ATC Guide

(HKVACC-TM-GEN-002)

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Contents

1 INTRODUCTION

This is part two of the VATSIM HKVACC training material. It will focus more on the practical skills and methods that are used when conducting ATC. To get the more theoretical background, please read the manual (HKVACC-TM-GEN-001).
There are a lot of examples of phraseology in this guide, but it is impossible to include all variations. Please refer to the reference section on the left side of the screen for a comprehensive listing about phrases used in aviation.

1.1 Getting Started [S]

Some say it can be quite a challenge to find all material and all programs that are needed in order to conduct on-line ATC in VATSIM. While we strive to make this process as easy as possible, we do recognize that this is an obstacle that you need to overcome. Please take a look at this step by step guide if you are in need for guidance. http://www.vatsim.net/controller.html You can also refer to your local vACC homepage to find more information on the training and upgrading process in it. If you get stuck or are lost in some way, please do not hesitate to contact the one in charge for training in your local vACC or VATSEA ATC Training Department.

1.2 Radar Client [S]

First you will need a radar client. There are links to approved software and manuals on VATSIMs Home Page www.vatsim.net (Controller Resources => Controller Software). Since there is more than one radar client available, you might want to check with your instructor which one (s)he will be using in your training. Even though a radar client is all what you need, there are other programs that can be helpful. You may find many of them on www.vatsim.net under links and resources.
http://vatsim.net/links/linksandresources.html

1.3 Setting Up for an ATC Session [S]

A good advice is to prepare for your on-line session. In some areas you are requested to book a position before you man it. A good habit is to log on to VATSIM as an observer first and coordinate with fellow ATCs controlling sectors adjacent to the sector you are planning to man. This also gives you an overview of the present traffic situation. Make sure you have access to current maps and charts for the area you are planning to give ATC in. Prepare your ATIS and start the session. It is a good practice to send an ATC-message as soon as you get on-line to inform you fellow ATCs that you have opened your position. Please refer to the software manual to see how this is done. Before closing your sector, inform fellow ATCs in the same manner as above and give information to all the pilots that are under your control on how they shall proceed i.e. hand-over traffic to another controller or switch to UNICOM and continue on own navigation.

We have placed links to two excellent and highly recommended manuals explaining how to set up an Observer Session using either ASRC or VRC, these can be accessed here for ASRC and here for VRC (both are Pdf format)

1.4 When in need of help [S]

If you need help "off-line", the first instance you should turn to is your local vACC. Search for the answer to your question on the local Webpage or forum or write in the forum and ask for help. You can also search/write in the VATSIM forums http://forums.vatsim.net/ If this isn‟t helping you or your question is better dealt with in private, rather on a forum, please look at the staff-listing on your local vACC and write an e-mail to the staff-member in charge for the area which your question concerns. This will usually solve the problem, but if not and if needed please write an e-mail to someone in the HKVACC-staff. If you need help on-line, you should contact a more senior fellow colleague on-line and ask for guidance and help. If there is none or if this doesn‟t solve your problem, you should contact a SUPERVISOR. This is done by typing [**.wallop**] in the radar client's command field. The message is sent to all Supervisors on-line and they will do their best to help you sort the problem out. Good Luck with your controlling!

2 ATC POSITION OVERVIEW

2.1 Choosing your ATC position [S]

When first getting introduced to Virtual Controlling the various positions and call signs used can look very intimidating at first glance. The easiest manner to decipher these is to divide them into three distinct categories:

While the exact terminology varies from country to country, there are generally three different types of ATC.

- **Control Towers**
- **Approach controllers**
- **Centre controllers**

As a new member to VATSIM and depending on the local restrictions in use at your vACC, Student Controllers will usually start controlling at a Ground or Tower position and then move up to Approach and Departure positions and from there to Area Control positions and eventually once the required rating has been achieved will be able to control the Euro Control Areas if interested.

2.1.1 Aerodrome Positions [S]

The primary method in real life of controlling the immediate airport area is by means of visual observation from the control tower. The tower is a tall, windowed structure located on the airport. Tower controllers are responsible for the separation and efficient movement of aircraft and vehicles operating on the taxiways and runways of the airport itself, and aircraft in the air near the airport.
Radar displays are also available at some airports (on VATSIM at all airports). Tower uses radar to display airborne traffic on final approach and for departing traffic once they are airborne.
Some airports (on VATSIM all airports) also have radar designated to display aircraft and vehicles on the ground. This is used by Ground controllers as an additional tool to control ground traffic.
The areas of responsibilities for aerodrome controllers fall into three general operational disciplines:

- **Clearance Delivery**
- **Ground Control**
- **Local Control (Actual Tower position)**

The following provides a general concept of the delegation of responsibilities within the tower environment:

Clearance Delivery - the position responsible for verifying a flight plan and issuing IFR clearance.

Ground - responsible for controlling traffic on the airport “movement” areas, this generally include taxiways and holding areas and giving traffic information and suggestions (for example approving push-back) to traffic on aprons.

Tower - responsible for movements on the runways and traffic in the control zone, (CTR) which surrounds the aerodrome and normally extends around 5 to 10 NM from the aerodrome and from the ground up to normally, 1500-2000ft. The tower is the position that clears aircraft for takeoff or landing and ensures the runways are clear for these aircraft.
As in real life and in dense traffic, at certain large airports more than one of these positions may be opened, for example S or N for South or North.

2.1.2 Radar Positions [S]

Even though as described above Tower and Ground also use radar displays, we will refer to the following as Radar Positions since they rely 100% on radar in order to control and separate traffic.
These positions are not located in the actual tower; these facilities on the other hand can be located in buildings adjacent to an airport or even in buildings totally separated from it. A radar position as the name implies uses Radar scopes to track and follow the movement of traffic in the air. These teams are in turn subdivided into:

- **Approach Control (APP)**
- **Area Centre Position (ACC)**
- **Flight Information Service (FIS)**

Approach Control - the position responsible for controlling, separating and sequencing arriving and departing aircraft. APP is usually responsible for the terminal control area (TMA). At small airports, the TWR and APP position is often combined. On the contrary, at large airports or in complex TMAs, APP is usually divided into several sectors. APP positions may have different radio callsigns depending on the function, such as Departure, which as the name implies controls departing aircraft, Arrival or Director, which usually handle vectoring of arriving aircraft.

Area Control Centre - the position responsible for controlling traffic in the control areas (CTA) and upper control areas (UTA) within the centre"s area of responsibility. The area of responsibility is generally a FIR or part of a FIR, so ACCs cover large areas, and therefore may be divided into several sectors, both horizontally and vertically.

FIS, Flight Information Service is not used much in VATSIM and seldom in Europe, but should it be on line then it is responsible for providing traffic information, flight following and providing information to VFR flights. It is not a Control Position and can not give instructions to aircraft but only advisories and information. As FIS is not a standard Designator on VATSIM, controllers providing this service usually log in with XXXX_I_CTR call-sign
FIS in essence is the most basic form of air traffic service that is provided to aircraft. However, the FSS suffix is used in Europe as part of the different Euro Control positions which even though they use FSS as part of the log-on to the net work are proper Control positions in the Upper Airspace from FL245 and above.

2.2 List of positions in VATSIM [S]

Call sign	Designator	Short Description
Delivery (Clearanc	DEL	Responsible for issuing IFR clearances
Ground	GND	Responsible for movements on the ground on the manoeuvring area.
Tower	TWR	Responsible for traffic on the runways and in the CTR..
Departure	DEP	Responsible for separation and flow of departing traffic at certain airports.
Arrival/Approach	APP	Responsible for separating and
Final/Director	APP	Responsible for final vectoring of
Control/Radar	CTR	Responsible for en-route traffic and traffic
Flight Service	FSS	Responsible for control of upper

A further position is AFIS:

AFIS (Aerodrome Flight Information Service	TWR	Gives information about traffic and weather at some uncontrolled airports.

In VATSIM **AFIS** must log on with a TWR call-sign but the controller information (ATIS) will state when it is an **AFIS**

Examples:
VHHH_DEL: *Hong Kong Delivery*
VHHH_S_GND: *Hong Kong Ground*
VHHH_S_TWR : *Hong Kong Tower*
VHHH_DEP : *Hong Kong Departure*
VHHH_APP: *Hong Kong Approach*
HKG_CTR: *Hong Kong Radar*

2.3 Visual Ranges [S]

The VATSIM community relies on a network of computers interlinked to provide position updates to controllers and pilots alike. The network is donated by third parties. In an effort to avoid any wasting of bandwidth the following maximum ranges have been imposed.

Position	Range
DEL/GND	10 to 20 nm
TWR	30 to 50 nm
APP/DEP	100 to 150 nm
CTR	300 to 600 nm
FSS	1500 nm

When a user logs on to network, it is important that the visual range slider be set to the appropriate range depending on the position being manned, the main reason is to limit the waste of bandwidth. Bear in mind that a user will receive information packets every few seconds, so a GND controller having a range of

400nm will also be receiving traffic information in a radius of 400nm from the position being manned this is an absolute waste of bandwidth and should be avoided at all cost.

Unfortunately some controllers forget to change their facility type when switching to another ATC position. Setting a correct facility type is important; since it affects the radio range of the controller. Therefore in some cases a wrong facility type could affect the text communication between a controller and a pilot.

RANGE is the visual range set by the controller in ASRC/VRC options using the range slider. There is one exception: visual range for FSS facilities is hard coded to 1500nm (since this is much more than the slider is allowed to be set to). This range defines from which distance the controller gets aircraft position reports, so which traffic is shown at the radar scope and which not. It is obvious it should be adjusted to the service the controller is providing. The best situation is when controller is capable to see the traffic within his sector plus a small margin. Therefore the visual range should be adjusted to the size and shape of the sector

(NOTE that the visual range is calculated from the point where the radar scope is actually centered, unless the .vis command has been used to set a different visibility point).

If you use VRC as radar client, it is a good practice to configure it for the facility you are manning and then save the profile with its callsign to make sure that all settings are appropriate for your position. (i.e.: LEBL_TWR, EGKK_APP, etc.)

There are some situations, when extended range is justified, for example a very large or an irregular shaped sectors or some special operations.

(NOTE: for irregular shaped sectors, you can use multiple visibility points in order to have a “radar antenna” at the significant points of your sector, so that it’s not needed to increase range)

3 COMMUNICATION

3.1 Radio Communication the Basics [S]

Communication is essential for air traffic control. Both text and radio can be used (even if voice is preferred) in order to exchange information and are equally important. Sending in a flight plan is a form of communication, as are the instructions transmitted over radio between pilot and controller. Messages between two or more controllers, in order to coordinate traffic, are also communication. In short, there is a lot of communication required in order to control the traffic in the air. With this amount of messages being sent, there is an obvious risk for misunderstanding. There is also a need to keep transmissions short in order to save valuable time. These are the main reasons why a special format and syntax of radio communication has been created. In order to give proficient and safe ATC, you will need to learn this radio communication language.

Fictive callsigns will be used in the examples below:

XXX123 = Exair 123

Control= Somewhere

3.1.1 Radio Technique [S]

Let‟s start with the basics – there are some basic rules that you need to adhere to or there will be chaos:

Listen before you talk – It is impossible for two radio stations to transmit on the same frequency at the same time. If this is done, the radio signal will be blocked and this will result in a nasty noise on the frequency. Therefore it's important that every station monitors the frequency for about 5 seconds before transmitting, to make sure there is no ongoing radio traffic. If you hear an ongoing conversation, wait until the conversation is over before you begin to transmit. Do not start your communication if there is a read-back expected on the last transmission even if there is a short pause.

Think before you talk - The radio traffic flow should be as smooth as possible. To achieve this it's vital to "think first" before transmitting so that a clear, concise and uninterrupted message can be sent.

Use standard phraseology and syntax - To prevent misunderstandings and to maintain the radio traffic as effective as possible, stick to standardized phraseology and skip slang and of course private messages.

Speak out - Long messages shall be cut into shorter phrases with a little pause in between. Normal speaking speed is about 100 words / min but when reading out long messages such as weather reports and complicated route clearances, decrease the speed to about 60 words / min. When transmitting, talk with normal voice tone and keep the microphone at a constant distance from your mouth.

3.1.2 Language [S]

English is the primary language for communication in aviation. Local language is allowed in most European countries, i.e. French in France, German in Germany, but in most countries English is prevailing at international airports. Local language may be common at smaller airports where there is lots of general aviation and/or VFR traffic.

There are several advantages to using English, the most obvious being that everybody on the radio channel understands everybody. It is the pilot who chooses which language is used, and ATC should respond in the same language. However, ATC may suggest changing language if it is believed that it will ease communication.

3.1.3 Callsign [S]

Due to the fact that it is impossible to see the one you are talking to when using a radio, it is vital that all stations at all time knows who is transmitting and to whom the message is sent to. Hence all users of the radio shall have a specific and unique callsign.

(NOTE: the system prevents you to log on using a callsign already in use).

If you for example are flying DLH123, your callsign will be DLH123 *(Read Lufthansa one- two-three).* If you are talking to for example Stockholm Control then Stockholm Control will use *"ESOS_CTR"* as his/her callsign.

When establishing contact with a station you must first state what station you are addressing your call to, and then state your own callsign. When the receiving station calls you back, he/she must first state your callsign and then his/her own callsign. An example of establishing contact:
XXX123: “Somewhere Control, Exair one-two-three, good evening”
Control: “Exair one-two-three, Somewhere Control, good evening”

When contact is established, the controller may leave out his/her own callsign when answering or contacting aircraft with which he/she has already established contact. The controller may also use abbreviated callsigns if contact is established and there is no risk of misunderstanding a callsign. Once contact is established, aircraft also may leave out the controller’s callsign when transmitting a request. An example of a descent clearance once contact is established:
Control: "Exair one-two-three, Descend to flight level one-two- zero."
XXX123: “Descend to flight level one-two-zero, Exair one-two- three"

Callsigns used by airline flights usually consist of the airline's callsign followed by the flight number (SAS123 being "Scandinavian 123"). General aviation flights, however, normally use the aircraft's registration as callsign.
Example: **SE-IBG (Sierra-Echo-India-Bravo-Golf)**

When checking in to a new controller you have to state your full callsign, (all five letters).

As long as the controller calls the pilot using the full callsign, the pilot should use it as well. However, the controller often reduces the callsign to the first letter, followed by the two or three last letters, for example S-BG. If aircraft with similar callsigns, such as SE-IBG and SE-EBG are on the same frequency, ATC must not reduce the callsign so that confusion may occur. In this case the correct abbreviation would be S-IBG and S-EBG. When ATC has contacted the pilot using the abbreviated callsign, the pilot may use it as well.

When a station takes the initiative to call another station, regardless of whether the stations have established contact or not, it is mandatory to begin the transmission saying the station callsign so all others in the frequency know who is transmitting. This does not apply to the controller since all stations recognize the controller and it will be pretty obvious who is directing the traffic. An example where XXX123 takes the initiative and requests descent:

XXX123: "Exair one-two-three, request descent"
CTR: "Exair one-two-three, descend to flight level one-two-zero"
XXX123 "Descend to flight level one-two-zero, Exair one-two-three"

Below is another example, where the controller takes the initiative and issues a clearance for XXX123 to turn left direct TROSA VOR. Note that the controller leaves out his/her callsign:

Control: "Exair one-two-three turn left direct TROSA"
XXX123: "Left direct TROSA, Exair one-two-three"

3.1.4 Readback [S]

When a controller (or aircraft) transmits a message to a station it is very important that the receiving station acknowledge the message and reads back any required parts. If the receiving station does not acknowledge, the transmitted message is considered as a lost transmission and the sender should resend the message or check if the receiving station got the message.

Items that <u>must always be read back in full</u> are all clearances (including altitudes, headings, speeds, radials etc), runway in use, altimeter setting (QNH or QFE) and transition level, and all frequencies. For a controller, this is extremely important to remember: <u>if a pilot's readback is incorrect, the controller has to ask for confirmation</u>, i.e a new readback. There are also items that should not be read back to reduce unnecessary radio transmissions. In short, this includes everything not mentioned above, but a few examples are: wind, temperature and other weather information (except altimeter settings) and traffic information in detail. Here are a few examples of how to acknowledge transmissions:

Arrival: "Exair one-two-three, turn left heading three-six-zero, descend to altitude two- thousand-five-hundred feet on QNH niner-niner-eight"
XXX123: "left three-six-zero, descend to two-thousand-five-hundred feet, QNH niner- niner-eight, Exair one-two-three"
Tower: "Exair one-two-three, wind two-six-zero degrees at one-two knots, runway two- six, cleared to land"
XXX123: "runway two-six, cleared to land, Exair one-two-three"

Note: that when a pilot reads back a message, the pilot should end the transmission by stating his/her callsign.

Remark: *"Roger" means "I have received and understood your message", and thus is only used to acknowledge messages, or parts of messages, which do not require* *a read back. "Roger" does NOT mean either "yes" or "no". When a positive or negative reply is required, the phrases "affirm" and "negative" should be used.*

3.1.5 Readability [S]

When calling another radio station, it is sometimes good to perform a radio-check to test the transmission and reception quality. For this purpose a readability scale has been developed:

Scale Definition

1 Unreadable
2 Readable now and then
3 Readable, but with difficulty
4 Readable
5 Perfectly readable (loud and clear)

XXX123: "Somewhere Tower, Exair 123 - radio check" Tower: "Exair 123, somewhere Tower, Read you five" XXX123: "Roger, read you five as well, Exair123" XXX020: "Somewhere Tower, Exair 020, radio check"
Tower: "Exair 020, Somewhere Tower, read you five by five - go ahead"

XXX123: "Somewhere Tower, Exair 123 - radio check"
Tower: "Exair 123, somewhere Tower, Read you five"
XXX123: "Roger, read you five as well, Exair123"
XXX020: "Somewhere Tower, Exair 020, radio check"
Tower: "Exair 020, Somewhere Tower, read you five by five - go ahead"

Note: 5 by 5 does not mean 5 out of 5. The first value indicates the signal strength, while the second value is the signal clarity.

3.1.6 Priority [S+]

To obtain a smooth traffic flow and to avoid any situation where less important messages block the frequency and obscure more vital messages to be sent, a message priority and classification list has been developed. This list shows that some messages have a higher priority as follows:

1. Emergency messages Begin the transmission with: "MAYDAY, MAYDAY, MAYDAY" Use this transmission only when an emergency is stated.
2. Urgency messages Begin the transmission with: "PAN PAN, PAN PAN, PAN PAN " Use this transmission only on situations that might develop to an emergency
3. Messages related to direction finding helping disoriented aircraft to obtain their position
4. Flight safety messages Clearances, position reports and vital weather information as SIGMET.
5. Other weather information METAR etc.
6. Airline messages, for the airlines flight office, service of aircraft etc

3.2 Phraseology [S]

To a friend, you can tell a story in a number of different ways. To a pilot, you should give instructions in a very strict and specified way. This is to minimize the risk of misunderstandings and keep the message as short as possible. Some words, which you normally think of as synonyms, cannot be exchanged in aviation, since they mean different things. It is hence important to learn the phraseology used in aviation.

It is a bit like learning a new language and this can only be done by practice. Many persons are afraid of talking on the radio. It can be hard to get all words right in the beginning, but you should remember that it is often better to say something, even though it is not perfectly correct, than saying nothing at all. Practice and studying radio phraseology will give you experience.

You can find various phraseology links under References sub menu on the left side of the screen.

