ft VFR overhead EGXT

Downwind for rwy 21 EGNJ

Final rwy 21 EGNJ

Taxying to parking EGNJ

7.8 Rehearse your ATC Dialogue

It is an apocryphal truism that the commonest word spoken by pilots to controllers is "er..."! Good, confident, clear and accurate ATC dialogue helps controllers enormously, (there is quite a lot of poor dialogue, they will tell you), and gives you a great sense of satisfaction of doing a professional job as well as helping you fly well under ATC control.

So before departure, you may wish to write some notes about what you will say and when. Even if communicating with ATC via text.you should use the same dialogue, as it is designed for brevity, so will be quicker writing it than anything else. Avoid non-standard abbreviations, as they may not be understood.

7.9 Transponder Use

Most aircraft carry a transponder within their radio equipment. The transponder is a type of radio or radar transmitter-receiver that transmits a “reply” signal automatically when it receives a predetermined signal from an airport transmitter. The new Mode S transponders also transmit the aircraft's callsign. Transmitting on a transponder is called “Squawk”ing in the aviation world, hence “G-ABCD Squawk 7000” means set 7000 on the transponder.

The reply signal is displayed on the Controller's radar screen. The transponder transmits a 4-digit code which identifies what Air Traffic service the aircraft is receiving, e.g. 5051 is allocated to Bristol Radar. Any ATS unit within 40 miles or so of Bristol seeing that code on his scope will know that the aircraft is in communication with Bristol Radar.

There is a list of all European Transponder codes at http://www.flightradars.eu/squawkcodes.html but you do not need to know them, with the exception of the following important ones.

7000 General conspicuity code for FVR traffic in the UK and Europe

1200 General conspicuity code for VFR traffic in the US and most other parts of the world.

2200 General conspicuity code for IFR traffic on VATSIM if a service is not available.

7500 Hijack

7600 Radio failure

7700 General Emergency

The use of 7600 and 7700 codes should only be used on VATSIM in special circumstances – you should not simulate these conditions as part of your hobby except as part of a training or other exercise. If a service is being provided to you, and you want to practice an emergency, or you have a 'real' emergency (such as a failure in the highly realistic A2A aircraft), the controller may send you a private message : "Sorry, no can do, due traffic/workload". If that happens you must abandon your practice emergency. If it is a genuine failure (A2A again) then you MUST disconnect from VATSIM.

Note: Transmitting the Code 7500 is strictly forbidden under any circumstances on VATSIM, and will lead to immediate suspension of your VATSIM membership.

If a controller asks you to “Sqawk IDENT, then, depending on the Pilot Client software you use, the procedure is slightly different. In FSInn, for example, double-clicking the small box at the top right of the FSInn control panel (which is either “S” on a yellow background or “C” “S” on a green background in normal use), will squawk IDENT, and the small window will display the letter “i” on a black fbackground or 10 seconds.

When you squawk IDENT, your aircraft's “blip” will be displaayed with a circle round it on the Radar controller's scope, so that he can pick you out from the hordes of traffic in his area!

8 PROCEDURES LOCAL TO THE AIRPORT

8.1 Controlled and Uncontrolled Airports

In the USA, there are many uncontrolled airports which have a system of broadcasting intentions on a dedicated radio frequency - UNICOM on 122.80 in fact, with which VATSIM members will be familiar. See section 7.7 for details about UNICOM and its use.

8.2 Ground Procedures – Departure

8.2.1 Starting Position

You must start your flight from a parking area at the aerodrome from which you wish to depart. These are called ramps in the USA (and in flight simulator), and aprons in the UK. They are basically wide areas of tarmac

or concrete on which an aircraft can turn in any direction with ease. In the case of small airfields, parking and manouevring can be on a grass area adjacent to a taxiway and often won't be marked as a parking area. In FSX, parking spaces are typically shown as "Ramp Small GA". For best realism, don't park your light single at a "Gate" as that is where the passenger aircraft load up and you would not be welcome there in the real world! If flying a helicopter, FSX has designated Helipads at many of the larger airports, but otherwise you are on the grass again!

At an ATC controlled aerodrome, no aircraft (or vehicle) must move anywhere without express permission from ATC. In some cases, ATC even require the light aircraft pilot to obtain permission to start his engine(s), a procedure which is mandatory for commercial aircraft.

YOU MUST NEVER MAKE CONNECTION TO VATSIM WHILE PARKED ON A RUNWAY OR TAXIWAY.

After start up and before taxiing, the pilot should obtain the Automatic Terminal Information Service (ATIS) broadcast where provided, and note the designation letter. A real world ATIS gives some or all of the following information: - Airport, time, runway in use, runway surface condition (at three positions along the runway), Surface wind direction and speed, Cloud information, Visibility, QNH, QFE, Temperature, Dewpoint, and ends with "On first contact, report information <phonetic letter> received."

For example:

```
Liverpool information Quebec. Time zero niner too zero zulu.
Runway too seven in use. Wet, wet, wet, Surface Wind too
fower zero degrees wun too knots. Scattered at too tousand,
broken at tree tousand five hundred. Queue enn aitch wun zero
wun too, queue eff ee wun zero zero niner Temperature plus
too dewpoint plus wun. On first contact, report information
Quebec received.
```

8.2.2 ATC Dialogue at the Departure Airport

The Club's ATC Manual contains all the communication dialogue required, plus the rules and procedures which dictate what is said when and where during departure.

8.2.3 Taxying Rules

Taxying is fully described in the Club's Flight Training Manual, Exercise 5. In addition, the rules below must be strictly observed.

3). Regardless of any ATC instruction, it is the duty of the pilot alone to avoid a collision with another aircraft, vehicle or object.

4). Aircraft on the ground must give way to aircraft landing or taking off, and to any vehicle towing an aircraft.

5). When two aircraft are approaching each other head on or nearly so, each should turn right.

6). When two aircraft are converging, the aircraft which has the other aircraft on its right should give way. It should also avoid crossing ahead of the other aircraft unless passing well clear.

7). If overtaking another taxying aircraft, pilots must overtake on the left and pass well clear.

8). If in any doubt - STOP. The pilot is solely responsible for his aircraft when taxying, even when being guided by a marshaller.

8.2.4 Runway Selection for Take Off

Runway numbers are one tenth of the magnetic bearing of that runway. Runway 27 for example is aligned at 270º magnetic. This system is used universally. All aircraft normally take off into the wind, light aircraft especially. This allows airspeed to build most quickly, which results in the take off roll being as short as possible, a vital factor for some very small airfields.

In the Flight Simulators FSX, X-Plane and Prepar3D, the windsock at airports is animated according to the wind direction, so can be used in conjunction with other wind information.

If the wind is straight down the runway, say 270º at 7 knots, then 27 is the departure runway. If the wind is say 300º at 15 knots, then it is at an angle to the 27 runway heading. Its direction is 300º - 270º = 30º from the runway heading. From the triangle of velocities, you will know that the wind can be divided into two components, one parallel to the runway and one at right angles to it. So taking the parallel component, which is the "into wind" component, this calculates as total wind x **cosine**(angle of wind to the runway), or 15 x 0.866 = 13 knots.

A very useful rule of thumb, though, is that

- if the wind is anywhere from 0º to 30º off the runway heading, use the full wind speed in your take off calculations,
- if the wind is anywhere from 30º to 45º off the runway heading, use half the full wind speed in your take off calculations,
- if the wind is anywhere from 45º to 60º off the runway heading, use 30% of the full wind speed in your take off calculations.

Be aware of course that the wind component across the runway (total wind x **sine**(angle of wind to the runway) may be important when considering the aircraft's crosswind take off limitations.