3.3 Radio Communication - specific

When the aircraft is airborne it is essential for ATC to verify that the transponder is working properly and that a good radar image is shown on the scope with a correct information tag. This is why pilots should report their current altitude and the one they are climbing or descending to when they check in to a new controller. They should also report which intersection/heading or (in certain FIR's) the SID they are over or following. When the controller has verified that the tag on the radarscope matches the information given by the pilot, he can reply with "radar contact or "identified"

TWR: "Exair 131, contact somewhere Control on 118.4"
XXX131: "Somewhere Control on 118.4, Exair 131"
XXX131: "Somewhere Control, Exair 131, passing 3000 ft, climbing to 5000 ft"
CTR: "Exair 131 good evening, Somewhere Control radar contact, Climb to FL 320"
XXX131: "Climb to FL 320, Exair 131"

3.3.1 Take Off [S]

Pilots appreciate if they can receive a continuous climb from takeoff to cruise altitude. The controllers should therefore try to re-clear the aircraft for a higher flight level well before it reaches the current cleared level.
If this means that the aircraft must be handed over to a new controller it is important to make this handover well in advance.

One example is the handover from TWR to DEP. One method of preventing "level offs" because of long hand over times is to issue the following clearance before departure:
TWR: "Exair 131, when airborne contact departure on 126.65. Runway 19 Right, cleared for takeoff, winds 170 at 21 knots."

Below are some other examples of takeoff clearance that can be used.

TWR: "Exair 131, when airborne fly runway heading and climb to 5000 ft. Runway 21, winds 190 at 15 knots, cleared for takeoff."

"Right turn out" must always be specified if a right turn is to be performed after take-off, because left turn is standard procedure. This is not required, however, if the aircraft is on a SID which begins with a right turn, since the right turn is implied in the clearance for the SID.

TWR: "Exair 131, Runway 08, right turn out, cleared for takeoff."

3.3.2 Cruise [S+]

In the cruise the most common phraseology is the frequency changes between different controllers.

CTR_1: "Exair 131, contact Another Control on 124.40"
XXX131: "Another Control on 124.40, Exair 131"
XXX131: "Another Control, Exair 131, flight level 360"
CTR_2: "Exair 131, Another Control, radar contact"
or
CTR_2: "Exair 131, Another Control, identified"

During the cruise phase of flight, the pilots should check the ATIS broadcast for their destination airport if it is available. By doing this they will get such information as current weather and runway in use so they can start planning for their arrival. Pilots should report the current ATIS designation to the controller handling the arrival traffic.

If no ATIS is available, this kind of information can be forward to the pilots from the controller directly.

CTR: "Exair 131, are you ready to copy MET REPORT for Somewhere airport?"
XXX131: "Affirmative go ahead, Exair 131"
CTR: "Met report for Somewhere, Winds 210 degrees at 9 knots, visibility 5 kilometers in light rain, scattered clouds at 2000 ft and overcast at 4000 ft, Temperatures 15, dewpoint 14, QNH 998. Expect ILS approach for runway 17"
XXX131: "QNH 998, transition level 55, runway 17, Exair 131"
CTR: "Exair131"

Note the mandatory data in the read back of this example: altimeter setting, Transition Level and runway in use.

Most major airports have pre-defined arrival routes (STAR), which are used to reduce workload for the controller handling the final stage of the flight by channeling arriving IFR traffic.
The clearance to fly these routes should be given well before the aircraft reaches the first waypoint of the STAR. The inbound clearance is normally given by the last ACC controller before the flight is transferred to the APP controller. However, this varies between different countries and airports.

CTR: "Exair 131, cleared to Somewhere via Rasmu 3 Echo arrival runway 17"
XXX131: "Rasmu 3 Echo runway 17, Exair 131"

When it is time to leave cruise altitude and start descent it is important to remember the following: *It is the pilots responsibility to request descend in order to meet aircraft performances and any altitude restriction on the STAR or approach*

XXX131: "Exair 131, request descent"
CTR: "Exair 131, descend to flight level 100"
XXX131: "Descend to flight level 100, Exair 131"

If there is no conflicting aircraft in the way, the ATC on duty can issue the following descend clearance to an aircraft before the pilot has requested descent:

CTR: "Exair 131, when ready, descend to flight level 100"
XXX131: "When ready descend to flight level 100, Exair 131"

This means that the pilot can maintain the current altitude and start the descent whenever he wants.

Now an example when the aircraft is cleared below the Transition Level (TL) for the first time. QNH should always be read out when this is done:
APP: "Exair 131, descend to 2500 ft on QNH 998, Transition level 110"
XXX131: "Descend to 2500 ft on QNH 998, Transition level 110, Exair 131"

The TL is omitted where ATIS is available, because TL is included in the ATIS
APP: "Exair 1465, descend to 4000 ft on QNH 998"
XXX1465: "Descend to 4000 ft on QNH 998, Exair 1465"

3.3.3 Approach [S]

There are many different ways to make an approach to an airport. An aircraft can:
1. Receive radar vectors all the way in to final approach course.
2. Initially follow a STAR and then receive radar vectors to final approach course.
3. Follow a STAR all the way in to final approach course.
4. Fly by own navigation to the Initial Approach Fix and perform a full Procedure Instrument Approach.
5. Perform a visual approach if the pilots have a good visual sight of the airport.

Let us now see some examples of the instructions given by ATC for these 5 different approaches:
(1) An aircraft (XXX950) is approaching an airport without ATIS and STARs. The pilot has received inbound clearance from ACC "via LAPSI runway 19"
XXX950: "Approach, Exair 950 FL 150"
APP: "Exair 950, Approach, radar contact. Descend to 2500 ft on QNH 998, transition level 110"
XXX950: "Descend to 2500 ft on QNH 998, transition level 110, Exair 950"
APP: "Exair 950, intention radar vectoring for ILS approach to runway 19. MET Report, Wind 210 degrees 9 knots, visibility 5 kilometers in light rain, clouds scattered 2000 ft overcast 4000 ft, Temperature 15 dewpoint 14"
The Controller omits QNH and Transition Level in the met report as is has just been given to the pilot
XXX950: "Roger runway 19, Exair 950"
APP: "Exair 950, turn right heading 030 degrees"
XXX950: "Right heading 030, Exair 950"
APP: "Exair 950, turn right heading 160, cleared ILS approach runway 19, report established"
XXX950: "Right heading 160, Cleared for ILS approach runway 19, WILCO, Exair 950"
XXX950: "Exair 950 established ILS rwy 19"

Note: WILCO = WILL COMPLY. (This is one of the few cases where you can use this word)

(2) An aircraft (XXX112) is approaching Somewhere, an airport with ATIS and STARs. The last waypoint in the STAR (Clearance Limit) that XXX112 is cleared to is Tebby VOR (TEB).

APP: "ExAir 112, after TEBBY turn right heading 050 and descend to 2500ft Vectors for ILS approach runway 26"

XXX112: "After TEBBY descend to 2500 ft and turn right heading 050, vectors for rwy 26, ExAir 112 "

APP: "ExAir112, Turn left heading 290, cleared ILS approach runway 26, report established"

XXX112: "Turn left heading 290, cleared ILS approach rwy 26, wilco, ExAir112 "

(3) An aircraft (XXX131) is approaching airport Somewhere on XYZ 3 ECHO arrival. The airport has ATIS and the STARs will guide the aircraft all the way in to final approach course. So if the traffic situation is light and no ATC vectors are needed for separation it can expect to follow the arrival route all the way in to the localizer.

Exair131: "somewhere control, ExAir131 flight level 100"

APP: "ExAir131, radar contact. Descent to 2500 ft on QNH998, cleared ILS approach runway 17"

ExAir131 "Descent to 2500 ft on QNH998, cleared ILS approach runway 17, Exair 131"

(4) An aircraft (PA28 D-IAM) is approaching somewhere airport. It is a student pilot and he requests to perform the full procedure ILS approach for runway 21.

D-IAME: "Somewhere Tower, Delta-India-Alpha-Mike-Echo, maintaining 5000 ft, request the full procedure ILS"

TWR: "Delta-Mike-Echo, radar contact. Descend to 3300 ft on QNH 1013, cleared for the ILS app runway 21 via ABC VOR, report localizer established"

D-IAM: "3300 ft on QNH 1013 and cleared ILS approach runway 21 via ABC VOR, wilco Delta-Mike-Echo."

TWR: "Delta-Mike-Echo, Met Report "somewhere" CAVOK, Wind 230 degrees at 4 knots, QNH 1000, Temperature 15 degrees, dew point 8 degrees, No Significant Change.

(5) A visual approach is basically a pilot's request approach. This means that the pilot will take the shortest and most convenient way to the runway. A visual approach is permitted (ATC approval is required) whenever there is visual contact to the destination airport.

X4321 Is inbound ABC VOR with runway 07 in use at "Somewhere" airport:

X4321:Somewhere Approach, ExAir4321 request visual approach runway 07"

APP: "Exair4321 roger, report runway in sight"

X4321: "Wilco, Exair4321"

X4321: "Exair 4321 runway in sight"

APP: "Exair 4321, cleared visual approach runway 07, final"

X4321: "Cleared visual approach runway 07 wilco, Exair 4321"

3.3.4 Holds [S+]

Sometimes traffic density reaches its limit and it is necessary to put aircraft in a holding pattern for a while.
Some examples of phraseology to use when putting an aircraft in to a hold:
The first example is used when the aircraft is instructed to join a holding pattern which is to be flown as published in the charts.

APP: "Exair4321, due to traffic congestion, join DEF holding flight level 150 as published "
X4321: "join DEF holding flight level 150, ExAir4321" APP: "ExAir 4321 expect further clearance in 5 minutes"
X4321: "Roger, ExAir 4321"

If the pilot is not familiar with the holding pattern, the following phraseology is used:
XXX4321: "ExAir 4321 request detailed holding instructions"
APP: "ExAir 4321 hold at DEF, inbound track 272, left hand pattern, expected approach time 21"
XXX4321: "Hold at DEF, inbound track 272, left hand pattern, ExAir 4321."

APP: "ExAir 4321 make a right 360 for spacing"
XXX4321: "Make a right 360, ExAir 4321."
or
APP: "ExAir 4321 orbit left until further advised"
XXX4321: "Orbit left, ExAir 4321

Note: ATC should always give the pilot information about how long he will be flying the holding or what time he can expect further clearance, also called EAT for Expected Approach Time.
Note: If an aircraft cannot follow a standard hold pattern and needs to make more than one 360 degrees turn, the aircraft should be instructed to orbit (left) or (right).

Some examples of phraseology to use when putting aircrafts back on course after holdings:
APP: "ExAir 4321, exit DEF holding on course and descend to FL 090"
X4321: "Exit DEF holding on course and descend to FL 090, ExAir4321"
- - - -
APP: "ExAir 112, leave DEF on on heading 170"
X112: "Leaving DEF on heading 170, ExAir 112"

3.3.5 Missed Approach [S]

A missed approach can be initiated both from the pilot or the controller to prevent a dangerous situation from occurring.

If the runway is occupied or if the arriving aircraft is too high or too fast on the approach, the controller can instruct the pilot to carry out a missed approach.

Every runway has a missed approach procedure that the pilot is expected to follow unless otherwise instructed by ATC. Often ATC revises the missed approach procedure due to traffic or to shorten the aircraft's route. Missed approach initiated by the pilot.

X4321: "ExAir 4321, going around"
TWR: "ExAir 4321, roger, climb to 4000 feet and turn right heading 300. Radar vectors for a new approach"
X4321: "Climb to 4000 feet and right heading 300, ExAir 4321"
TWR: "ExAir 4321 contact somewhere Approach on 126.650"

Missed approach initiated by ATC:
TWR: "ExAir 4321 go around (I say again, go around)."
X4321: "Going around, ExAir 4321"
TWR: "ExAir 4321, climb to 4000 ft and turn right heading 300, vectoring for new approach

3.3.6 Urgency and Emergencies [C]
A distress or Emergency call is always initiated by the pilot and the phraseology to use depends on the nature of the call

XXX123: "PAN PAN, PAN PAN, PAN PAN". Somewhere control, ExAir123 need to return to the field immediately. Have a sick passenger that need medical attention"
CTR: "ExAir 123, distress call is confirmed, turn right heading 070 Vectoring ILS runway 36 Left"
XXX123: "Right turn heading 070, runway 36 Left, ExAir123"
- - - - -
XXX123: " MAYDAY, MAYDAY, MAYDAY," Somewhere control, ExAir 123 needs to return to field immediately. Fire in left engine"
CTR: "ExAir 123 your emergency is confirmed. Turn right heading 070. Vectoring ILS approach runway 36 Left"
XXX123: "Right to heading 070, runway 36 Left, ExAir 123"
CTR: "Exair 123 when able report fuel and souls onboard and recycle transponder to 7700"
XXX123: "2 tons of fuel and 78 souls onboard, transponder 7700, ExAir 123"
CTR: "Ex Air 123, roger"

3.4 Correcting Mistakes [S]
Examples on how to act when things don‟t run as smooth as you wish:
APP: "Exair 987, turn right heading 35. correction, right heading 250"
X987: "Right heading 250, Exair 987"
or
APP: "ExAir987, descend to ……….t…Q..05……. "
X987: "Approach, say again for Exair 987"
APP: "ExAir 987, descend to 5000 feet on QNH 1015"
X987: "Descend to 4000 feet on QNH 1015, exAir 987"
APP: "ExAir 987, negative, I say again, Descend to 5000 ft on QNH 1015"
X987: "Descend to 5000 feet on QNH 1015, ExAir 987"
Useful words here to use: *Correction, Say again* and *Negative***.**

The example below shows a situation where the pilot in XXX123 does not copy the name of the VOR (SCHIPHOL, SPL) that he is cleared to and ATC therefore spells out the identification code of the (VOR)

CTR: "ExAir 123, re-cleared direct Schiphol "
XXX123: "Say again for ExAir 123"
CTR: "ExAir 123, I repeat, re-cleared direct Schiphol "
XXX123: "Read you two, say again the name of the points please Exair123"
CTR: "ExAir 123, re-cleared direct Sierra-Papa-Lima VOR"
XXX123: "Direct Sierra-Papa-Lima, ExAir 123"

3.5 Recap

- Get a Good Microphone
- When you speak, use a calm and even voice
- Don't speed up or speed down your voice
- Don't change the voice Pitch
- Don't get excited or stressed when using voice, as this clearly is transmitted to all
- Before you speak, think what you are about to say
- Do not start a sentence and then fall into the "uhmm" or "ahhmn"
- Learn the Alphabet as published.
- Lear and use the standard phraseology
- Pause slightly before and after numbers.
- Limit your messages to those required for the provision of ATC, remember voice use is not a chat room
- Avoid discussions with pilots on the frequencies. Use private messages instead and preferably wait until the aircraft has landed. If necessary, contact a Supervisor
- Ensure the Read Back is correct, if not Identify and correct the read back

4 CLEARANCE

Before a pilot departs on a flight, he/she has to make a number of Pre Flight preparations based on, amongst others, information about current weather, departure routes, arrival routes, waypoints en-route, cruising levels, weight and balance and aircraft conditions etc. When the pilot has received all information needed, he/she will create a flightplan (mandatory for IFR flights, but only required in some cases for VFR flights) either from scratch or from a pre- stored flightplan. When the flightplan is complete it will be sent to the ATC and be processed into a flightstrip and distributed to suitable ATC facilities. The flightstrip will contain data such as departure and arrival aerodromes, requested cruise level, route, type of aircraft, cruising speed, if the flight is to be flown under VFR or IFR regulations, alternate arrival aerodrome and special remarks. This flightstrip makes the substratum for the controller‟s actions. This means that it is vital that the flightplan and flightstrip is updated by ATC if any changes should occur during the flight.

4.1 On the Ground [S]

4.1.1 Clearance [S]

The pilot will perform pre startup checks and call clearance delivery for ATC-clearance, provided clearance delivery is on-line. If Delivery is not on line but Tower is on line, then the pilot will call Tower for clearance. If Tower is not on line but Approach is on line, then the clearance will be requested from Approach. I.e. the pilot will always call the next position “above” the one ideally required. **(NOTE: FSS stations do not provide clearance service, as they man traffic ONLY above FL245).** The pilot in command will also go through loading sheets, fuel data, and boarding data together with ground personal and flight crew. The ATC-clearance is very important, because this clearance clears the aircraft from the aerodrome of departure to a specified clearance limit. This is normally the destination aerodrome, but may in certain cases be a navaid or fix (such as a FIR border). It also contains the route to follow after departure (a SID, direct to a significant point, or a heading/track or radial to follow), including altitude restrictions (although altitude restrictions may be included in the SID, and thus not included in the spoken clearance).These give the pilot a chance of pre-tuning radios and prepare himself and the aircraft so the workload on climb out may be limited. Due to the fact that the pilot is quite busy with the pre startup procedures the controller shall make sure the pilot is ready to copy the ATC clearance before reading it out. It is vital that the clearance is understood correctly so everything in the clearance must be read back before proceeding.

Items marked with (*) below can be excluded in some instances.

<u>The call for clearance from the pilot should include:</u>

1. Who (s)he is *(Exair 131)*
2. Where (s)he is (*Somewhere stand 36/Apron South)*
3. What (s)he is* *(Boeing 737)*.
4. Current ATIS designation, at some airports including QNH *(Information Mike, QNH 993)*
5. What do s(he) want *(Request startup and clearance to Someplace airport)*

The clearance from ATC should include:

1. Clearance limit *(Someplace airport)*
2. Departure route (*Can be a SID/Significant Point/Heading /Track/ Radial) (OCEAN2A departure)*
3. Route* *(Victor 3 transition)*
4. Initial altitude/level *(5000 feet, not needed if this is specified in the SID)*
5. Transponder code (*Squawk) (Squawk 7351)*
6. Departure frequency *(After departure contact 125.35)*

NOTE1: A SID normally includes the published initial altitude and climb constrains as such this information is not usually necessary. However it is often included in the clearances.

NOTE2: mainly in the USA, the clearance also includes the departure frequency, as such a 6th element in the clearance would be.This is also referred to as ***CRAFT****:* ***C*** *(learance): cleared to destination,* ***R****(oute): via SID dep* ***A****(ltitude): climb initially 5000'* ***F****(req): after dep contact xxx.xx* ***T****(ransponder): squawk 7134*

Additional information from the controller:

1. Departure runway* (Runway 19 – not given if it is included in ATIS)
2. Wind* (250 degrees 5 knots – not given where ATIS is available)
3. QNH* (QNH 993 – not given if the pilot has already reported the correct QNH)
4. Temperature* (15 – given to turbine engine aircraft where no ATIS is available)
5. Runway Visual Range* (RVR) for the departure runway (given when reported, where no ATIS is available)
6. Runway conditions (braking action and contamination)* (Braking action good, runway wet – given when reported, where no ATIS is available)

At many smaller airports, where the ATC clearance is transmitted to the pilot by TWR or AFIS, the controller or AFIS officer must obtain the clearance by calling the ACC or APP unit, when the pilot requests start-up. Therefore, at these airports, TWR/AFIS will not be able to transmit the clearance to the pilot on the initial call. Depending on how long time it takes to retrieve the clearance, it will be issued before or during taxi. Naturally, it must be given before take-off.

If you have the time, it might be good to write down the clearance on a piece of paper before you feel that you can give a clearance fluently.

An alias sentence is very valuable in order to issue ATC clearances.

If the pilot calls you before you have been able to make all necessary preparations to give the clearance, you can ask the pilot to wait. It is however important to stress that any call from a pilot should be acknowledged as soon as possible, even though you can't give the clearance straight away. In those instances you can often give some information, such as the QNH and active runway.

XXX131: Somewhere Clearance delivery, Exair 131, Boeing 737, Stand 36 with information Echo. Request start-up and clearance to Someplace."

DEL: Exair 131, Start-up approved, QNH 993. Stand by for clearance.
XXX131: Start-up approved, QNH 993, Exair 131.