Wind Direction	Headwind	Crosswind
Up to 30 degrees off the runway direction	Full	Zero

From 30 degrees to 45 degrees off runway direction	50%	50%
45 degrees to 60 degrees off runway direction	30%	70%
More than 60 degrees off runway direction	Zero	Full

Other factors influence take off direction of course: -

- Aircraft performance - is my chosen runway long enough?
- ATC instructions. You can request an alternative runway if the "runway in use" is unsuitable for your aircraft performance
- Traffic flow where there is no ATC. Observe other traffic and take off in the same direction. If necessary ask other pilots by private message in the pilot client software which is the preferred runway for take off.
- Terrain clearance. Some runways are situated very close to mountains which dictate the take off and landing directions.
- Runway surface - some aircraft such as the Tiger Moth do not have a tail wheel, but a skid. They were really designed to take off on grass. So if there is a grass runway, you might prefer to use that if possible. Conversely, some aircraft need a hard runway because of their weight and distance required to reach take off speed.

8.2.5 Entering the Runway for Take Off

At an ATC controlled aerodrome, no aircraft (or vehicle) must move anywhere without express permission from ATC. In some cases, ATC even require the light aircraft pilot to obtain permission to start his engine(s), a procedure which is mandatory for commercial aircraft.

So a pilot MUST NOT enter the active runway without permission, nor even cross a non-active runway while taxying to the active runway. At smaller airfields or where there is no ATC from VATSIM pilot's should use common sense having gathered as much information as possible from other pilots in the vicinity, and from manuals and charts which are commonly available on the internet as well as Club training documents.

Section 3 of the Club's Air Traffic Control for VATSIM VFR Pilots on the Club website gives the dialogue exchange between ATC and the pilot who is departing a airport.

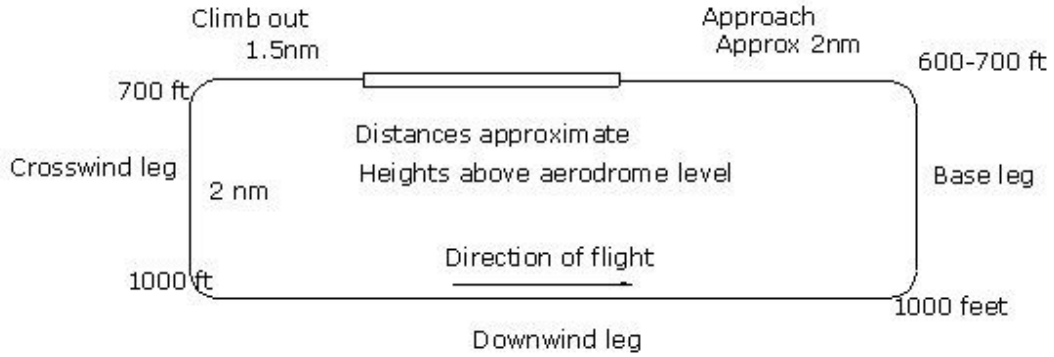
One exception with AFIS controlled airfields (see Section 8.1e)) is that the AFIS Operator has mandatory control of all ground movement, just like full ATC, but the pilot has full discretion when airborne. Sections 4 and 5 of the

Club's Air Traffic Control for VATSIM VFR Pilots give full details of these services.

8.3 The VFR Circuit

In the USA, this manoeuvre is called "The Pattern, and in the UK "The Circuit". It defines the way that airborne traffic must fly when approaching the aerodrome, and when flying around the aerodrome practicing take offs and landings and other training exercises.

The VFR circuit forms a rectangle with rounded corners. It consists of the take off and initial climb along the line of the runway, a 90o climbing turn onto the crosswind leg, then completing the climb to circuit height followed by a further 90o turn onto the downwind leg, parallel with the runway. The downwind leg is flown straight and level at cruise speed. Next comes another 90o turn onto the base leg, slowing down and commencing the descent, followed by a descending 90o turn back onto the runway extended centreline and completing the descent to land.



The VFR Circuit

Flying a circuit is fully described, with illustrations, in the Club's Flight Training Manual Exercise 12 and Exercise 13.

8.4 Approaching an Aerodrome to Land

8.4.1 Joining Procedures

A pilot cannot just approach an aerodrome from any direction, manoeuvre round to the landing runway and land. There may be other traffic doing the same thing, so there has to be order; a system. You may have guessed that this system is that an approaching aircraft flying under Visual Flight Rules and wishing to land must join the VFR circuit. If the circuit is busy, it will be one of several all going round the same racetrack pattern at the same altitude, and thus the risk of confliction or collision is minimised.