A rule of thumb is that you shouldn't read the clearance to the pilot if he hasn't asked for it. If he only asks for push-back, that's what you should give him initially. The actual clearance would then follow in a separate transmission. If you have asked the pilot to wait until you have reviewed his flightplan and made necessary preparations to give him the clearance, you should ask him if he is ready to copy the clearance before you read it to him. In other words, avoid issuing the clearance unless you are certain that the pilot is ready to copy.

DEL: Exair 131, (are you) ready to copy clearance?
XXX131: Ready to copy / Go ahead, Exair 131
DEL: Exair 131, clearance to Someplace via VORING 2 Golf departure, 5000 ft, Squawk 7351
XXX131: Clearance to Someplace via VORING 2 Golf departure, 5000 ft, Squawking 7351, Exair 131"
DEL: Exair 131, read back correct, Contact Ground on 121.95 for pushback
XXX131: Ground on 121.95, Exair 131, Bye

The pilot should read back all elements in the clearance to confirm that he has copied them right. As controller it is hence very important to listen to the read back actively. If the read back is correct, this should be acknowledged and if not, the mistakes should be corrected. If for example the squawk is read back wrongly, you don't have to read the whole clearance one more time. It is enough to correct only the parts that were misunderstood.

4.1.2 Push-back and Start Up [S]

When boarding is completed and all pre-startup procedures are done, the pilot will call for either pushback or startup or both. (whether pushback is required naturally depends on the parking position). At certain airports, apron control (callsign "Apron") is available to handle pushback, start-up and aircraft movements on the aprons. At other airports, Ground approves pushback and start-up, but the actual manoeuvres are supervised by ground mechanics. Before you give push-back approval, make sure that the immediate area around the aircraft is free of any conflicting vehicles or other aircraft. You can also tell the pilot to push-back at own discretion, in which case he has to look out for traffic on his own. It is however better to give clear and precise instructions in order to minimize the risk of crashes.

XXX131: Somewhere Ground, Exair131. Stand 36, request pushback
GND: Exair 131, pushback approved
XXX131: Pushback approved, Exair 131
XXX124: Somewhere Ground, Exair 124, Stand 34, request pushback
GND: Exair 124, hold position, company MD11 pushing from Stand 36"
GND: Exair 124, when free of company MD11 pushing from Stand 36, push back approved

Sometimes ATC may have to delay the start up approval due to congestion on the ground or due to saturation in the area.
GND: ExAir123, Expect Start Up at 1515Z

Or

GND: ExAir123 Expect Departure time at your discretion

4.1.3 Taxi [S]

To allow the ground controller to rely on and use traffic flows on the taxi ways, the pilot should be ready to taxi before requesting taxi clearance. As soon as the taxi clearance is received, the pilot is expected to carry out the taxi instructions as soon as possible to obtain best traffic flow.

The taxi-ways are many and varied and their structure is complex, especially at bigger airports. Taxi-ways are often one-way only in order to avoid situations with two aircraft converging nose to nose – aircraft have no reverse gear. The ultimate embarrassment for a Ground controller occurs when two aircraft taxi on the same taxiway but head on. In these hopefully rare cases the rule of thumb is that each aircraft on the ground should turn to the right to allow sufficient space between the aircraft, prior to continue with taxiing Taxi-ways can be one-way in one direction (say south) when one runway-configuration is in use, and one-way the other way (say north) when another runway-configuration is in use. It is good to have a chart over the published standard taxi-way routes at hand when you are controlling a bigger airport. All Taxiways that you want an aircraft to follow to the Runway or to a gate should be specified by the controller.

If traffic is dense and many planes are taxiing to and from the gates and runway, you have to think one step ahead. You might have given instructions to pilots to hold at certain intersections to let other aircraft pass, or instruct pilots to follow preceding traffic to maintain a safe and smooth flow.

XXX131: Exair 131 request Taxi

GND: Exair 131, behind company DC 9 passing from left to right on Yankee, taxi to holding point runway 19 Right

XXX131: Behind company DC 9, taxi to holding point runway 19 Right, Exair 131

NOTE: In 2005 ICAO as part of a comprehensive effort to improve runway safety, changed the phraseology "TAXI TO HOLDING POSITION" into "TAXI TO HOLDING POINT" in the PANS-ATM, in order to avoid confusion with the non-ICAO phraseology "TAXI INTO POSITION AND HOLD" which continues to be used by some worldwide. As the "holding point" referred to in the revised phraseology is synonymous with "runway holding position" Therefore; when used in radiotelephony phraseology, "runway holding point" refers to "runway holding position".

Whilst Ground is primarily responsible for all traffic movements on the ground and would normally hand over to Tower when the aircraft is holding short of a Runway, an exception occurs at many airports having taxi routes that cross a Runway (even if not active) as in these cases Ground hands over responsibility to Tower at the holding point of the runway to be crossed and Tower from that moment on continues issuing Taxi instructions, except when Ground and Tower coordinate the ground and taxi movement between them in which cases usually Ground will have received prior approval from Tower authorizing Ground to issue Runway crossing instructions to any aircraft on the ground. There are different manners in which Ground or Tower as the case may be can issue Taxi Instructions:

GND "ExAir23 Taxi Via Y and B to holding point B3 runway 22R"

Or

GND "ExAir123 Taxi to Holding Point F1 runway 18"

Or

GND "ExAir123 line up rnway 12 via backtrack, report ready for departure"

Or

GND "ExAir123 Turn (First/Second) taxiway (Left/Right)"

4.2 Airborne [S]

4.2.1 Take-off and Cruise [S]

When the aircraft has reached the holding point and the pilot is ready for departure, it is time to line up. An aircraft is lined up when it is standing on the runway centre-line with the nose pointing in the direction of the active runway. It is allowed to instruct a pilot to line up even though the runway isn't clear – i.e. preceding traffic hasn't vacated the runway.

The only time the word "take-off" is used is when the aircraft is cleared for "take-off". In all other transmissions, the word "departure" should be used. This is very important since a misunderstanding at this stage can be very dangerous.

XXX131: Tower, Exair 131

TWR: Exair131, You are no 2 for departure, in sequence behind the SAAB 340, line up and wait rwy 19 right

XXX131: In sequence behind the SAAB 340, line up and wait rwy 19 Right, Exair 131

The instruction "line up in sequence" means that when the aircraft in front of XXX131 has begun his take-off roll down the runway, XXX131 can line up and wait behind him with no further ATC instructions

TWR: Exair 131, you are no 2 for departure

XXX1465: Tower, Exair 1465 is ready for departure

Next follows the take-off clearance. The runway designation always has to be included in the take-off clearance. Also include the present wind if it is significantly different from the wind reported in the ATIS or previously given to the pilot.

TWR: Exair 131, rwy 19 Right cleared for take off; wind 210 degrees 8 knots.

XXX131: Rwy 19 Right, cleared for take off, Exair 131

Reminder: Wind direction and speed is weather information from the ATC and is not required to read back. (QNH is the exception) As QNH is required information for procedures (TA/TL) it's a directive and not an information. That said, QNH, being a directive, needs the read back. All other information which does not imply directives (as weather information or ANY other information) do not need read back.

4.2.2 Landing and Vacating the Runway [S]

Before you can clear an aircraft to land, you have to make sure the runway is free from all other traffic and that no other aircraft is ahead on final. If this is the case, you will have to instruct the pilot to "continue approach" until you are able to give him clearance to land.

Remember that speed is the best way of separating aircraft on final, but that speed restrictions usually are waived when the aircraft passes over the outer marker, as specified in the AIP for the airport. If the phrase "Callsign only" is included in handover, it means that the pilot should check in to the new controller with his callsign only. No need to make any position report to ATC.

APP: Exair 4321, contact Tower 118.5, callsign only
XXX4321 Tower 118.5, with callsign only, Exair 4321
XXX4321: Somewhere Tower, Exair 4321
TWR: Exair 4321, continue approach, you are no 2, wind 280 degrees 4 knots
XXX4321: Continue approach, number 2, Exair 4321

TWR: Exair 4321, Runway 26, cleared to land

XXX4321: Runway 26, cleared to land, Exair 4321

Note: If there is no big changes in wind speed or direction this information only have to be told by the controller one time and therefore be left out the in the last "cleared to land" phrase in this example.
The word "vacated" is used when we mean that an aircraft has left the runway or "vacated runway". The word "clear" or "cleared" should never be used in this context in order to avoid confusion.

XXX4321: Exair 4321 vacated runway 26
TWR: Exair 4321, roger taxi to stand 36
XXX4321: Taxi to stand 36, Exair 4321

4.2.3 Ending the Flight [S]

When the aircraft has vacated the runway it is time to taxi to the gate or apron. These instructions are covered in the section above (3.1.3). Since aircraft are very different in shape and size, parking stands and gates are designed for different aircraft types and sizes. There may also be different terminals for different airlines and different aprons for different types of traffic (general aviation, cargo, military etc) Study the information for your airport to know where different aircraft should be parked.
Many pilots ask permission to end the flight at gate, or to shut the engine.

XXX4321: At the gate, request closing Flight Plan and leave frequency
TWR: Roger, thanks for Flying to "Somewhere" Have a nice evening. Goodbye

4.3 Clearance Limits [S]

We have mentioned the words Clearance Limit in various contexts above but for good orders sake, in order that both ATC and Pilots know what these words mean The Clearance Limit mainly concern pilots and what actions they are expected to take in the event of communication failure. This is of course especially important in busy periods like a fly-in:
Clearance Limit is the point to which an aircraft has been cleared by a particular ATC. The aircraft is at any time allowed to proceed to that particular point, but not past it.
The Clearance Limit differs, depending on the ATC Position issuing the clearance.

<u>Clearance Limit issued by Delivery:</u>
ExAir123, cleared as filed to LFPG via flight plan route, sq 1122, initial climb 5000ft, Rwy 36C
In the above example, the Clearance Limit is LFPG and forms part of the general clearance.

Clearance Limit issued by Ground:

ExAir123, taxi via Y and A to 22R, hold short of crossing 12/30

In the above example, the Clearance Limit is the Holding Point short of crossing 12/30 where the aircraft HAS to stop and await further instructions.

Clearance Limit issued by Tower:

ExAir123, taxi via Y to Rwy 22R hold short at A3

In the above example the Clearance Limit is the holding point A3, short of runway 22R, the aircraft HAS to stop at A3 and await further instructions.

Or

ExAir123, cleared for takeoff on SORGA1C SID, winds 220 at 20

In the above example the Clearance Limit is the prescribed Max Altitude relevant to the SID being flown and the Limit (in event of a communication failure) is SORGA, the aircraft will climb to and maintain this altitude until cleared to climb further and will need to enter a hold over SORGA is no further instructions are given.

Clearance Limit issued by ACC

ExAir123, Proceed EEL reach EEL at FL110

In the above example the Clearance Limit is EEL, the aircraft has been cleared to EEL VOR at FL110, if the aircraft does not receive further instructions before reaching EEL, the aircraft HAS to enter a standard hold until receiving further instructions. Most pilots like to receive a short cut from ATC if possible, and this usually is done during the cruise by the ACC. The thing to bear in mind here is that you should never clear a pilot to a ”direct” NAVAID or point which falls outside of your AOC.

If however ACC instructs the pilot to proceed “direct EEL” as a short cut, then the pilot is expected to continue according to the flight plan route when reaching EEL

ExAir123, Cleared Direct EEL

Or

ExAir123, Cleared inbound Arlanda via TROSA3M arrival Runway 26

In this example the Clearance is the end of the STAR in this case it would be at TEB (which is the IAF). The pilot can follow the arrival route as prescribed and over TEB unless the approach controller has re-cleared the aircraft further would enter the hold.

In conclusion, unless a follow up clearance is given or a handoff to a new ATC is done, an aircraft will HOLD at the clearance limit. Aircraft’s on the ground will stop and hold for instructions, whilst aircraft’s in the air will enter standard Hold patterns.

4.4 Conditional Clearance [S+]

Conditional clearances, in which the controller issues an instruction that becomes valid after another event has occurred, have been identified as a contributory factor in a significant number of incidents, particularly in relation to clearances issued to aircraft in the vicinity of a runway. It is essential that pilots fully understand the clearance that they have been given and the event that must occur before the clearance is valid. If a pilot is in any doubt whether he or she is cleared to enter or cross a runway, either when the clearance is issued or later, confirmation of the clearance must be sought from ATC.

Common causes of confusion are instructions that relate to a particular aircraft type when there are several aircraft of that type (or a number of aircraft that are similar in appearance, for example A319, A320 and A321) in the area. Similar confusion can result when an instruction relates to an aircraft operated by a specific company when there are several aircraft in that company's livery in the area (this can be a particular problem at an operator's home base).

Conditional clearances will take the form of the aircraft callsign, the event that must occur before the clearance is valid (including the identification of vehicle or other aircraft involved), followed by the clearance/instruction.

ExAir123, After departing A320, line up Runway 01 Right.

Or

ExAir123, Behind the landing B757 on short final, line up behind, Runway 01 Right

If there is any doubt about the identification of the aircraft that is the subject of the condition, pilots must obtain clarification from ATC. Conditional clearances may not be used for movements affecting the active runways except when the aircraft or vehicles concerned are seen by both the controller and pilot. Conditional clearances will normally relate to one movement only and, in the case of landing traffic, this will be the first aircraft on approach.

Sometimes ATC may consider it necessary for an aircraft to take-off without any delay. Therefore, when given the instruction. "cleared for immediate take-off", the pilot is expected to act as follows:

At the holding point: Taxi immediately on to the runway and commence the take off roll without stopping the aircraft.

If already lined up on the runway: to take off without delay.

Exair123, Cleared for immediate take-off Runway 26 Left

Or due to unexpected traffic, or a departing traffic taking longer to take off than anticipated, it is sometimes necessary to cancel the take off clearance or quickly free the runway for landing traffic.

Exair123, Take-off immediately or vacate the runway Or**Exair123, Take-off immediately or hold at the holding point**

Sometimes ATC may need to cancel a take-off clearance even after the pilot has started the take-off roll. In these cases ATC will need to repeat the instructions and ensure the pilot reads-back.

Exair123, Hold position, cancel take-off. I say again, cancel take-off, acknowledge.

5 AIRBORNE

5.1 In the Air [S]

This is the place where aircraft belong – flying. The preparations done by air traffic control and pilots prior to departure aim to enable a safe and smooth journey through the airspace. In general you might say - the better the preparations done prior to departure, the less work for the air traffic controller and pilot en-route.

5.1.1 General [S]

Rules regarding separation follow ICAO document 4444, however in VATSIM these rules vary a bit from country to country especially in relation to reduced separation applied at certain busy airports. It is not in the scope of this guide to give all details regarding separation in all countries in VATSIM, but we will focus on the general rules. Maintaining separation between aircraft is the main task for air traffic control, a task that can be quite difficult and very demanding. Here you will find the rules and some tips on how to maintain good separation in the air. Let's start with the basics – some guidelines and tips that make separation easier.

- Have a clear strategy what you want the pilot to do. Order and contra orders leads to confusion and frustration.
- Consider what implications your instructions have. It's not a good idea to give a pilot clearance to land if you at the moment before gave another pilot instruction to line up on the same runway.
- Talk clearly and not too fast. It may sound "cool" talking fast but it often leads to misunderstanding which makes it slower.
- Use standard phraseology. This reduces the risk of misunderstanding and confusion.
- Listen to the read back carefully as it was the first time the instruction was given. Mistakes happen easily.
- Act immediately if you have a situation with a potential conflict. Don't wait until the conflict is imminent – then it's usually too late.
- Don't take on more than you can manage. Take a position which you feel you manage and ask for help if you need it.

Since VATSIM is a radar environment, radar separation may be used in general. A rule of thumb for separation minima is; **1000ft and 5nm.** There are of course several exceptions to this rule of thumb, but you will manage most situations just fine with it alone.

5.1.2 Vertical Separation [S+]

Minimum vertical separation is:

- **1000ft below FL 410 (RVSM)**
- **2000ft above FL410 (RVSM)**

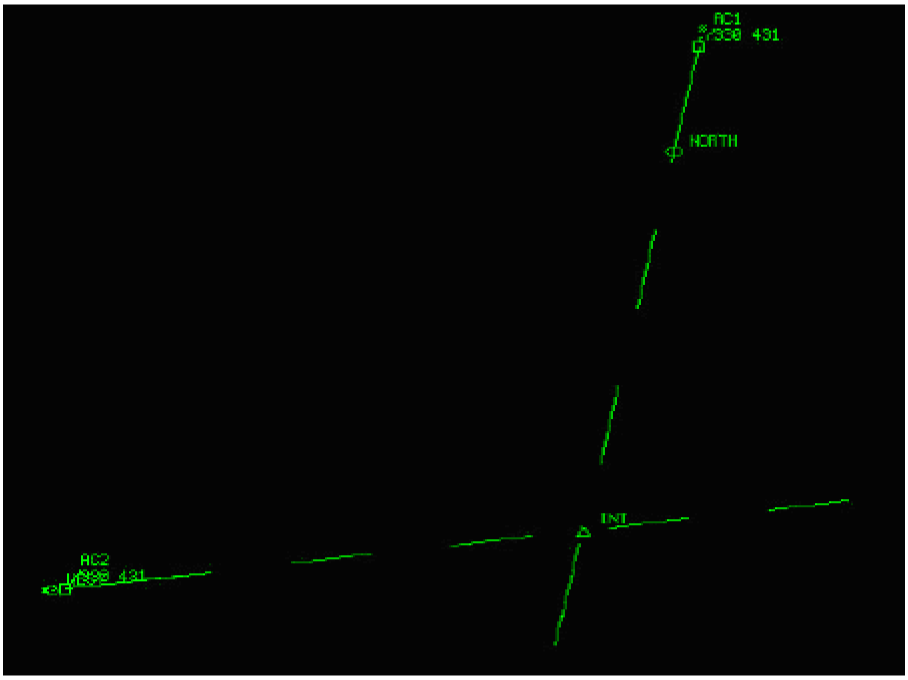
You are allowed to climb or descend an aircraft to a level previously occupied by another aircraft provided that vertical separation is maintained. This is done by observing the transponder echo in mode C. You should check with your local vACC for more information regarding vertical separation in the FIR(s) you will be working in. There are three easy guidelines for maintaining the vertical separation as listed below. There are many ways of achieving the same thing, but some ways interfere more with the flight then others.

- **Use level change rather than turns to maintain vertical separation en route.**
- **Use vertical speed adjustments for descending and climbing aircraft that have conflicting paths en route.**
- **Use turns and speed (IAS) to maintain separation in the approach stage of the flights.**

5.1.3 Horizontal Separation [S+]

There are several ways of maintaining horizontal separation, but as long as aircraft are within radar coverage and use an altitude reporting transponder the following rules apply. There are other conditions not covered here that applies for example when crossing oceans, or when flying in other areas where no radar coverage is available. The basic rule is that there should be 5 nm horizontal separation in all directions. You can therefore imagine a circle around each aircraft with 2.5 nm radius to reach the 5 nm requirement between two tangential circles. There are situations when the 5 nm separation can be overruled. Three easy guidelines for maintaining the horizontal separation are listed below. There are many ways of achieving the same thing, but some ways interfere more with the flight than others.

- **Use turns to maintain horizontal separation for flights en route.**
- **If on crossing routes, turn the slower aircraft behind the faster.**
- **Use turn and speed (IAS) to maintain separation in the approach stage of the flights.**



This is a typical situation: Two aircraft (AC1 and AC2) are flying on two different but intersecting airways using the same flight level. As a controller you have to consider all flights crossing an intersection point at the same flight level as a possible separation conflict. If you do not do anything then after about 3 to 5 minutes there two aircraft will be converging at the same altitude. Hence ATC needs to take action. If either of the aircraft is flying at a FL which is incorrect then the first course of action would be to instruct the aircraft at the wrong altitude to climb or descend as wished by the pilot to the correct FL thereby ensuring the correct minimum vertical separation. If both aircraft however are on a correct, FL then a very often used instruction is to turn one or both of the conflicting aircraft by 15 to 25 degrees away from each other.

ExAir123, turn left by 15 degrees for separation

Once the potential conflict situation has passed the aircraft should be turned back to follow the previously cleared route.

ExAir123, Proceed on Course
Or
ExAir123, Turn right heading…re-cleared direct ABC VOR
Or
ExAir123, Resume Own Navigation direct ABC VOR (*could be misunderstood on VATSIM)*

The main elements to use for successful conflict separation are:

If 2 Aircraft are approaching head on: Then both aircraft should be turned to the RIGHT If 2 aircraft are on the same route and FL then: The slower aircraft should be turned to the RIGHT to allow the faster aircraft to overtake the slower aircraft. If on the other hand ATC turns the faster aircraft, both speeds may become equal and then the conflict would be maintained.

5.2 Departure and SID [S+]

Standard Instrument Departures (SID's) are routes that have been developed in order to have standard routings for IFR departures at controlled airports. These routes provide terrain clearance and usually follow minimum noise routings. They lead all aircraft via headings, tracks, radials or fixes in the required direction onto the airway system. SID's are named after their clearance limit and include a number and a letter. The number shows the version of the SID while the letter usually (depending on the FIR or airport) indicates the runway the SID is suitable for as well as whether it is CNAV or RNAV. IFR departures at larger controlled airports are normally always assigned a SID without exception. At most of the larger airports there are dedicated SID‟s than can only be used for Jets or for Propeller aircraft as the case may be. ATC may at any time route and aircraft off a SID, either by radar vectors or by instructing the pilot to fly direct to a navaid or a fix.

TWR IB123, Standard Departure Route Cancelled, after takeoff, climb to FL110 direct ABC VOR
IB123, Copy Direct to ABC VOR and FL110 once airborne.

In addition to the SID or route clearance issued by DEL, clearances issued by TWR/DEP may specify any or all of the following

- Turn after take-off
- Track to follow before turning on to a desired heading
- Initial cleared altitude or flight level
- Time, point, and/or rate at which changes of level are made

Before an outbound aircraft is transferred to area control any local conflicts must have been resolved or co-ordination effected.

Pilots of all aircraft flying instrument departures are required, on first contact, to inform DEP, APP or CTR as appropriate of their call-sign, SID designator (if appropriate, again this is dependent on the rules in force in certain FIR's), current or passing level and their cleared level. If the SID involves a stepped climb profile then the initial altitude/flight level to which the aircraft is climbing will be given.

5.3 Route [S+]

A route is a description of the path followed by an aircraft when flying between airports. Most commercial flights will travel from one airport to another, but private aircraft, commercial sightseeing tours, and military aircraft may often do a circular or out-and-back trip and land at the same airport from which they took off.

5.3.1 Route Components [S+]

Worldwide, there are a large number of named official airways, along which aircraft fly under the direction of ATC. An airway has no physical existence, but can be thought of as a 'motorway' in the sky. On an ordinary motorway, cars use different lanes to avoid collisions. While on an airway, aircraft fly at different flight levels to avoid collisions. Charts showing airways are published by various suppliers and are usually updated once a month coinciding with the AIRAC cycle. AIRAC (Aeronautical Information Regulation and Control) occurs every fourth Thursday when every country publishes their changes, which are usually to airways.

Each airway starts and finishes at a waypoint, and may contain some intermediate waypoints as well. Airways may cross or join at a waypoint, so an aircraft can change from one airway to another at such points. A complete route between airports often uses several airways. Where there is no suitable airway between two waypoints, and using airways would result in a somewhat roundabout route, ATC may allow a direct waypoint to waypoint routing which does not use an airway (in flight plans abbreviated as 'DCT').

Most waypoints are classified as compulsory reporting points, i.e. the pilot (or the onboard flight management system) reports the aircraft position to air traffic control as the aircraft passes a waypoint. There are two main types of waypoints:

- **A named waypoint** appears on aviation charts with a known latitude and longitude. Such waypoints over land often have an associated radio beacon so that pilots can more easily check where they are. Useful named waypoints are always on one or more airways.
- **A geographic waypoint** is a temporary position used in a flight plan, usually in an area where there are no named waypoints, e.g. most oceans in the southern hemisphere. Air traffic control requires that geographic waypoints have latitudes and longitudes which are a whole number of degrees.

Note that airways do not connect directly to airports.

- After take-off an aircraft follows a Departure Procedure (SID or Standard Instrument Departure) which defines a pathway from an airport runway to a waypoint on an airway, so that an aircraft can join the airway system in a controlled manner. Most of the climb portion of a flight will take place on the SID.
- Before landing an aircraft follows an Arrival Procedure (STAR or Standard

Terminal Arrival Route) which defines a pathway from a waypoint on an airway to an IAF, so that aircraft can leave the airway system in a controlled manner. Much of the descent portion of a flight will take place on a STAR.

Special routes known as ocean tracks are used across some oceans, mainly in the northern hemisphere to increase traffic capacity on busy routes. Unlike ordinary airways which change infrequently, ocean tracks change twice a day, so as to take advantage of any favourable winds. Flights going with the jet stream may be an hour shorter than those going against it. Ocean tracks often start and finish perhaps a hundred miles offshore at named waypoints to which a number of airways connect. Tracks across northern oceans are suitable for east-west or west-east flights, which constitute the bulk of the traffic in these areas.

5.3.2 Complete Routes [C]

There are a number of ways of constructing a route. All scenarios using airways use SIDs and STARs for departure and arrival. Any mention of airways might include a very small number of 'direct' segments to allow for situations when there are no convenient airway junctions. In some cases political considerations may influence the choice of route (e.g. aircraft from one country can't overfly some other country).

- Airway(s) from origin to destination. Most flights over land fall into this category.
- Airway(s) from origin to an ocean edge, then an ocean track, then airway(s) from ocean edge to destination. Most flights over northern oceans fall into this category.
- Airway(s) from origin to an ocean edge, then a free-flight area across an ocean, then airway(s) from ocean edge to destination. Most flights over southern oceans fall into this category
- Free-flight area from origin to destination. This is a relatively uncommon situation for commercial flights.

Even in a free-flight area, air traffic control still requires a position report about once an hour. Flight planning systems organise this by inserting geographic waypoints at suitable intervals. For a jet aircraft these intervals are 10 degrees of longitude for east-bound or west-bound flights and 5 degrees of latitude for north-bound or south-bound flights. In free-flight areas commercial aircraft normally follow a least-time-track so as to use as little time and fuel as possible. A great circle route would have the shortest ground distance, but is unlikely to have the shortest air-distance, due to the effect of head or tail winds. A flight planning system may have to do quite a lot of analysis in order to determine a good free-flight route.

Aircraft routing types used in flight planning are: Airway, Navaid and Direct. A route may be composed of segments of different routing type. For example, a route from Chicago to Rome may include Airway routing over the U.S. and Europe, but Direct routing over the Atlantic Ocean.

Airway routing occurs along pre-defined pathways called Airways. Airways can be thought of as three-dimensional highways for aircraft. In most land areas of the world, aircraft are required to fly airways between the departure and destination airports. The rules governing airway routing cover altitude, airspeed, and requirements for entering and leaving the airway Most airways are eight nautical miles wide, and the airway flight levels keep aircraft separated by at least 1000 vertical feet from aircraft on the flight level above and below. Airways usually intersect at Navaids, which designate the allowed points for changing from

one airway to another. The airway structure is divided into high and low altitudes.
As by definition an airway is a control area or portion thereof established in the form of a corridor. Airways normally lead from one navigation aid to another, so from a VOR station to another VOR, but also NDB stations are included in the airway system, as well as five letter code Intersections.

Two airways intersecting each other mark a so-called intersection. Airways may be suitable for both directions, called two-way airways, but there are also airways only suitable for one direction. These airways are called one way airways.

Airway Names Every airway has its own name, which normally consists of one or more letters and one or more numbers. Often when calling an airway the phonetic alphabet is not used, instead "colored" designations are used. **A - Amber, B - Blue, G -Green, W - White, R - Red and V - Victor** are the most common names for airways. The prefix U means, that the airway is only suitable for the upper airspace.

The same route may be followed by airways in different airspace (lower of upper/higher). The difference usually is the U in their designator for the upper/high airways.

Navaid routing occurs between Navaids which are not always connected by airways. Navaid routing is typically only allowed in the continental U.S. If a flight plan specifies Navaid routing between two Navaids which are connected via an airway, the rules for that particular airway must be followed as if the aircraft was flying Airway routing between those two Navaids. Allowable altitudes are covered in Flight Levels.

Direct routing occurs when one or both of the route segment endpoints are at a latitude/longitude which is not located at an airway. Some flight planning organizations specify that checkpoints generated for a Direct route be a limited distance apart, or limited by time to fly between the checkpoints (i.e., Direct checkpoints could be farther apart for a fast aircraft than for a slow one).

5.3.3 Airways- Flight Levels and Direction of Flight [C]

The enroute charts can usually be found in the official webs of aeronautical administrations under the AIP Section and ENR tab. There you will find the charts under tab ENR 6 and the detailed information on direction of flight and flight levels under tab ENR 3 if not depicted in the chart itself.

The edition of enroute charts may vary depending on the state and the symbols may also vary accordingly. You will always find a legend where everything is explained.

The one-way airways usually have an arrowed box in the route pointing towards the correct direction with its designator in that box and two-way airways usually have their designator in a square box without arrow.

The direction of flight is usually depicted together with the correct flight level (even or odd). The direction of flight is usually depicted as a thin arrow or a symbol. The flight levels may be depicted with the letter E for EVEN flight levels or an O for the ODD ones. Other editors use A or B to indicate the correct flight levels. In any case, the legend of the chart provides all information. In some cases, like for the Spanish enroute charts, no indications on directions or flight levels are indicated. In such situation, the ENR 3 documents (ATS routes) give the direction and levels of flight for any airway.

At (http://www.eurocontrol.int/ead/public/subsite_homepage/homepage.html) you can access the public area where charts (aerodrome and enroute) for the European states can be found and also for many other non EU countries. You should access the BASIC EAD site and register for free to gain full access.

Before the enroute charts were available for the simulation community, it was usual to follow the "semi-circular" rule for flight levels. This rule said to use EVEN flight levels for westbound flights and ODD flight levels for eastbound flights. This rule is partially used in the USA but should not be used in Europe as long as enroute charts are available.

5.4 STAR and Arrival [S+]

STAR's or Standard Terminal Arrival Routes exist to lead all IFR traffic from the airway system to the IAFs (Initial Approach Fixes) of an airport. They are named after the waypoint they are starting with and also include a number showing the version the STAR is valid for as well as whether it is CNAV or RNAV. For all instrument approaches the following information is to be passed to the pilot unless it has already been passed and acknowledged:

- Type of Approach
- Runway to which the approach will be made
- Runway for landing if different

QNH should only be passed to the pilot by ATC (normally APP) once the Pilot has been instructed to descend below the Transition Level

The initial assigned level to arriving IFR aircraft should normally not be below the appropriate minimum sector altitude or, if this is not known, the highest minimum sector altitude. If a pilot is flying at, or has requested, a lower level then a reminder of the highest sector altitude should be issued.

At aerodromes where radar procedures are in force CTR will negotiate with APP a cleared level for arriving IFR flights and then subsequently transfer control and communications simultaneously when clear of other CTR traffic. Radar procedures are assumed to be in force at all aerodromes in VATSIM. At busy airports, when holding procedures are in effect, coordination and transfer of control will be effected in accordance with local agreements.

CTR will clear arriving aircraft to the holding facility if the flight is remaining within its airspace and will give instructions to hold if necessary unless prior agreement has been reached between CTR and APP that the aircraft will not be required to hold in which case the aircraft may be placed on a radar heading towards the initial approach area by CTR.

APP may issue any instructions to an aircraft released to it by CTR, however such aircraft should not be instructed to climb above, or stop descending above the level at the holding facility agreed with CTR without prior coordination with CTR.
If an arriving aircraft makes its first call to APP not having been handed over from

a CTR unit (can happen in VATSIM that no CTR controller is on line in the FIR) the following information shall be passed as soon as practicable:

- Runway in use
- Current meteorological information, which should include the surface wind direction and current visibility
- Aerodrome QNH

Even if visual reference to the ground is established before completion of the approach procedure, pilots will normally complete the whole procedure. At the pilot's request however, the flight may be cleared to break off the instrument procedure and carry out a visual approach.

To expedite traffic at any time, an IFR flight may be authorized to execute a visual approach if the pilot reports that he has the airfield or preceding traffic in sight and can maintain visual reference to the surface.
Standard Separation shall be effected between such aircraft and other IFR and/or SVFR aircraft notwithstanding that the flight is now operating by visual reference to the surface.

Where radar vectoring is in use, then the ATC shall vector the aircraft in such a way to achieve the minimum overall delay to arriving flights. On occasions this may necessitate altering the arrival order of inbound aircraft.

5.5 Approaches [S]

The Approach Controller main task is to separate arriving traffic in order to maintain an optimum flow of traffic into any given field by means of giving course, altitude and if needed speed restriction instructions to pilots.

In VATSIM, pilots most often request and ATCs most often give ILS approaches regardless of time, weather conditions, or type of aircraft. There are however more types of approach types than only ILS.

So, the aircrafts are now well on their way in to the field, they have followed the STAR and the Approach or Director Controller now has to vector the aircraft in towards the field for a safe and orderly handoff to the Tower Controller for a safe landing.

5.5.1 General Principles [S]

The most challenging and work intensive part of any flight is the landing phase, as the saying goes a good landing is a controlled crash at the best of times. But before an aircraft actually lands it has to Approach a field.

Approaches are classified as either **precision** or **non-precision**, depending on the accuracy and capabilities of the navigational aids (navaids) used. Precision approaches utilize both lateral (course) and vertical (glide-slope) information. Non-precision approaches provide course or glide-slope information only.

An instrument approach or instrument approach procedure (IAP) is a type of air navigation that allows pilots to land an aircraft in reduced visibility (known as instrument meteorological conditions or IMC), or to reach visual conditions permitting a normal landing.

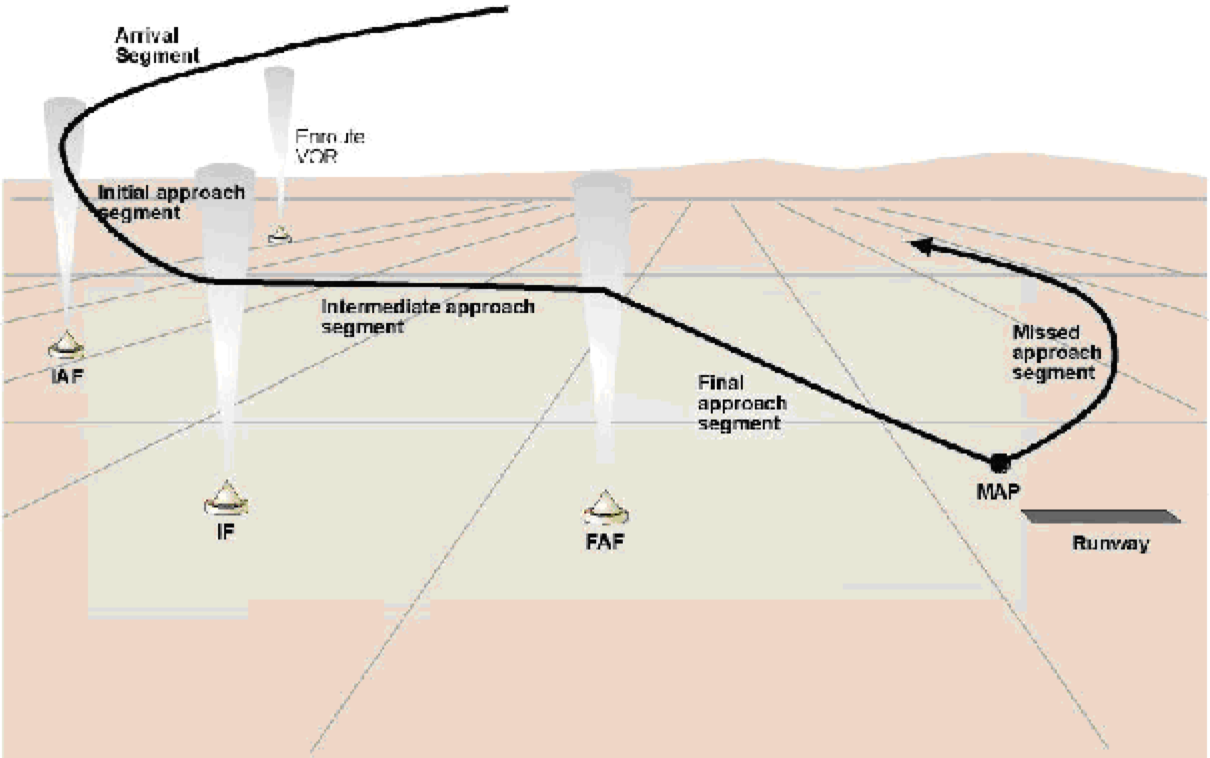
Charts depicting instrument approach procedures are called Terminal Procedures, but are commonly referred to by pilots as "approach plates." These documents graphically depict the specific procedure to be followed by a pilot for a particular type of approach to a given runway. They depict prescribed altitudes and headings to be flown, as well as obstacles, terrain, and potentially conflicting airspace. In addition, they also list missed approach procedures and commonly-used radio frequencies.

The whole of the approach is defined and published in this way so that aircraft can land if they suffer from radio failure; it also allows instrument approaches to be made procedurally at airports where air traffic control does not use radar or in the case of radar failure.

5.5.2 Instrument Approaches [S+]

This kind of approach being the most common in VATSIM in general is made up of 5 distinct phases (segments) of flight:

1. Arrival: where the pilot navigates to the **Initial Approach Fix (IAF)**
2. Initial Approach: the phase of flight after the IAF, where the pilot commences the navigation of the aircraft to the **Final Approach Fix (FAF)**, a position aligned with the runway, from where a safe controlled descent back towards the airport can be initiated.
3. Intermediate Approach segment: an additional phase in more complex approaches that may be required to navigate to the FAF. This segment begins at the **Intermediate Fix (IF)**
4. Final Approach: between 4 and 12 nm‟s (Generally 10 miles final) of straight flight descending at a set rate (usually an angle of between 2.5 and 6 degrees).
5. **Missed Approach**: an optional phase; should the required visual reference for landing or landing clearance not have been obtained at the end of the final approach, this allows the pilot to climb the aircraft to a safe level and navigate to a position to hold and from where another approach can be commenced.



ATC may replace some or all (with the exception of the **FAF**) of these phases of the approach with radar vectors to the final approach, to allow traffic levels to be increased over those of which a fully procedural approach is capable. It is very common for ATC to vector aircraft to the final approach aid, e.g. the ILS, which is then used for the final approach. If traffic allows it or indeed if it becomes necessary then ATC can issue specific constraints on the approaching traffic:

ExAir123 Make Short Approach Runway 12

or

ExAir123 Make Long Approach Runway 07

or

ExAir123 Extend Downwind Leg Runway 10 due to traffic on final

5.5.3 Precision Approaches [S+]

There are quite a few different systems in use, the main thing they all have in common is the Decision Height which is a specified height in the precision approach at which a missed approach must be initiated if the required visual reference to continue the approach has not been acquired. This altitude specified allows the pilot sufficient time to safely re-configure the aircraft to climb and execute the missed approach procedures while avoiding terrain and obstacles.
The following is a brief explanation of the different ILS approach types: some you may have heard about, some not, some are in use others in development. The certain thing is that technology and above all GPS will have a major impact in years to come.