The first requirement is to determine the runway in use.

How an aircraft joins the circuit is mainly a function of the aerodrome size or "potential busy-ness". Clearly there is greater danger from other nearby traffic at a busy airport than there is from a small aerodrome on a weekday. (It may be a different kettle of fish at weekends though!).

There are four basic approach patterns: -

1). The downwind join,
2). The base leg join,
3). The straight in approach, and
4). The overhead join

As a general rule, but not always, busy airports will want aircraft to join the circuit on Base Leg, then make one turn onto final approach, as this minimises the time that that aircraft is potentially in conflict with others.

Medium size airports - with some commercial traffic but mostly mixed local VFR and IFR, and full ATC, the Downwind Join or the Base Leg Join will be given depending on traffic and approach direction.

At small aerodromes with no ATC, just an AGS or AFIS it is at the pilots discretion, but strong hints may be given by the man in the tower "Report downwind" would suggest a downwind join is expected, for instance.

When a small aerodrome is busy, it is common to be asked to make an overhead join ("report overhead" would be the hint from the tower). Overhead joins are peculiarly British, and some other countries in the world consider them to be outright dangerous. However, properly executed, they are as safe as any other.

In special circumstances, where an aircraft is approaching an aerodrome or airport on a heading close to the runway heading, it may be given a Straight In Approach. Although this type of approach sounds the simplest, it can actually be quite tricky, because the visual cues of turning base leg, then final, with the speed and altitude associated with those points - are entirely missing, and the approach has to be judged on distance and height and the visual appearance of the runway perspective.

Medium and large airports usually have a system of indicator lights at the beginning of a runway, comprising a set of red and white lights. These Visual Approach Slope Indicators (VASI) and Precision Approach Path Indicators (PAPI) lights are very similar in the information they provide. The only functional differences them is that VASI have one or two red lights above one or two white lights, as seen from the approaching aircraft, whereas with PAPI lights, the four lamps are in a row.

They are set such that at the approved glideslope for the airport (normally 3^{o}, but can be more), the pilot will see and equal number (one or two) white and red. If he is approaching too high, he will see more whites than reds, and if too low, more reds than whites.

- Red over White, you're alright. (on glidepath)
- Red over Red, you're dead. (too low)
- White over White, you're out-of-sight (too high)

For a full description of VFR approach procedures, see the Club Training Manual Exercise 21 and Exercise 22.

8.4.2 Runway Selection for Landing

Remember that runway numbers are one tenth of the magnetic bearing of that runway. Runway 27 for example is aligned at 270° magnetic. All aircraft normally land into the wind, light aircraft especially. This allows the approach to be maintained at a lower ground speed than the essentially fixed "book" landing configuration airspeed (ground speed = airspeed - wind speed). This results in the landing roll being as short as possible, a vital factor for some very small airfields.

Also, if possible during the approach phase, check the windsock. It will give information about wind direction in addition to any weather reports you have obtained.

The headwind and crosswind considerations are the same as for the take off as described in section 8.4.2 above.

An interesting difference between take off and landing, which may not be immediately obvious, is that landing requires less runway length than take off. This is because touchdown groundspeed is normally lower than take off groundspeed, and landing roll deceleration, braking, is normally greater than the take off roll acceleration. One consequence of that, which pilots need to consider when contemplating landing on a short runway, is, "can I take off from here again?" A good read of the aircraft's Pilot Operating Handbook is therefore necessary when planning a flight into a small airfield.

Wind Direction	Headwind	Crosswind
Up to 30 degrees off the runway direction	Full	Zero
From 30 degrees to 45 degrees off runway direction	50%	50%
45 degrees to 60 degrees off runway direction	30%	70%
More than 60 degrees off runway direction	Zero	Full

8.5 Ground Procedures – Arrival

After landing and slowing the aircraft to a walking pace, you should turn off the runway "vacate" at the next available turn off point. This may be the far end or one of several intermediate turn offs, depending on the aerodrome layout.