Precision Approaches provides pilots both horizontal (Localizer) and vertical (Glide Path) information and is conducted by the use of an ILS (Instrument Landing System), a MLS (Microwave Landing System) a PAR (Precision Approach Radar) or any of the other rather "exotic" systems described bellow. ILS - Instrument Landing System (see Section 5.7 bellow)

MLS - Microwave Landing System The Microwave Landing System (MLS) is an all- weather, precision landing system originally intended to replace or supplement the Instrument Landing System (ILS). MLS has a number of operational advantages, including a wide selection of channels to avoid interference with other nearby airports, excellent performance in all weather, and a small "footprint" at the airports. Although some MLS systems became operational in the 1990s, the widespread deployment initially envisioned by its designers never came to be. GPS-based systems, notably WAAS, allowed the same level of positioning detail with no equipment needed at the airport. GPS/WAAS dramatically lowers the cost of implementing precision landing approaches, and since its introduction most existing MLS systems in North America have been turned off.

MLS continues to be of some interest in Europe, where concerns over the availability of GPS continue to be an issue. A widespread installation in England is currently underway, which included installing MLS receivers on most British Airways aircraft, but the continued deployment of the system is in doubt.

PAR - Precision Approach Radar (Military) is a type of radar guidance system designed to provide lateral and vertical guidance to a pilot for landing up to the missed approach point. Controllers monitoring the PAR displays observe each aircraft's position and issue instructions to the pilot that keep the aircraft on course. It is similar to an Instrument Landing System (ILS) but requires control instructions. Precision Approach Radars are heavily used by Military Air Traffic Control Facilities. Most of these facilities use the FPN-63 Precision Approach Radar. This Radar can provide precision guidance to a distance of 20 miles in normal mode and 15 miles in MTI mode.

GPS (with vertical navigation via WAAS or EGNOS) The Global Positioning System, usually called GPS, is the only fully-functional satellite navigation system. A constellation of more than two dozen GPS satellites broadcasts precise timing signals by radio to GPS receivers, allowing them to accurately determine their location (longitude, latitude, and altitude) in any weather, day or night, anywhere on Earth. The European Geostationary Navigation Overlay Service **(EGNOS)** is a satellite navigation system under development by the European Space Agency, the European Commission and EUROCONTROL. It is intended to supplement the GPS systems by reporting on the reliability and accuracy of the signals. According to specifications, horizontal position accuracy should be better than 7 meter. In practice, the horizontal position accuracy is at the meter level. It will consist of three geostationary satellites and a network of ground stations and was intended to be operational in June 2005, but due to delays the date has been pushed back to the first quarter of 2006. It is planned as a precursor to the Galileo positioning system. A similar service is provided in America by the Wide Area Augmentation System **(WAAS)** system

LAAS - Ground Based Augmentation System (GBAS) for Global Satellite Navigation Systems (GNSS) is an all-weather landing system based on real-time differential correction of the GPS signal. Local reference receivers send data to a central location at the airport. This data is used to formulate a correction message, which is then transmitted to users via a VHF data link. A receiver on an aircraft uses this information to correct GPS signals, which then provides a standard ILS-style display to use while flying a precision approach.

JPALS - Joint Precision Approach and Landing System (military) is a all-weather landing system based on real-time differential correction of the GPS signal, augmented with a local area correction message, and transmitted to the user via secure means. The onboard receiver compares the current GPS-derived position with the local correction signal, deriving a highly-accurate three-dimensional position capable of being used for all-weather approaches via an ILS-style display. While JPALS is similar to LAAS but intended primarily for use by the military, some elements of JPALS may eventually see their way into civilian use to help protect high-value civilian operations against unauthorized signal alteration.

Further Precision aids are the **PAPI** or precision approach path indicator which is a system consisting of four light units situated on the left side of the runway (or on both sides of the runway, in the case of a military field) in the form of a wing bar.The aircraft is on slope if the two units nearest the runway show red and the two units furthest from the runway show white, too high if all units show white, and too low if all units show red.

Bear in mind though that VATSIM and Flight Simulator constraints only make it possible to simulate the ILS precision approach.

5.5.4 Non Precision Approaches [S+]

These kind of approaches have a minimum descent altitude in common, the (MDA) this is the equivalent of the DA/DH for non-precision approaches, however there are some significant differences. It is the level below which a pilot making such an approach must not descend his or her aircraft unless the required visual reference to continue the approach has been established. The significant difference compared to a DA is that a missed approach need not be initiated once the aircraft has descended to this level: in non-precision approaches the point at which a missed approach must be initiated is defined as a separate point known as the missed approach point (MAP). Thus, in non-precision approaches, a pilot may descend to the minimum descent altitude and, having not gained visual reference, fly level at the MDA attempting to gain visual reference until the MAP is reached, at which point a missed approach must be initiated if the required visual reference to continue the approach has not been obtained.

If a runway has both precision and non-precision approaches defined, the MDA of the non- precision approach is almost always greater than the DA of the precision approach, due to the lack of vertical guidance of the non-precision approach: the actual difference will also depend on the accuracy of the navaid upon which the approach is based, with ADF approaches tending to have the highest MDAs.
Typical Non Precision approaches are those conducted with the aid of a VOR, VORDME a NDB, and of course a visual approach. Where by the obstacle assessment in the final segment is based on minimum descent altitude (MDA). The Plane is then flown in level flight at the MDA whilst the pilot attempts a visual identification of the airfield. If the runway or airport is not visible by the time the plane reaches the Missed Approach Point (MAP) then the approach has to be aborted and another attempt made from the beginning When performing a non-precision approach, the pilot shall be given a position report together with handoff to Tower.
ExAir123, you are 15 miles from touchdown, a bit right of extended centerline.

Contact Tower on….

or

ExAir123, you are 10 miles from touchdown, about half a mile east of extended centerline, contact Tower on ………

5.5.5 Straight In Approach [S+]

An approach where the track of the instrument approach procedure is aligned to within 15 degrees of the runway heading, therefore allowing aircraft to land easily after making the approach.

ExAir123 Cleared for the approach, proceed direct to the FAF to cross at 3000 feet report Established

Or

EXAir123 Make Straight-In Approach for Runway 25R turn to heading 240, cleared for the approach

5.5.6 Circling Approach [S+]

A circling approach is an instrument approach to a runway which is not aligned to within 15 degrees of the track of the instrument approach procedure, and therefore requires some visual maneuvering of the aircraft in the vicinity of the airport after the instrument portion of the approach is completed for the aircraft to become aligned with the runway to land.

ATC must ensure the pilot does not descend below the Minimum Descent Altitude until in a position from which a descent to a landing on the intended runway can be made at a normal rate of descent using normal maneuvers. The following basic rules apply:

1. The pilot will maneuver the shortest path to the base or downwind leg, as appropriate, considering existing weather conditions. There is no restriction from passing over the airport or other runways.
2. Circling maneuvers may be made while VFR or IFR traffic is in progress at the airport. Standard left turns or specific instruction from the controller for maneuverings must be considered when circling to land.
3. At airports without a control tower, it may be desirable to fly over the airport to observe wind and turn indicators and other traffic which may be on the runway or flying in the vicinity of the airport.

ExAir123 Make Circling Approach, left turn to Runway 19

Or

ExAir123 Cleared for ILS approach runway 14 followed by visual circle to land runway 32

5.5.7 ARC Approach [S+]

On an ARC approach the pilot maintains a certain predetermined distance from a Navaid. This means that the pilot will fly an arc (semi-circle) around the Navaid. When the pilot is approaching the FAF he turns towards the centerline and continues the final approach using the appropriate kind of final approach as available at the airfield.

ExAir123 Cleared for ARC Approach Runway 36 maintain 15 DME, ABC VOR report final

5.5.8 Visual Approach [S+]

An IFR flight may be cleared to execute a visual approach provided that the pilot can maintain visual reference to the terrain and the visual approach is coordinated with aerodrome control. Separation has to be maintained (during daytime, and it is possible to delegate the obligation to maintain separation to the Pilot). The weather must be good enough and the reported ceiling has to be at or above the initial approach altitude. The clearance for a visual approach during radar vectors shall only be issued after the pilot has reported the aerodrome "field in sight" or the preceding aircraft in sight.

The visual approach is the shortest and most efficient approach considering fuel consumption and time

ExAir123, request vectors for visual approach.
ExAir123, roger, field at your 4 o'clock, turn left heading 160 degrees, report field in sight.

ExAir123 field in sight.
ExAir123, roger, cleared left (right) hand visual (or Straight In) visual runway 33 contact Tower.

5.5.9 Full Procedure Approach [S+]

A full procedure approach is performed by first flying towards a navaid at the airfield called the initial approach fix.
The pilot then navigates according to the approach plate procedure and will make all the required turns without any further ATC instructions and will report once established on final approach.
This is also the kind of procedure that would be used in the event of a radio communication failure as described in chapter 8.

A full procedure approach is something which can come in quite handy for Center Controllers being responsible for multiple fields on their own, which due to traffic concentration in a particular field are unable to give accurate vectors at secondary fields.

Example: CTR controller for Madrid has traffic inbound also in Malaga

ExAir123 Cleared inbound LEMG runway 13 full procedure Approach report on final.

5.5.10 Further Reading [S+]

http://www.centennialofflight.gov/essay/Government_Role/landing_nav/POL14.htm

5.6 Airfield Traffic Pattern

5.6.1 Aerodrome Traffic Circuit [S+]

An Aerodrome Traffic Circuit is a standard path followed by aircraft when taking off or landing.

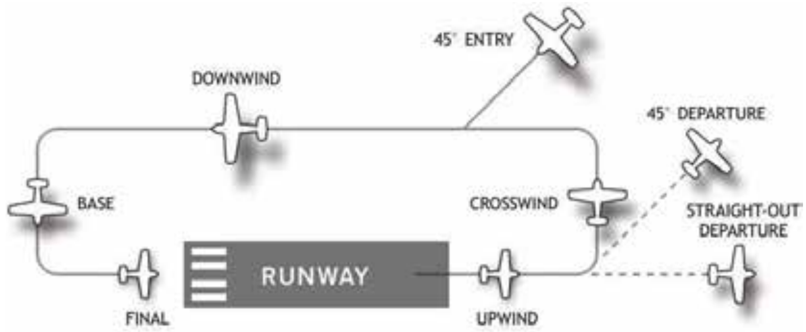
At an airport, the pattern also known as a circuit is a conventional standard path for coordinating air traffic. It differs from so-called "straight in approaches" and "direct climb outs" in that aircraft using a traffic pattern remain in close proximity to the

airport. Patterns are usually employed at small general aviation airfields and military airbases. Most large airports avoid the system, unless there is GA activity as well as commercial flights. However, a pattern of sorts is used at airports in some cases, such as when an aircraft is required to go around.
The use of a pattern at airfields is for air safety. Rather than have aircraft flying around the field in a haphazard fashion, by using a pattern pilots will know from where to expect other air traffic, and be able to see it and avoid it. GA pilots flying under VFR will not be separated by air traffic control, and so the pattern is a vital way to keep things in order.

5.6.2 Wind Direction [S+]
All aircraft prefer to take off or land facing into the wind. This has the effect of reducing their speed over ground and hence reducing the distance required to perform either maneuver, but mainly to keep lift with reduced engine power.
Many airfields have runways facing a variety of directions. A common scenario is to have two runways arranged at or close to 90 degrees to one another, so that aircraft can always find a suitable runway. Almost all runways are reversible, and aircraft use whichever runway in whichever direction is best suited to the wind. In light and variable wind conditions, the direction of the runway in use might change several times during the day.
However, it is not always necessary or possible to use the runway that is best aligned with the wind. Depending on the length of the runway headwinds up to 10kts can be accepted. It's for example better to take a runway with CAT II ILS with a bit of headwind in case of low visibility than to take the runway that has no headwind but just CAT I ILS.

5.6.3 Layout [S+]
Traffic patterns can be defined as left-hand or right-hand, according to the turn direction in the pattern. They are usually left-hand because most small airplanes are piloted from the left seat (or the senior pilot or pilot in command sits in the left seat), and so the pilot has better visibility out the left window. Right-hand patterns will be set up for parallel runways, for noise abatement or because of ground features (such as terrain, towers, etc.). Helicopters are encouraged, but not required, to use an opposite pattern from fixed wing traffic due to their slower speed and greater maneuverability. Because the active runway is chosen to meet the wind at the nearest angle (upwind), the circuit orientation also depends on wind direction. Patterns are typically rectangular in basic shape, and include the runway along one long side of the rectangle. Each leg of the pattern has a particular name:

- The section extending from the runway ahead is called the **climb out** or **upwind** leg.
- The first short side is called the **crosswind** leg.
- The long side parallel to the runway but flown in the opposite direction is called the **downwind** leg.
- The short side ahead of the runway is called the **base** leg.
- The section from the end of base leg to the start of the runway is called the **final approach** or **finals**.
- The area of the airfield adjacent to the runway but opposite the circuit is known as the dead side.



While many airfields operate a completely standard pattern, in other cases it will be modified according to need. For example, military airfields often dispense with the crosswind and base legs, but rather fly these as circular arcs directly joining the upwind and downwind sections. An aircraft taking off will usually be expected to follow the circuit in use, and one arriving at the field to land will be expected to join the circuit in an orderly fashion before landing. This is often accomplished using an overhead join or by entering the downwind leg at a 45 degree angle abeam midfield traffic permitting. Aircraft are expected to join and leave the circuit in an orderly and safe manner. Sometimes this will be at the discretion of the pilot, while at other times the pilot will be directed by air traffic control.

OY-DH Join Downwind for runway 15, winds 140 at 10kts, number 1 for landing

There is also a procedure known as an orbit which is where an aircraft flies a 360 loop either clockwise or anticlockwise. This is usually for separation with other circuit traffic, and can be the result of a controller‟s instruction, else the pilot will report:

OY-DH making 1 left-hand orbit, will advise complete

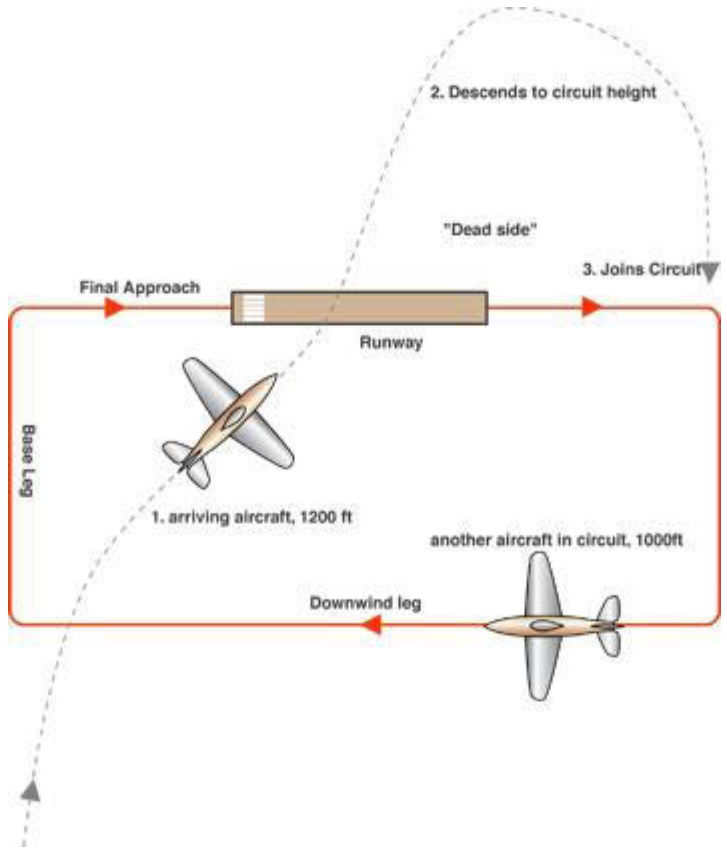
5.6.4 Overhead Join [S+]

This is a conventional method for an aircraft to integrate with the air traffic pattern near an airfield, join the circuit and land.

Aircraft may arrive at the landing site from any direction, so a safe means of integrating into existing traffic and aligning with the runway is required. The overhead join is the standard method used predominantly in the UK but also in a number of other countries, at smaller airports by general aviation aircraft flying under the Visual Flight Rules.

Prior to arrival, the pilot will liaise with air traffic control over the radio to establish the runway in use, the circuit height and direction (left or right hand), and the QFE of the field.

This information is verified by the approaching pilot by over flying the airfield and ascertaining the wind direction (from looking at a wind sock). This involves piloting the aircraft so that it is flying against the direction of the runway but usually at 2000 feet above ground level (AGL). The pilot flies over the runway, looking out for other traffic in the circuit, and descends to circuit height (usually 1000 feet AGL) on the dead side (opposite that of the circuit). He can then safely position himself in the circuit behind or between other traffic without conflicting, and land in turn.



5.6.5 Contra Rotating Pattern [S+]

In cases where two or more parallel runways are in operation concurrently, the aircraft operating on the outermost runways are required to perform their patterns in a direction which will not conflict with the other runways. Thus, one runway may be operating with a left-hand pattern direction, and the other one will be operating with a right-hand pattern direction. This allows aircraft to maintain maximum separation during their patterns; however it is important that the aircraft do not stray past the centerline of the runway when joining the final leg, so as to avoid potential collisions. If 3 or more parallel runways exist, then the middle runway(s) can, for obvious reasons, only be used when either a straight in approach is used or when the aircraft joins the pattern from a very wide base leg.

5.6.6 Altitude [S+]

An airfield will define a circuit height or pattern altitude, that is, a nominal altitude above the field (QFE) at which pilots are required to fly while in the circuit. Unless otherwise specified, the standard pattern height is 1000 ft above ground level, although many small airports operate with a pattern height of 800 feet above ground level. Helicopters usually fly their pattern at 500 feet above ground level.

5.6.7 Helicopters [S+]

Helicopters also prefer to land facing the wind and are often asked to fly a pattern on arrival or departure. Many airfields operate a special pattern for helicopters to take account of their low airspeed. This is usually a mirror image of the fixed-wing pattern, and often at a slightly lower standard height above surface level; as noted above this altitude is usually 500 feet above ground level.

5.7 ILS System [S+]

The most common Approach used in VATSIM. As ATC you will usually vector aircraft in on an intercept course between 20 and 30 degrees offset from the runway heading in order for the aircraft to be established on the localizer in general 10 miles from the touch down zone.

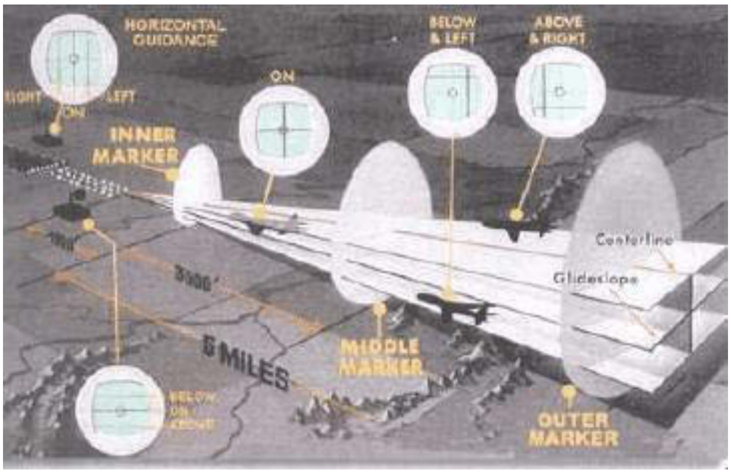
ExAir123, turn right heading 190, cleared ILS runway 22L.

5.7.1 Course and Glide Slope [S+]

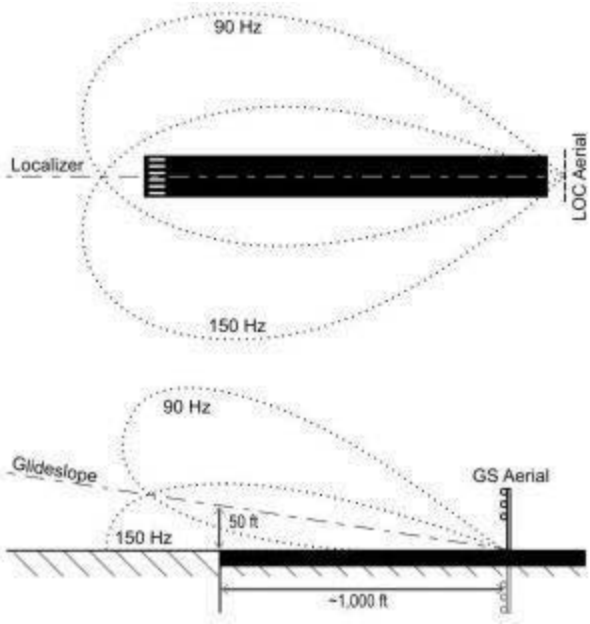
The Instrument Landing System (ILS) is a landing navigation system that is used only within a short distance from the airport. Its purpose is to help the pilot land the airplane. Historically is was generally used only when visibility is limited and the pilot cannot see the airport and runway. Now a days it is used in both fiar and bad weather, and most commercial aircraft use ILS for the vast majority of landings.

The system, which is ground-based, broadcasts very precise directional signals. These signals provide a lateral and vertical path to the runway to a distance of 18 nautical miles from the runway.
Equipment on board the plane that allows the pilot to use the ILS consists of a glide slope and Localizer and a marker-beacon receiver. They show the pilot whether the airplane is to the right or left of the centerline and whether it is above or below the glide slope. The marker beacon receiver has a light display that shows when the plane passes over each marker beacon. As the plane crosses each marker beacon, the radio speaker can also broadcast a tone if the pilot has turned on this feature.

The pilot has to fly within range of the ILS in order to use it. When the pilot is approaching an airport, ATC directs the pilot to where the plane will be in range of the ILS. The pilot also tunes his navigational receivers to the ILS frequency.



An ILS consists of two independent sub-systems, one providing lateral (course line) guidance, and the other vertical (glide slope) guidance to aircraft approaching a runway.



Normally approaching aircraft will be flying at an altitude which places them at an altitude between 3000 feet and 4000 feet to pick up the glide-slope. At times it is possible that due to temporary restrictions an aircraft may be coming in higher than normal in these cases the approach clearance needs to include the advise to the pilot that he can follow the glide or not to follow the glide as the case may be.

ExAir123, turn left heading 090, cleared ILS runway 12 Descend on the glide.

Or

ExAir123, turn left heading 090, cleared ILS runway 12, maintain 3000 feet until 5 nm from the runway.

Modern localizer antennas are highly directional. However, usage of older, less directional antennas allows a runway to have a non-precision approach called a localizer back course. This lets aircraft land using the signal transmitted from the back of the localizer array. This signal is reverse sensing so a pilot would have to fly opposite the needle indication. Highly directional antennas do not provide a sufficient signal to support a back-course. Back-course approaches are commonly associated with Category I systems at smaller airports, that do not have an ILS on both ends of the primary runway.

5.7.2 Marker Beacons [S+]

On some installations marker beacons operating at a carrier frequency of 75 MHz are provided. When the transmission from a marker beacon is received it activates an indicator on the pilot's instrument panel and the modulating tone of the beacon is audible to the pilot. The height at which these signals will be received in an aircraft on the correct glide slope is published.

The marker beacons are directed upward within a relatively narrow space. These beacons serve as checkpoints to tell the pilot the airplane's position. Some systems use three marker beacons-an outer, middle, and inner-while others use only an outer and middle beacon. These marker beacons tell the pilot that he has reached an important place along the approach path. For instance, it might tell the pilot that the plane's landing gear should be lowered.

- The outer marker should be located 7.2 km (3.9 NM) from the threshold except that, where this distance is not practicable, the outer marker may be located between 6.5 and 11.1 km (3.5 and 6 NM) from the threshold. The modulation is two dashes per second of a 400 Hz tone, the indicator is blue. The purpose of this beacon is to provide height, distance and equipment functioning checks to aircraft on intermediate and final approach.
- The middle marker should be located so as to indicate, in low visibility conditions, that visual contact with the runway is imminent, Ideally at a distance of 1050m from the threshold. It is modulated with a 1300 Hz tone as alternate dots and dashes.
- The inner marker, when installed, shall be located so as to indicate in low visibility conditions the imminence of arrival at the runway threshold. This is typically the position of an aircraft on the ILS as it reaches Category II minima. The modulation is 3000 Hz dots at 6 per second.

5.7.3 DME [S+]

Distance Measuring Equipment is replacing markers in many installations. This provides more accurate and continuous monitoring of correct progress on the ILS to the pilot, and does not require an installation outside the airport boundary. The DME is frequency paired with the ILS so that it is automatically selected when the ILS is tuned.

5.7.4 ILS Categories [S+]

As outlined in the training manual, there are 3 types of ILS Precision Approach Procedures which we recap bellow:

- **Approach CAT I**: Operation down to minima of 200 ft. decision height (DH) and runway visual range (RVR) 550 Meters. with a high probability of success. (When RVR is not available, 800 meters ground visibility is substituted.)
- **Approach CAT II**: Operation down to minima 100 ft. decision height (DH) and runway visual range (RVR) 300 Meters.
- **Approach CAT III**: Operation down to minima prescribed in the carrier‟s operating specifications in the operator‟s operations manual from a DH of 50ft and RVR of 100 Meters to as low as 0 ft DH and 0 Meters RVR

As you can see Category one (CAT I) is the least accurate, and CAT III is the most accurate, meaning that the PIC can fly the approach to lower limits (decision heights) on a CAT III ILS than on a CAT I ILS.

In turn all depends on the actual Runway in use, not all runways are equal, some may offer a higher CAT level than others, we therefore also speak about Precision Runways.

5.7.5 Runway Categories [S+]

The visibility is the limiting factor on an approach. If the Cloud base is at 50 ft, but the visibility is 600 meters, you may fly and land with a CAT I ILS. The chances that you can see the runway at 200 ft are very limited, but maybe the approach lights are very bright.

The Precision Runway is one which is served by visual aids and non-visual navigation aids providing lateral and vertical guidance to the operating minima as outlined below in precision Runway CATI, CATII and CATIII.

- **Precision runway CAT I**: A runway adequate for instrument approach down to a decision height (DH) lower than 250 ft., but not lower than 200 ft., above "height above aerodrome" (HAA) or "height above touchdown" (HAT) and in operating visibility not less than 0.5 SM or RVR 550 Meters.
- **Precision runway CAT II**: A runway adequate for instrument approach down to a decision height (DH) lower than 200 ft., but not lower than 100 ft., above "height above aerodrome" (HAA) or "height above touchdown" (HAT) and in operating visibility not less than RVR 300 Meters.
- **Precision runway CAT III**: which is subdivided into a further there types of precision runway CAT III:
  - **CAT III A**: Operations are conducted or intended to be conducted down to a runway visual range (RVR) not less than 100 Meters and a DH of 50ft.
  - **CAT III B**: Operations are conducted or intended to be conducted down to an RVR not less than 50 Meters. (no DH being applicable).
  - **CAT III C**: Operations are conducted or intended to be conducted with no DH and no RVR limitations.

5.7.6 Other Limiting Factors [S+]

There are more factors which can change the limit such as:

- Pilot Qualification
- Aircraft Classification

Typical Aircraft Classification:

- CAT A : F50, ATR42, Dash 800
- CAT B : DC9, MD80 & 90 Series, B737, A320
- CAT C : B767, B777, B747, DC10, MD11, A330, A340

6 CHANGE OF PLANS

6.1 Vectors [S]

As ATC we tell aircraft what to do, what route, heading or track to follow, as well as what Flight Level to fly at. In essence ATC has the right to instruct any aircraft to turn in any direction depending on local circumstances.

When dealing with lateral separation we speak about vectoring and when dealing with vertical separation we speak about climb or descend instructions. (in fact all of these are a kind of vectors)

In order to issue either of the above correctly, efficiently and above all purposefully you need to have the Area Charts and know the airspace around you.

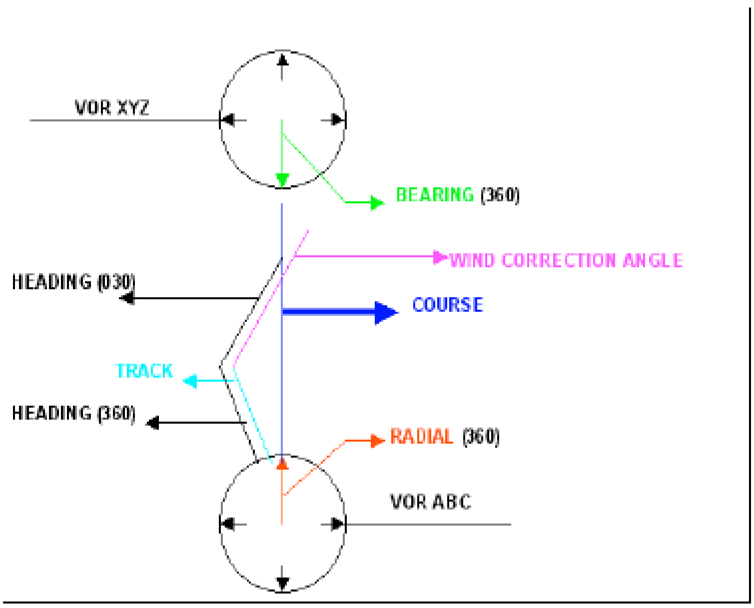
There really is not that much that can be explained about radar vectoring as it is something you will pick up and learn as you progress.

The Main thing to bear in mind is "Do not Over Vector". What we mean by this is keep your instructions to the point, do not tell the pilot what to do every 2 minutes, don‟t ask the pilot to report in every 5 minutes. There is absolutely no need for this and above all think ahead at all times.

6.1.1 Lateral Vectoring [S]

Let us start with an explanation here of what navigation is. This is more relevant to pilots, but from time to time you get a pilot who has just un-packed his Flight Simulator, joined VATSIM, fired it all up, come on line being totally new and does not know the difference between a VOR and an ILS.

The essential component of navigation is the concept of direction and this applies both to Pilots and to ATC.



Let us consider the above diagram: bearing in mind that a VOR has 360 different Radials or if you want 360 compass degrees, where 360 degrees (note that 000 does not exist) indicates North, 90 degrees East, 180 degrees South and 270 degrees West.

- Heading: The direction the nose of the aircraft is pointed at
- Course: The direction over the ground that the PIC want to fly
- Track: The actual path over the ground which the aircraft is following
- Wind Correction Angle: The angle used to compensate for wind drift.
- Radial: The direction from a navigation aid (outbound)
- Bearing: The direction to a navigation aid (inbound)

Now that we have established the most basic components dealing with direction or lateral navigation we will look at a few things you as ATC need to bear in mind when controlling.

When issuing a HDG advice to an aircraft, always use a direction ending on 0 or on 5.

ExAir123, Turn Right Heading 090, or Left Heading 155

If we once again refer to the above diagram, keep in mind that the radials of a VOR (all 360 of them) extend from the VOR. Therefore if you instruct an aircraft to leave VOR ABC on Radial 360, Direct to VOR XYZ, the aircraft will point its nose to heading 360 and will be flying the inbound leg towards VOR XYZ on Radial 180, but on a Bearing of 360.

When issuing Left or Right turn instructions to an aircraft, keep the turn radius in mind, as the heading the aircraft ends up on after leveling out, may very well be the heading you instructed but on a different track altogether. Therefore add the expected variance to the head instruction.

The higher the speed at which an aircraft is flying, the larger turn radius is needed to come to the heading instructed by ATC.

For instance an Aircraft is flying a heading of 190 but you want it to be at a specific point, showing a heading or track of 130 at a particular moment in time. Instead of instructing the aircraft to turn Left hdg 130, add another 5 to 10 degrees that you want the aircraft to turn, in this instance to intercept your desired points, instruct the aircraft to Turn Left Hdg 120.

The above example depends on a number or factors, such as speed of aircraft or speed and direction of wind. As you become more experienced you will automatically get into the habit issuing these corrective-heading instructions.

Most of your active vectors will be when you as ATC have traffic inbound to a field that either requires ATC vectors for the approach due to not being able to follow a STAR or who need to be vectored away from conflicting traffic or vectored for the sake of maintaining or increasing separation on approach or final.

A good Controller will always explain to the pilot the reason for the vector instructions being issued. For instance a pilot is following a published STAR and ATC decides to deviate from this STAR

ExAir123, Turn Right heading 120 expect vectors for approach runway 05L.

6.1.2 Vertical Vectoring [S]

Let us start by recapping on the two main concepts to use when giving climb or descend instructions:

- **Flight Levels**
  - Used for aircraft flying Above the Transition Altitude, Transition Level or for Aircraft climbing through and above the Transition Layer
  - The Altimeter in the aircraft is set to Standard Barometric Pressure 1013
- **(QNE) Altitude**
  - Used for aircraft flying below the Transition Altitude or for Aircraft descending through and below the Transition Layer
  - The Altimeter in the aircraft is set to Local QNH pressure.

When instructing an aircraft to climb or descend to a Flight Level below FL100, omit the initial "0" from the FL.

ExAir123 Climb and Maintain FL80
or
ExAir123 Descend and Maintain FL60

Remember to ensure that the aircraft are at a correct Altitude when nearing the Final Approach Fix (a good rule of thumb is 3000FT at 10 miles from the Runway. Remember that aircraft fly slower and use more fuel at low altitudes than at higher altitudes; it is therefore pointless getting an aircraft down to 5000ft or 3000ft with 50 or 60 miles to go until on final.

Try to avoid the Descend/maintain/descend again/maintain etc situation and instead aim for a continuous and fluid movement where the aircraft at all times is gently descending, if needed advice the Pilot the Rate of Descend he should follow.

Another advice that ATC can give to a pilot which helps the pilot to choose a good rate of descent is to advice the pilot of the remaining track-miles to touchdown
ExAir123 expect 45nm to touchdown, when ready decent to 4500ft, QNH 1020

6.1.3 Conditional ATC instruction [S+]

As ATC you can issue specific constraints or conditions in a climb or descend instruction

An instruction could be conditional on the aircraft having to pass a given FL or Altitude over a Fix or Navaid.
ExAir123 Climb To Reach FL150 at GED VOR
This would instruct the pilot to climb towards FL150 and reach this level at GED

It could also be an advice to the pilot to expect further action after having passed a navaid
ExAir123 After Passing GED VOR Descend to 5000 feet

An instruction could be conditional on the aircraft having to pass a given FL or Altitude at a specific time.

ExAir12 Descend To be at FL180 At 20.15Z

But it can also be that ATC needs specific action to be taken at a given time.

ExAir123 Expect Further Climb At 20.15Z

Similarly as ATC a pilot can be instructed to expedite a Descend or a Climb

ExAir123 Expedite Descend until passing FL90

If you have instructed a pilot to "expedite" climb or have issued a conditional minimum climb per minute for whatever reason, and the pilot is unable to maintain this rate of climb after a time, then the pilot will continue climb to whatever Level he has been cleared to at his Best Rate of Climb

ExAir123 Climb to FL280 maintain 3000 feet per minute until passing FL250

App, ExAir123, passing FL220 unable to maintain 3000 FPM

ExAir123 Continue Climb to FL280 at best rate of climb

Or ATC can instruct a pilot to Stop his climb or descend

ExAir123 Stop Climb at FL120

Usually followed by

ExAir123 Continue Climb to FL240

ATC can also issue conditional report instructions to a pilot

ExAir123 Report Leaving FL330

Or

ExAir123 Report Reaching FL190

Or

ExAir123 Report Passing FL100

Or

ExAir123 Report Passing LBE VOR

If ATC needs urgent action from a pilot then the word immediately is used

ExAir123 Descend FL230 immediately

6.1.4 Calculating the TOD [S+]

There are several ways to calculate the Top of Descend (TOD), let's take an example of a Jet Flying at FL330 with a GS of 530 (average TAS of a Jet at Cruise Speed is 8 nautical miles per minute.

Method A = Altitude divided by average rate of descent will give the descent time in minutes. Multiply this by the average ground speed, which will give you the approximate distance required

Explanation: FL330 at 2500 fpm aircraft needs 13 minutes at average 8 miles per minute So 13x8=104nm, next add 5 to 10 miles for the deceleration and approach segments and the aircraft should commence descend approximately 115 miles out.

Method B = An aircraft looses 300ft each nm on a 3 degree glide, so from FL330 the aircraft will descend at 33000 divided by 300, equals 110nm, again add between 5 and 10 nm for deceleration and approach and again the descend should start

115 to 120 nm miles out

Another aircraft is cruising at FL310 and you want it to be at FL250 in 40nms. 40 divided 8= 5 minutes. The Difference in FL is FL60 or for ease 6000ft, divide 6000 by 5 minutes and the aircraft should be instructed to descend with a minimum rate of descend of 1200fpm.

If you have 2 or more aircraft following the same track with identical destination but maintaining different FL on cruise and you want them to descend. Never instruct the trailing aircraft, even if at a higher level to descend before the Leading aircraft.

If you are unsure when to instruct a pilot to descend, you can issue a “descend at Pilot Discretion” This means that the pilot may opt to descend immediately or may opt to maintain current FL until the pilot decides to commence descend.

ExAir123 When Ready Descend to FL120

Avoid asking the Pilot to report altitude as you can clearly see that on your radar, unless it looks like the aircraft is not where is supposed to be.

6.2 Re-Routing [S+]

ATC can reroute an aircraft away from its filed flight plan either with the aim of providing a more direct route or short cut to the destination or any other significant Navigation Aid filed in the plan, or for the sake of maintaining separation between aircraft or to maintain an orderly approach into a saturated field or to expedite the flow of air traffic.

It can also be used to assist pilots in circumventing adverse weather areas by vectoring them around these areas.
ExAir123 Re Cleared direct to HAM
Or
ExAir123 from present position proceed direct HAM

Directs or Re-Routes will usually be given by the Center Controller and the rule is that the direct clearance limit has to be within one’s own FIR. For example if you are controlling Barcelona Control you cannot give a direct to Zurich, but only to the border of your own FIR.

In the event however that Marseille Control is on line then you could coordinate between you an acceptable direct route and offer this to the pilot.

A different kind of re-routing is provided by Departure or Approach respectively. For example you are on as Departure:

Departure, Good Afternoon ExAir123 with you passing 2000feet on the LOPIK1F
ExAir123, Good afternoon Turn Left Heading 170 direct LOPIK, then climb FL190

In the above example Departure has re-routed the aircraft direct to LOPIK intersection instead of having to follow the prescribed SID.
Another type of re-routing occurs when a pilot decides to divert to an alternative airport due to adverse weather condition or fuel shortage.

6.3 Holdings

6.3.1 Holding Concept [S+]

In aviation, a holding (or hold) is an area of airspace used to delay aircraft already in flight. Because fixed-wing aircraft cannot stop in midair, they fly in circles, which keep them near their destination airport until it is their turn to land.

A holding for IFR aircraft is usually located over a radio beacon such as a NDB or a VOR, this is called the holding fix. Aircraft will fly towards the beacon, and enter a a fixed racetrack pattern over the beacon. A standard holding pattern uses right-hand turns and take; Depending on FL flown; approximately 4 to 5 minutes to complete (one minute for each 180 degree turn, and two one-minute to one and a half minute straight ahead sections) . Deviations from this pattern are common, if long delays are expected longer legs (usually two or three minutes) may be used or aircraft with distance measuring equipment may be assigned holds with legs defined in nautical miles rather than minutes. Less frequent turns are more comfortable for passengers and crew.