If there is a Tower controller active at the aerodrome, you will usually be given an instruction immediately after the aircraft touches down "vacate first right" or "vacate at golf" are typical instructions. If there is a Ground Controller on duty, then the Tower Controller's instruction will be (for example), "Contact Liverpool Ground on 121.95". As you taxi slowly along the runway (preferable to remaining stationary if there is other traffic) tune the new frequency and call the Ground Controller. They will then give you the "vacate at..." instruction.

You will then be given taxi instructions by either the Ground controller, or the Tower controller if there is no Ground Controller, e.g. "taxi via taxiway alpha to holding point kilo and report passing kilo." As with departure, at an ATC or AFIS controlled field, you must only move on the ground in accordance with ATC instructions.

If there is no ATC on duty, make sure before starting your approach, that you know where you are going to vacate, taxi and park. Announce your intentions on Unicom 122.80 of course. At large airports there is often a General Aviation Apron located away from the passenger or freight terminals. As a VFR pilot, that will normally be your parking place.

8.5.1 Arriving IFR Traffic

This paragraph applies only to those airports which are equipped for IFR arrivals. The runway must be long enough and the airport must be equipped with instrument landing instrumentation - an ILS approach system or a VOR, or as a bare minimum, suitable only for non-commercial aircraft, an NDB on the airfield itself. The small General Aviation aerodromes and grass strips with which the UK abounds, and which are used by VFR pilots are not going to receive any IFR arrivals.

IFR traffic must be separated from VFR traffic by at least 1000ft vertically, and except when taking off and landing, or under ATC control, by 5 nautical miles horizontally. So local to the airport, IFR traffic will clearly not join the "visual circuit", but will be descended to a height not below 2000ft above aerodrome level (aal) because VFR traffic should have descended to 1000ft aal before joining the visual circuit.

Normally IFR traffic are in fact descended to a height of 2500ft aal, because that is the height at which they should capture the ILS for final approach. They will be "vectored" (given a heading and target altitude), by ATC, if there is no ATC, they will follow a predefined approach path, published, in

the UK, by the National Air Traffic Service (NATS). These procedures are known as "STARS" (Standard Arrival Routes).

For example, the Bristol arrival route BRI-2D requires an IFR arrival to fly to Berry Head VOR, then continue to the EXMOR fix (on the southern shoreline of the Bristol Channel near Clevedon) tracking the 009° radial. then to track the BRI NDB on a bearing of 065°. On reaching BRI the aircraft will fly a heading of 120° to make a left hand transition (teardrop) turn onto the ILS for runway 27. If an Approach or Radar controller is on duty, however, IFR traffic is usually vectored on to the ILS before reaching BRI.

As a VFR pilot, the preceding paragraph may not be readily understood, but you are recommended to look on the NATS website at Instrument flight procedure charts to get a feel for how they work. What is important though is to remember that regardless of the procedure, IFR aircraft will not descend below 2500ft aal. So the VFR pilot, to ensure safe separation should remain below 1500ft aal when approaching the airport.

If you approach the airport with no Approach or Radar ATC on duty and realise that an IFR arrival is on approach, either flying the ILS, or generally within 10 nautical miles of the airport, as a VFR arrival you must give way to the IFR traffic. Take up a hold, orbiting round a visual object on the ground, at 1000ft aal until the IFR arrival is clearly well ahead of you and will have landed before you join the visual circuit.

If the IFR arriving aircraft is a “heavy” (as defined by ICAO) then it will generated wake vortexes from its wingtips which can severely disrupt any light aircraft flying into those vortices. Wake vortex clearances are published on the web for different aircraft, so look up the details, and comply with them. In generally a wake vortex clearance of 6 nautical miles will be a safe distance to remain behind. If there is ATC, they will instruct you as necessary to maintain safe separation.

On the ground, the same rules apply as for departure. Light aircraft give way to heavy, VFR gives way to IFR on the taxiways and aprons. If you find yourself landing ahead of a faster heavier aircraft, common sense dictates that you should vacate the runway as soon as possible to avoid the need for the following aircraft to make a missed approach.