A holding for VFR aircraft is usually a (smaller) racetrack pattern flown over something easily recognizable on the ground (such as a bridge, highway intersection or lake).

In our VATSIM environment we often have to do with pilots who have little or no knowledge on how to fly or follow a Holding Pattern or who my have some idea but do not have the charts. The positive side of things however is that most of our traffic has sophisticated FMS on board which in most cases should be able to fly the hold.

Although of more importance to pilots, ATC must be familiar with all Hold related concepts, especially as you will be issuing the hold instructions. Let us therefore look at the components of a hold in more detail.

6.3.2 Usage [C]

The primary use of a holding is delaying aircraft that have arrived over their destination but cannot land yet because of traffic congestion, poor weather, or unavailability of the runway. Several aircraft may fly the same holding pattern at the same time, separated vertically by 1,000 feet or more. This is generally described as a holding stack or stack. As a rule, new arrivals will be added at the top. The aircraft at the bottom of the stack will be taken out and allowed to make an approach first, after which all aircraft in the stack move down one level, and so on. ATC controls the whole process.

One airport may have several holdings; depending on where aircraft arrive from or which runway is in use, or because of vertical airspace limitations.

An aircraft with an emergency will be allowed to bypass the holding and proceed via vectors directly to the airport of course this would cause further delay to other aircraft already in the stack.

Remember that you can have more than 1 aircraft holding at the same fix, this is called “Stacking” where the 1st aircraft is holding at the lowest FL and so forth. As aircraft are cleared out of holds, they are cleared from the Lowest FL. This means that all aircraft in the hold are then sequenced down to a lower FL and a new aircraft about to enter the hold will enter at the highest flight level.

Once you as ATC want to clear the aircraft out of the hold you just instruct the aircraft to fly a new heading or to a new fix.

6.3.3 Flying a Hold [S+]

Most aircraft have a specific holding speed published by the manufacturer, this is a speed at which the aircraft uses the least amount of fuel per hour, this a relatively low speed compared to en-route flying. A typical figure for airline aircraft is 180 to 230 knots. If possible, a holding is flown with flaps and landing gear up to save fuel.

Maximum holding speeds are established in order to keep aircraft within the protected holding area during their one-minute inbound and outbound legs.

As a rule of thumb the Speed to be flown depends on the altitude or flight level the aircraft is at within the hold as follows :

- At 6,000' MSL and below: 200 knots
- From 6,001' to FL 140: 230 knots
- At and above FL140: 265 knots

Having entered the holding pattern, on the second and subsequent arrivals over the fix, the pilot would execute a right turn to fly an outbound track that positions the aircraft most appropriately for the turn onto the inbound track. When holding at a VOR, the pilot should begin the turn to the outbound leg at the time of station passage as indicated on the TO– FROM indicator.
The pilot would then continue outbound for one minute if at or below FL140, or one and a half minutes if above FL140 and then turn right to realign the aircraft on the inbound track. A Complete hold should take:

- FL140 and below 4 minutes
- FL140 and above 5 minutes

These times do not take any wind into consideration as such the pilot should make due allowance in both heading and timing to compensate the wind effect. After the initial circuit of the pattern, timing should begin abeam the fix or on attaining the outbound heading, whichever occurs later. The pilot should increase or decrease outbound times, in recognition of winds, to effect 1 or 1 1/2 minutes (appropriate to altitude) inbound to the fix.
Pilots are to advise ATC immediately if airspeeds in excess of those specified above become necessary for any reason, including turbulence, or if unable to accomplish any part of the holding procedure. After such higher speed is no longer necessary, the aircraft should be operated at or below the specified airspeeds, and ATC notified.

After departing a holding fix, pilots should resume normal speed subject to other requirements, such as speed limitations in the vicinity of controlled airports, specific ATC requests, etc
At all times ATC needs to bear in mind the Minimum Holding Altitude (MHA) which is the lowest altitude prescribed for a holding pattern that assures navigational signal coverage, communications and meets obstacle clearance requirements.

6.3.4 Holding Clearance [S+]

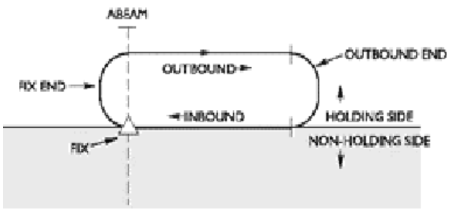
A holding clearance issued by ATC includes at least

(a) A clearance to the holding fix.
(b) The direction to hold from the holding fix.
(c) A specified radial, course, or inbound track.
(d) If DME is used, the DME distances at which the fix end and outbound end turns are to be commenced.
(e) The altitude or FL to be maintained.
(f) The time to expect further clearance or an approach clearance.
(g) The time to leave the fix in the event of a communications failure.

During entry and holding, pilots manually flying the aircraft are expected to make all turns to achieve an average bank angle of at least 25˚ or a rate of turn of 3˚ per second, whichever requires the lesser bank. Unless the ATC clearance contains instructions to the contrary, or a non-standard holding pattern is published at the holding fix, pilots are expected to make all turns to the right after initial entry into the holding pattern.

Occasionally, a pilot may reach a clearance limit before obtaining further clearance from ATC. In this event, where a holding pattern is published at the clearance limit, the pilot has to hold as published. Where no holding pattern is published, the pilot has to hold in a standard pattern on the inbound track to such clearance limit and request further clearance.
If for any reason a pilot is unable to conform to these procedures, ATC should be advised as early as possible.

6.3.5 Standard Holding Pattern [S+]



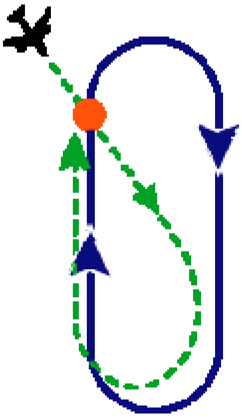
- Standard Hold A hold where all turns are made to the right
- Non Standard Hold A hold where all turns are made to the left
- Holding Course The course flown on the inbound leg to the holding fix.
- Inbound Leg The standard 1 or 1.5 minute leg to the holding fix as Published
- Holding Fix This can be a VOR, a VORDME, an Intersection or an NDB
- Outbound Turn A standard rate, 180 degrees turn which is begun at the holding Fix. Also called the “Fix End”
- Abeam The position opposite the holding fix, where the outbound Begins.
- Outbound Leg This leg is defined by the inbound leg, pilots should adjust the outbound leg so that the inbound turn, the other standard 180 degrees turn is completed just as the holding course is intercepted.
- Holding Side The side of the course where the hold is accomplished.

- Non Holding Side The side of the course where you do not want the pilot to be Holding

6.3.6 Non Standard Holding Pattern [C]

A non-standard holding pattern is one in which

(a) The fix end and outbound end turns are to the left; and/or



(b) The planned time along the inbound track is other than the standard one-minute or one-and-a-half minute leg appropriate for the altitude flown.

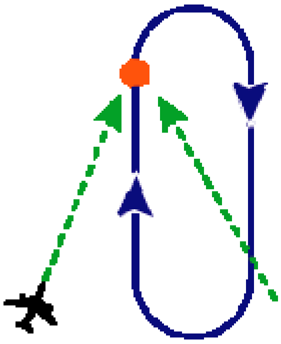
6.3.7 Entry Holding Procedure [C]

The entry to a hold is often the hardest part for a novice pilot to grasp, and determining and executing the proper entry while simultaneously controlling the aircraft, navigating and communicating with ATC require practice.

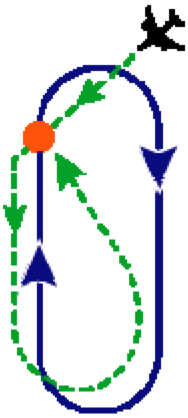
ATC Manual by VATSIM E

There are three standard types of entries: direct, parallel, and teardrop

A direct entry is exactly what it sounds like the aircraft flies directly to the holding fix, and immediately begins the first turn outbound.

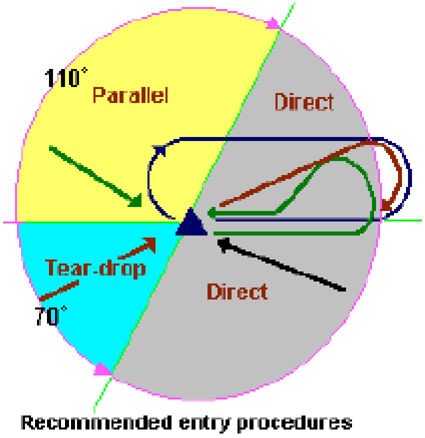


In a parallel entry, the aircraft flies to the holding fix, parallels the inbound course for one minute outbound, and then turns back, flies directly to the fix, and proceeds in the hold from there.



In a teardrop (or offset) entry, the aircraft flies to the holding fix, turns into the protected area, flies for one minute, and then turns back inbound, proceeds to the fix and continues from there

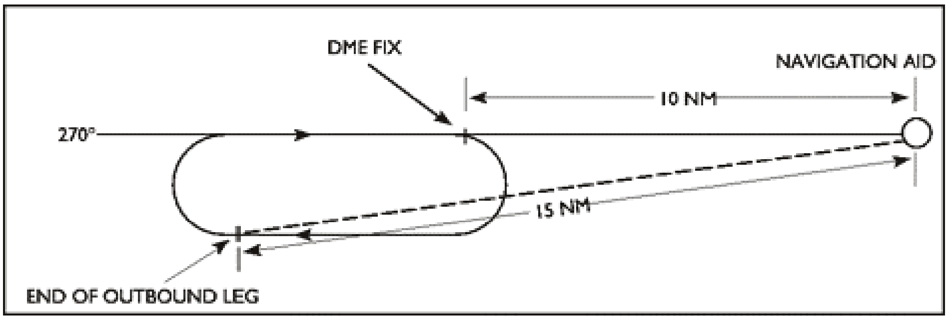
The pilot is expected to enter a holding pattern according to the aircraft‟s heading in relation to the three sectors shown bellow, recognizing a zone of flexibility of five degrees on either side of the sector boundaries. For holding on VOR intersections, entries are limited to the radials or DME arcs forming the fix as appropriate.



When crossing the fix to enter a holding pattern, the appropriate ATC unit shall be advised. ATC may also request that the pilot report "established in the hold". The pilot is to report "established" when crossing the fix after having completed the entry procedure.

6.3.8 DME Holdings [C]

DME holding is subject to the same entry and holding procedures previously described except that distances, in NM are used in lieu of time values. In describing the direction from the fix on which to hold and the limits of a DME holding pattern, an ATC clearance will specify the DME distance from the navigation aid at which the inbound and outbound legs are to be terminated. The end of each leg is determined by the DME indications.



For example: An aircraft cleared to the 270˚ RADIAL 10 mile DME FIX, to HOLD BETWEEN 10 AND 15 miles, will hold inbound on the 270˚ radial, commence turn to the outbound leg when the DME indicates 10 NM and commence turn to inbound leg when the DME indicates 15 NM.

6.3.9 Published en-Route and Terminal Chart Hold Patterns [C+]

At most high traffic density areas, holding patterns are depicted on IFR terminal area and en- route charts. When pilots are cleared to hold at a fix where a holding pattern is published, or if clearance beyond the fix has not yet been received, pilots are to hold according to the depicted pattern using normal entry procedures and timing in the hold ATC will use the following phraseology when clearing an aircraft holding at a fix that has a published holding pattern;

Exair123 cleared to (fix), hold (direction) as published expect further clearance at (time)

Note: If you at any time need to slow an aircraft down due to congestion and either are unsure if the pilot understands how to enter and maintain a hold or if the aircraft is nowhere near a published primary or secondary hold position. Then you can order the aircraft to make a 360-degree left or right turn, or an “Orbit”.

6.3.10 Estimated Approach Time (EAT) [C]

Note above the “Expect Further Clearance” this has the same meaning as EAT or “Estimated Approach Time. This is the time in UTC when an aircraft is expected to leave the Initial approach fix, usually the holding fix. In case off lost communications, an aircraft is expected to leave the holding at this time.

ATC should always include the EAT to the pilot in order for the pilot to compute his revised arrival time and above all to ascertain the remaining flight time endurance (Fuel onboard) **Exair123 "cleared to (fix), hold (direction), as published, EAT (time)"**
Or
Exair123 "cleared to (fix), hold (direction), as published, No Delay Expected”

If for whatever reasons the EAT changes then ATC should advise the pilot accordingly

Exair123 "cleared to (fix), hold (direction), as published, Revised Expected Approach Time (time)”
Or
Exair123 "cleared to (fix), hold (direction), as published, Delay Not Determined (reasons)”

6.3.11 Examples and Recap

Exair123, enter hold at FL100, inbound track 042, left turns, expect further clearance at 25 Zulu .

- The aircraft would fly the Inbound Leg on Radial 222 of the holding Fix.
- The aircraft would be doing Left Hand standard turns
- The aircraft would fly the outbound Leg on an approximate heading of 222
- The aircraft would maintain FL100 in the hold, unless told differently
- The aircraft would maintain the published Speed Restrictions
- The aircraft would continue holding unless told differently, until the pre advised Zulu time, at which time the PIC in absence of further clearance may proceed as per Radio Communication Failure.

Exair123, enter hold at FL80, inbound track 328, right turns, expect further clearance at 05 Zulu.

- The aircraft would fly the Inbound Leg on Radial 148 of the Fix
- The aircraft would be doing Right Hand standard turns
- The aircraft would fly the outbound Leg on an approximate heading of 148
- The aircraft would maintain FL80 in the hold, unless told differently

- The aircraft would maintain the published Speed Restrictions
- The aircraft would continue holding unless told differently, until the pre advised Zulu time, at which time the PIC in absence of further clearance may proceed as per Radio Communication Failure.

Exair123 hold at QDM 115 RK ndb, right hand turns, further clearance at 15 Zulu

- The aircraft would fly towards RK ndb on Track 115
- The aircraft would be doing Right Hand standard turns over RK.

Exair123 cleared to the 130 RADIAL 5 mile DME SPL, to HOLD BETWEEN 5 AND 10 miles.

- The aircraft will hold inbound on the SPL (Schiphol, EHAM) 130˚ radial.
- The aircraft will commence the turn to the outbound leg when the DME indicates 5 NM and commence the turn to inbound leg when the DME indicates 10NM.

Always keep the following in mind:

- Aircraft need to maintain the published speed restrictions
- Aircraft need to maintain proper separation, especially in a “Stack” situation.
- The order of instructing descends in a hold would be to:

1. Lowest aircraft to clear out of hold to a fix or hdg
2. Once you see the 1st aircraft leaving the hold, instruct 2nd lowest to descend to lowest FL available in the hold
3. Once you see the 2nd aircraft descending, instruct the 3rd lowest to descent to the FL vacated by aircraft nbr 2. Etc.

If a pilot cannot fly a hold, then instruct him to orbit over a navigation-aid or to do 360‟s away from the standard holding points.

Do not forger that an aircraft does not have unlimited fuel and react promptly on any pilot advises relating to fuel status.

Holding Patterns can be added with a bit of work to the standard sector files in use, usually entering them under the Low or High Airway section as required.

6.4 Speed [S+]

Because a knot is defined as a nautical mile/hour, the expression "knots per hour" is considered incorrect as a unit of speed, since this suggests 'nautical mile/hour2', which would be a measure of acceleration.

The retention of “knot” though for aviation use is important for navigational reasons, since the length of a nautical mile is identical to a minute of latitude. Airspeed is measured in knots in the lower airspace and in Mach numbers in the upper airspace.

In general across Europe all traffic at FL100 or bellow is restricted to 250 KIAS unless ATC has instructed otherwise. Please refer to your VACC local Training

Documents for specific information relating to the field you are controlling.

NOTE: the Information shown to you as ATC on your ASRC or VRC or Euroscope Screen is always the Ground Speed
The GS shown is influenced by the Wind Factor.
The GS shown is influenced by the Simulation Rate being used.

6.4.1 General Concepts [S+]

TAS: True Airspeed, This is the speed the aircraft is moving through the air, it is usually estimated prior to the flight and calculated during the flight in order to arrive at the required data for flight planning purposes. This is in turn used along with the winds data to arrive at the Ground Speed. **KTAS** is "knots true airspeed"

IAS: Indicated Airspeed, This is the speed shown on the flight instruments based on the dynamic pressure sensed by the Pitot System. The density of the air affects the airspeed indication during climb and descends. During climb the airspeed indicator shows a lower speed than the aircraft is actually moving through the air. Vice-versa during decent. IAS is used at lower flight levels (usually below FL280 and in certain FIRls FL250) **KIAS** is "knots indicated airspeed"

KCAS is "knots calibrated airspeed", or indicated airspeed corrected for position error. When flying at sea level under Standard Atmosphere conditions (15°C, 1013,25 hPa, 0% humidity, 1225 gr/cubic meter Density) calibrated airspeed is the same as equivalent airspeed and true airspeed (TAS). If there is no wind it also the same as ground speed (GS). Under any other conditions, CAS will differ from the aircraft's TAS and GS. Most aircraft have an inherent difference between (theoretical) calibrated airspeed (CAS) and the airspeed actually shown on the instruments (indicated airspeed or IAS). This position error is mainly due to errors in sensing static pressure. It is usually not possible to find locations for the static ports which accurately sense static pressure at all speeds and angles of attack.

KEAS is "knots equivalent airspeed", which is calibrated airspeed corrected for compressibility effects.

GS: Ground Speed, The actual speed the aircraft is covering (moving) over the ground. It is the sum of the aircraft's true airspeed and the current wind and weather conditions; a headwind subtracts from the ground speed, while a tailwind adds to it. Winds at other angles to the heading will have components of either headwind or tailwind as well as a cross track component.

MACH: The ratio of true airspeed to the speed of sound, which varies with altitude and is used at high Flight Levels, (usually above FL280 and in certain FIR's FL250)

6.4.2 So what does this all mean? [S+]

If you take two different aircraft flying at the same Flight Level then if they fly at the same IAS or MACH they will also be flying at the same TAS and indeed the same GS. (this assumes that the wind is also identical for the two aircraft)
The Speed of Sound (Mach 1) equals some 600 knots TAS at Fl250 but at FL350 this equals some 570 knots TAS.

In average you can say that at high Flight Levels 0.01 Mach is the same as 6 knots TAS, for instance Mach 0.80 at FL290 will be the same TAS as Mach 0.83 at FL370. This is because the speed of sound is less at FL370 than at FL290.
Therefore if you try to compare the speed of aircraft flying at different Flight Levels, the same Mach number will mean that the higher aircraft is actually moving slower. To get at an equivalent add 0.01 mach for every 2500ft separating the two aircraft.

IAS read outs are more pronounced, for instance an aircraft flying at 280 IAS at FL370, will have a TAS of 460 knots, and another aircraft flying at 280 IAS at FL270, will have a TAS of 417 knots.
If you want to compare IAS you should calculate 7 knots or 2% for every 1000ft separating the aircraft. In addition over FL250 15 knots of TAS more or less equals 10 knots IAS.

The Conclusion here is that of two aircraft flying at the same Mach number but at different Flight Levels the higher aircraft will be flying slower. In comparison aircraft using the same IAS will be faster the higher they are.
As a rule of thumb you can say that the average TAS of Jet aircraft at High Flight Levels is 8 nautical miles per Minute.

6.4.3 Why should I care [S+]

Speed can be used for separation, although this should only be used if absolutely required. The only exception is when separating traffic inbound for arrival. Climbing traffic and en route traffic should instead primarily be separated using vectors or altitude instructions.
Using speed for separation of inbound traffic is however important since all inbound aircraft approaching the same runway sooner or later will have the same height at the same place, but hopefully never at the same time.