8.5.2 Arriving VFR Traffic

If other VFR traffic is approaching the airport, ATC will determine which aircraft should proceed first into the visual circuit. This may necessitate a following aircraft to “hold” to provide staisfactory separation for landing. ATC will tell the following aircraft to “hold at xxx” or a better instruction would be “take up a left hand orbit overhead xxx until advised”. Left hand orbits are easier of course with the pilot in the left hand seat. If there is no ATC, then the both pilots should indicate their position to each other on

Unicom, and the following pilot take up an orbit over a clearly identifiable landmark and stay there until the other aircraft is clearly well ahead.

Separation for landing does not normally require wake vortex separation, but it does need space and time to allow the first aircraft to vacate the runway before the second touches down. Two aircraft MUST NOT occupy the runway at the same time. If this cannot be achieved, the following aircraft must go around for a second approach.

When taxiing to parking, remember to keep right on the taxiway if another aircraft is taxiing towards you. If you must overtake another aircraft going in the same direction as you, and generally this isn't a good idea as there may not be a lot of manoeuvring space, you must overtake on the LEFT. This may be counter-intuitive to people in the UK used to driving cars on the left and overtaking on the right, of course.

8.5.3 Dealing With Other Traffic

What do you do if another aircraft is moving nearby - either on the ground, taxiiing or preparing for take off, or approaching to land? This depends on several different factors which are described in the following sections from the viewpoint of you and your aircraft, engaged in or preparing for, a VFR flight. The procedures should be similar whether the aerodrome has any ATC cover or not.

The first and most important rule is that IFR traffic has precedence over VFR traffic - ALWAYS. Put bluntly, if in doubt, get out of his way!

8.5.4 ATC Dialogue at the Arrival Airport

The Club's ATC Manual contains all the communication dialogue required, plus the rules and procedures which dictate what is said when and where during the approach and landing phases of the flight.

8.5.5 VFR Landing and Take Offs, Off Airport

One of the delights of flying very small aircraft is teh ability to land and take off from airfields which are not "officially" recognised as such. These "Unlicenced Airfields are very often parts of abandoned military airfields with a remnant of tarmac runway, or simply a fairly flat piece of farm grassland without any obstructions for a 400 -600 metre length - enough to get a Cessna 172 airborne, for instance. Some may be well established with Buildings and several runways, others may simply be a field.

One characteristic of most of them will be that they have no Air Traffic Control facility at all, not even Air/Ground radio. Consequently, on VATSIM, these airfields will rarely be registered in the databases of the ATC client software, and most controllers will be completely unaware of tgeir presence. So pilots are really on their own here. When interacting with

other VATSIM users, therefore, a few simple rules should be applied before take off.

1). If the airfield is within or beneath controlled airspace, then tune your COM radio to the controller managing that airspace if one is one line.

2). If the airfield is outside controlled airspace, then tune your COM radio to the Unicom frequency 122.80.

3). Tell the Controller, or type on Unicom your location as best you can and your intentions after take off.

4). Look on VATSpy or Servinfo fot any traffic in the vicinity at a similar altitude to that to which yiou intend to climb and keep a good lookout.

5). Continue to monitor Unicom or a controlled position once airborne.

6). Follow any instructions you receive from a controller.

Similarly when landing at one of these unlicensed airfields, the following simple rules should be applied.

1). When approaching an unlicensed airfield within or beneath controlled airspace, tune your COM radio to the controller managing that airspace if one is one line, and advise them of the position and a brief description of the landing site.

2). If the airfield is outside controlled airspace, then while tuned to the Unicom frequency 122.80, type in your location, altitude, position in the circuit and intended landing direction or runway designator

3). Look on VATSpy or Servinfo for any traffic in the vicinity at a similar altitude to that at which you intend to ccircle to land and keep a good lookout.

4). Follow any instructions you receive from a controller.

8.6 Airport signage

Like roads, airport runways and taxiways need signs to tell pilots where to go (and where not to go). Although it is published by the U.S. Federal Aviation Administration, the chart displayed by the following link contains each of the signs a pilot needs to safely move around the airfield.

https://www.faa.gov/airports/runway_safety/publications/media/QuickReferenceGuideProof8.pdf

9 NAVIGATION

In addition to the information in this manual, the Club's General Training Manual contains all the VFR navigational information required by the P3 student, in two exercises: -

Exercise 18A Basic Navigational Theory, and

Exercise 18D Practical VFR Navigation.

There are four fundamental methods of visual navigation: -

α) Dead Reckoning: - the process of determining one's current position by calculating the distance and course flown from a known location (fix), by flying for an elapsed time at a known speed on a steady course.

β) Pilotage: - flying between fixed points of reference usually identified by means of an aeronautical chart.

χ) Radio Navigation:- This is not strictly a visual method, but is used in conjunction with visual methods, particularly when approaching an airport to land. Basic radio navigation skills - tracking inbound or outbound to or from VORs or NDBs to arrive at a known position have to be demonstrated during the P3 flight test.

δ) GPS: - Using a Global Positioning System receiver to locate one's posotion at any point during a flight. Subject to the reliability of the satellite transmitter, this method, in common use since about 1990 is by far the easiest. However good dead-reckoning and pilotage skills will need to be demonstrated during the P3 flight test.

The P3 student will be expected to be proficient in each of these skills.

10 FLIGHT TEST

10.1 The Flight

The P3 flight test will consist of four flights with a total distance of around 150 nautical miles, starting from an airport surrounded by Class D Controlled Airspace and landing at three other airports. At least one of the landing airports will be surrounded by Class D Controlled Airspace. At least one airport will be manned by VATSIM Approach and Tower ATC.

A full stop landing and take off from each of the intermediate airports will be required, but at one of the intermediate airports, a full circuit and touch-and-go will be required before landing.

10.2 Demonstration of Flight Skills

The student will be requirred to demonstrate pilot to ATC communications for all portions of the flight.

He will need to demonstrate the four types of VFR navigation skills described in 9 above.

He must navigate on a consistent course to a significant visual point at least 30nm away using only dead reckoning. He should give the examiner an estimated time of arrival at the waypoint.

He must navigate on a consistent course from a significant visual point to a second significant visual point using pilotage. He should give the examiner an estimated time of arrival at the waypoint.

He must navigate on a consistent course to a radio navigation station at least 20nm away.

10.3 Aircraft Selection

The student must fly a single engined or twin engined light aircraft for the duration of the test flight.

10.4 Preflight Planning and Preparation

The student must prepare a flight plan, using either Plan-G, Flightsim Commander, the built-in FSX/P3D flight planner or a paper chart showing the route, with, as a minimum, planned headings, altitudes and waypoints marked.

He must file a suitable flight plan once connected to VATSIM.

10.5 Air Traffic Control Communications

The student shall demonstrate the use of online flight ATC services and communications during the en-route portion of the flight.

The student shall demonstrate the ability to transit VFR through complex airspace in the vicinity of a major airport in communication with, and following the instructions of, live VATSIM online ATC radar coverage for approach and departure.

11 SUMMARY

This document has covered the requirements of the VATSIM P3 Pilot Rating at a level suitable for VATSIM members who have already gained the VATSIM P1 Rating. The links provided give access to the essential training material for the rating, so do read all the documents referenced. When you have done so, you should be in a position to take the P3 Pilot Rating Tests. The syllabus, the Practical Test Requirements and the P3 Rating application form are available from the Pilot Ratings page of the Club web site. The P3 written test is available on a separate page, once you have been registered as a student for the P3 Rating.

Members of CIX VFR Club automatically have access to all the training facilities offered by the Club. Those VATSIM members who wish to take the Pilot Ratings training or exams through CIX VFR Club are allocated a special temporary Student membership, which allows most of the privileges of Club membership while they are working through the courses.

The Club does not run a P3 Rating course with an instructor. However, we do offer a Single Engined Piston aircraft (SEP) flight training course with an instructor on a one to one basis, using all the training facilities available to Cix VFR Club members. The SEP course includes all the requirements of the VATSIM P3 syllabus.

The P3 Rating written test and flight test results are recorded in the Club's Student Training Records System, developed in-house. It includes the facility for students to look at (but not change) the information and comments entered by their instructor.