To descend and at the same time reduce speed can be difficult, especially for turbo jets. Therefore, it is essential to inform the pilot, which of the two instructions has priority. The idea is to give one instruction only and let the pilot execute this before one before executing the next.

ExAir123 Reduce to speed 230 knots, then descend to 7000ft”.

Instead of

ExAir123 Reduce to speed 230 knots, and descend to 7000ft”.

Or the opposite

ExAir123 Descend to 5000 feet on QNH 1015 then reduce to speed 210 knots”.

Instead of

ExAir123 Descend to 5000 feet on QNH 1015 and reduce to speed 210 knots”.

Remember that there is often a standard speed restriction of 250 knots below FL100. This means that the pilot sometimes has to level out at FL100 to reduce speed before continuing descent. You can temporarily remove the speed restriction with the phrase

ExAir123 Descend to FL80, No Speed Restrictions

Or

ExAir123 Climb to FL80, Free Speed

Or

ExAir123 Descend to FL70, High Speed Approved

These waivers can be used at the discretion of ATC to allow a better traffic flow or use of the airspace, always as long as the traffic situation permits it and the safety of air traffic is not compromised. This is especially handy when dealing with new and inexperienced pilots who have difficulty in controlling their speed whilst descending.

6.4.4 Minimum Speed [S+]

All aircraft need to maintain a certain speed in order to maintain lift and avoid falling to the ground. The minimum speed is mainly dependent on the weight of the aircraft. There are also other factors, so it is not always possible for a pilot to slow down or speed up to the instructed speed. It is the pilot's responsibility to inform you of this. In that case, you must separate him from other aircraft by other means. In aircraft performance tables, there are several speed restrictions given, but only two are of interest for the controller. The first is “minimum clean” which is the lowest speed an aircraft can maintain without using flaps or spoilers. The second is “minimum approach speed” which is the lowest speed an aircraft can maintain using both flaps and spoiler. Avoid giving a pilot, who is flying with flaps down, a speed instruction, which forces him to again retract his flaps.

Apart from the specific aircraft's speed restrictions; there are rule of thumb speed restrictions common for all aircraft. By following these, one does not need to study the specific aircraft's specifications:

Aircraft at FL280 – FL100: Do not give a speed restriction below 250 knots or corresponding Mach number.

Aircraft below FL100: Turbo jet: not slower than 210 knots, except when within 20 nm from the runway, in that case do not restrict them slower than 170 knots. Turbo prop: not slower than 200 knots, except when within 20 nm from the runway in that case do not restrict them slower than 150 knots.

Departing traffic (if speed restrictions apply) Turbo jet: not slower than 230 knots. Turbo prop: not slower than 150 knots. Helicopter: not slower than 60 knots

In other words there is no point in instructing a pilot flying a B747 to speed down to 130 KIAS with flaps up 35 miles from the runway due to separation, as this instruction will hopefully be ignored. But if acted on then two things will happen for sure:

No more separation
problems. No more target

6.4.5 Speed Restrictions [S+]

Sometimes you will need to issue specific restrictions to traffic, mostly as Approach, Final, Director or Tower Controller.

Up to about 15 nm from touchdown instructed speeds should not be less than 210 KIAS. Between 15 NM and about 4 NM from touchdown speed control shall only be applied if absolutely required due to wake turbulence or to maintain separation on the approach and should never be lower than 160 KIAS

Speed control must not be applied to aircraft on final approach after having passed a point 4 nm before touchdown.

ExAir123 are you able to maintain 170 KIAS until the outer marker? Affirm, ExAir123

ExAir123, roger, please maintain 170 KIAS until the outer marker.

Separation between aircraft flying at the same altitude or FL may be achieved by assigning speed restrictions provided that both aircraft are assigned a speed value which maintains or increases the separation between the aircraft.

Speed control can be achieved by instructing a pilot to:

Maintain his present speed

ExAir123 Descend to 5000ft Qnh 1013, Maintain Present Speed

Maintain a specific speed

ExAir123 Turn Right Heading 150, Maintain 220 KIAS

Increase or decrease to a specific speed or by a specific amount **ExAir123 Maintain Present Heading, Reduce Speed by 25 KIAS** Or

ExAir123 Climb to FL90, Increase speed to 280 KIAS

Resume normal speed when the application of speed control procedures is no longer required

ExAir123, Resume Normal Speed

6.4.6 Conversions [S+]

1 knot is roughly equivalent to:

101.268591 feet/minute
1.687810 foot/second
0.5144444 meter/second
1.852 kilometer/hour (exact)
30.86667 meter/minute
1.150779 mile (statute)/hour.

6.4.7 Summary [S+]

Speed Restrictions is a useful tool if used correctly and on the rare occasion it is really needed at Cruise Level. Generally however good use of vectoring and proper FL assignments and above all thinking ahead will ensure you rarely need to interfere with the settings preset by the pilot. Speed adjustment is however one of the best tools for separating aircraft during the stages of approach and is used largely by Final Approach positions to ensure an optimum sequence of aircraft.

Speed restrictions should always be given in Knots based on IAS in increments or decreases of 10 knots. Above FL280 or FL250 depending on the FIR the increments or decreases can be stated in Mach and be given in increments of 0.01 Mach. Whatever you do, remember not to instruct an aircraft to decrease or increase speed just to follow it up after a short while with a contrary command due to you seeing that your original command was wrong as this will only serve to irritate the Pilot

- Try to limit issuing any the speed instructions except:
- At FL100 or below if an aircraft is faster than 250KIAS
- In a holding pattern if the aircraft is faster than the prescribed maximum Speed
- On Final Approach if the aircraft is too fast
- On Intermediary Approach Phase if it looks like the 1ST aircraft in

sequence is in danger of being taken over by the next in line (here you would usually instruct aircraft 1 to increase speed and then instruct aircraft 2 to decrease speed)

- If it looks like you have several aircraft on different STARS who look like they will be established at the same time (again you would ask one to speed whilst asking the other to slow)
- On Climb out phase if it looks like an aircraft is too slow or too fast.
- In known areas of turbulence or thunderstorms.
- Never ever instruct an aircraft to slow below the Minimum Safe Approach Speed.

7 COORDINATION

Coordination before hand-off is needed when an aircraft has diverted from its planned route or isn't able to follow standard procedure. Coordination is not needed if the aircraft follows standard procedure. Should any uncertainty arise, coordination should be initiated and cleared before transfer of control

7.1 Cooperation with other controllers [S]

All coordination should be initiated well before the aircraft enters the airspace of the next controller. An aircraft is considered to follow standard procedure and does not need to be coordinated in the following instances:

- Traffic climbing or descending without restrictions to the temporary or final level as entered in the tag
- Traffic en-route, following the filed flight plan
- All regular departing traffic on a SID
- All Arriving traffic following a STAR
- Departing traffic from TWR climbing to initial altitude as published
- Traffic established on final approach according to the published procedures.

If a controller cannot accept any more aircraft into his sector, he should communicate this to other controllers by any means possible, usually could be due to over saturation. Other controllers should instruct traffic under their control to hold as published and not let any aircraft enter that sector until advised to the contrary.

7.2 Hand-off [S]

A handoff is an action taken to transfer the radar identification and control of an aircraft, from one controller to another. It consists of four steps:

- Coordination before hand-off
- Initiate and accept handoff, (using the relevant ATC software functions, "F4", etc) prior to traffic leaving the area of responsibility.
- Handoff of communication (advice the traffic on voice or text who they shall contact next), prior to traffic leaving the area of responsibility.
- Handoff of control either when traffic leaves the area of responsibility or immediately after handoff of communication. (depending on Letters of Agreement "LOA's" in place),

Provided that an aircraft is being transferred from one controller to another in accordance with Standard Operating Procedure then the handoff is simply accomplished by using the automated handoff facility built into ASRC and VRC (F4 function) or by using the Right Click Mouse hand-off to button if using VRC. In order to be able to use this facility it is essential that all aircraft which are in the air and under Control from ATC are "tracked" by the controller initiating the handoff.

The controller accepting a handoff is responsible for the aircraft from the moment the aircraft enters into its area of responsibility. The acceptance of the handover is an indication to the previous controller that the aircraft may enter into the area of responsibility of the receiving ATC.

When the receiving controller has accepted the aircraft, no further adjustments to the flight by the delivering controller are allowed. The aircraft should be issued instructions to change radio frequency before entering the next controller's Area of Responsibility.

Where a Standard Operating Procedure does not exist, or an aircraft has to be transferred other than in accordance with the SOP then individual Controller to Controller co-ordination must take place. This can be via ATC channel, via Private Chat or by direct voice communication using intercom or by other means (Discord, Teamspeak etc.).

When handing off an aircraft outside of SOP, it is important to let the receiving controller know about instructions you have given to an aircraft. At the same time it may be necessary to tell the pilot to report such instructions to the next controller. Although an area of control goes all the way to the boundary, it's polite to hand-over a good 10 to 20 miles from the actual boundary, regardless of sector, be it TMA, FIR or VACC. Under all circumstances, you need to ensure that a full hand-over has been completed at least 5 miles from the respective **Transfer of Control Point (TCP).**

Members using VRC and making use of the Flight Strip function should transfer the appropriate flight strip to the accepting position a few minutes prior to the aircraft being handed over.

Radar and non-radar handover: A number of VACC's operate under the procedure that Ground and Tower positions are non-radar hence these positions do not "track" any aircraft. In practice this would mean that Approach does not hand-over the aircraft to Tower but rather simply Drop Track whilst instructing the Aircraft to contact Tower.

Tower in turn would not Start Track but keep the aircraft untracked.

Similarly Ground and Tower would not track any aircraft as such departing aircraft are not handed over to Approach or Departure, but simply appear once airborne.

7.2.1 Handoff Recap [S]

To recap on the Main ATC positions here follows a general and brief reminder of where and when and to whom you will hand-off traffic

GROUND

Handles all Traffic on the Ground and hands over to Tower either at the Holding point or Prior to any aircraft crossing a runway. Ground will receive landing aircraft from Tower after vacating the active runway.
Runway crossings can also be done by coordination between TWR and GND without actually handing off the aircraft to TWR.

TOWER:

Handles all traffic on runways or the extensions thereof. Departing traffic should in general contact Departure or Approach depending who is on line as soon as airborne or before passing 2000ft and under all circumstances

within 10 miles from the runway. Arriving Aircraft should be passed to Tower by Approach once the landing aircraft is established on Final or when intercepting the localizer depending on the agreement made between Tower and Approach as the case may be.
Tower can also instruct traffic to contact GND prior to having vacated the runway after landing.

APPROACH:

Usually handles all inbound traffic within 30 to 50 miles from the airfield up-to FL120, once an aircraft is established on final it is passed to Tower, as a rule of thumb this is usually around 10 miles from the runway. There are airports where the FAF is closer to the runway and hence the handover to TWR will only take place at 6 to 8 miles from the runway.

DEPARTURE:

Handles all departing and crossing traffic within the area of control in general up-to FL120, some exceptions exist whereby Departure remains in control up to FL190 but this is an exception to the rule. Departure receives departing aircraft from tower once airborne, at or close to 2000ft and within 10 miles from the Runway. Departure in turn hands-off to Centre (also known in certain VACC's as "Control" or "Radar" at the appropriate point.

CENTER:

Handles all airborne traffic except that under the control of Tower, Departure or Apprpach in the FIR. co-ordinates with adjacent ATC facilities and passes aircraft over to Approach when entering the appropriate area.

Centre usually also handles all departing and arriving aircraft to any other airfield in the FIR which is not controlled at any given time, this can include the issuing of Clearances, Push and Start-Up as well as Taxi and Take of Clearances or Landing Clearances. Centre finally co-ordinates with Euro Control if no other appropriate ATC is on line.

7.3 Shift Change [S+]

This can be due to a number of reasons, most common is that a position is being vacated due to the controller going off-line or moving to a different position within the VACC Area.

In order to maintain continued control without aircraft being left uncontrolled for any given moment please follow the following guidelines.

1. Controller about to take over will have logged on in advance as an OBS and will have opened a Chat Box, or coordinated via Discord or other means with the active controller, set the com radios to the correct frequency and also have joined on the voice frequency.
2. The Controller about to take over will call up the ATIS information of the Active Controller and copy this information or if needed update the information.
3. The Active Controller will inform the new controller about all relevant aircraft movement under the relevant area of responsibility and any other important information (who is on Voice, who on Text, who is awaiting

clearance etc)

4. The existing Controller will advise all Aircraft under control by Text and/or Voice as required that a Shift Change is in progress and will shortly be completed.
5. The Controller about to take over will then disconnect and reconnect again with the correct call sign. But instead of using for example VHHH_1_APP will come back as VHHH_APP.
6. Immediately upon the New Controller having gained overall contact, he will notify the existing controller by opening a chat box or using Discord or any other means and typing/saying "I am Ready"
7. The existing Controller will at this stage signal that he is surrendering control by clearly stating on voice "You Have Control"
8. Immediately after this the Off-going Controller will disconnect but reconnect as soon as possible as Observer and rejoin the voice channel
9. The off-going controller will stay on line as Observer for a few minutes ensuring that the new controller has full control and that no conflicts or omissions are taking place.

The above steps from 1 to 9 should not take more than 2 to 3 minutes and will ensure a seamless and efficient way of ensuring continued control to all aircraft under control.

The above scenario is the ideal way, but it is rather complicated and a much simpler method is generally used:

- Inform the next controller about the current situation via Teamspeak or other means.
- Co-ordinate when the next controller is ready to take over.
- Go offline so that the new controller can login as an active controller.
- Logon again as observer if necessary.

7.4 Coordination between different ATC units [S+]

Information to/from Aerodrome Control (TWR)

Pertinent data on all overflying traffic which will enter or pass adjacent to the Aerodrome Traffic Zone

The anticipated order of arriving traffic

The anticipated delay to departing IFR flights together with the reason for the delay

Information to Area Control (CTR)

Lowest level at the holding facility available for use by CTR

Missed approaches when re-routing is entailed, in order that the subsequent action may be coordinated

Coordination with TWR

Aircraft approaching to land; if necessary requesting clearance

to land Arriving aircraft which are to be cleared to visual holding points Aircraft routeing through the traffic circuit

Transfer of Control/Communications

APP has responsibility for ALL flights (within its area of responsibility) which are NOT operating by visual reference to the surface i.e. any flight which is flying by reference to instruments.

Control of IFR flights may be transferred by APP to TWR control in the following circumstances;

- Aircraft operating in the aerodrome traffic circuit
- Aircraft approaching visually below all cloud when the reported aerodrome visibility is 10 km or more

APP may instruct IFR flights to establish communications with TWR control (for the purpose of obtaining landing clearance and essential aerodrome information) when the aircraft has become number one to approach and, for following aircraft, when they are established on approach and have been provided with the appropriate separation. Until such aircraft are flying by visual reference to the surface the responsibility for separation between them will remain with APP; TWR shall not issue any instructions or advice which would reduce the separation established by APP.

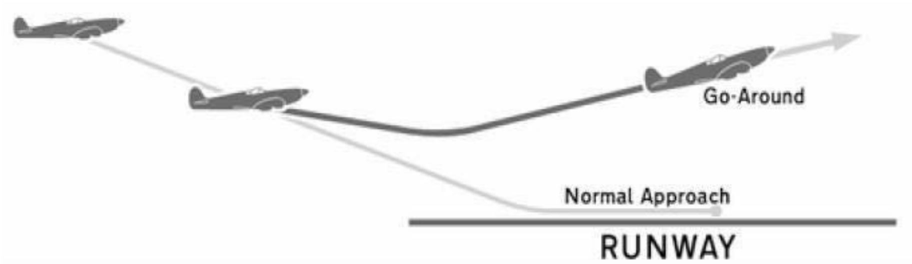
8 THE UNEXPECTED

8.1 General

You are manning a position and all has been going smooth since you came on line. Aircraft are following their routes, filing their flight plans, departing and arriving as directed and you wonder if anything ever gets interesting. Well it does as there are a few not so usual situations that can occur from time to time, especially at the Practical Tests all members have to take and pass for the Controller ratings.

We thought it may be interesting and beneficial to cover a number of these situations, in effect members are urged to simulate these on line as part of local VACC training, getting together with a few friendly pilots who are willing to participate. Some of the situations described below can occur in VATSIM others at least at the present time are impossible to recreate, however we hope you enjoy learning a bit about them all.

8.1.1 Missed Approach [SS]



A **go-around**, **overshoot** or **missed approach** is an aborted landing of an aircraft which is on final approach.

Missed Approach procedures differ from airport to airport and the procedure to be flown can be found on the respective approach plates. In general in VATSIM, ATC usually tends to give all aircraft the same command on a Missed Approach being something similar to:

> ***EX123 Fly runway heading to 3000ft, stand by for vectors.***

Whilst one could argue that there really is nothing wrong with this approach to things, as it would allow the pilot to climb on the runway heading giving him or her the time to read the published procedure, the fact is that it is not really correct as there are specific Missed Approach procedures in use at various fields, which call for different instructions.

The Fly Runway heading in VATSIM is being used generally for a number of reasons

- Easy to remember.
- Gives the ATC flexibility in deciding if the approach will be a left or a right had turn
- Easy for pilots.

However, as most of us know, the increasingly sophisticated Add On packages available means that a growing number of us are able to follow the correct Missed Approach procedure which – you have guessed it – is not a runway heading.

8.1.2 Standard Terms

Let us look at the standard phrases and terms that exist in respect to missed approaches, there are more than one may think.

- Missed Approach **(MA):** Other expression for Missed Approach Segment.
- Missed Approach Point **(MAPt)**: This designates the point during a non-precision instrument approach that signals the termination of the final approach and the start of the missed approach segment, this point may be:

  1. The intersection of an electronic glide path with a decision height.
  2. A NAVAID located at the field
  3. A suitable fix, for example a DME
  4. A specified distance beyond the NAVAID or final approach fix, (FAF), not to be exceeded.
  5. Missed Approach Holding Waypoint (MAHWP) the waypoint designated in the missed approach segment of an instrument approach procedure to which the aircraft will automatically fly and upon reaching this position, enter a specified holding pattern.

- Missed Approach procedure: The procedure that has to be followed after an instrument approach procedure, if, for any reason, a landing can not be effected. it normally occurs:
- When the Aircraft has descended to the decision height **(DH)** or to the minimum descent altitude **(MDA)** and reached the missed approach point or waypoint and has not established the required visual reference to land.
- When the aircraft is directed by ATC to pull up or to Go Around.
- Missed Approach Segment: The Part of an instrument approach procedure between the missed approach point, **(MAPt)**, the missed approach waypoint **(MAWP)** or the point of arrival at Decision Height, and the specified missed approach NAVAID, intersection, fix or waypoint, as appropriate, at the minimum IFR altitude. It is in this part of the approach procedure that the aircraft climbs and returns to the en-route structure or is directed for holding or subsequent approach.
- The route of flight and altitudes are shown on instrument approach charts.
- Missed Approach Turning Waypoint: **(MATWP)** The waypoint designated in the missed approach segment of an instrument approach procedure to which the aircraft will automatically fly en route to the specified missed approach holding waypoint.**(MAHWP)**
- Missed Approach Waypoint **(MAWP)** The waypoint on the final approach course that signifies the termination of the final approach segment and the start of the missed approach segment.
- Overshoot: The phase of a flight wherein a landing approach of an aircraft is not continued to touchdown **(also called Go-Around)**
- Decision height **(DH)** is a specified height in the precision a
- pproach at which a missed approach must be initiated if the required visual reference to continue the approach has not been acquired. This altitude

specified gives the pilot sufficient time to safely re-configure the aircraft to climb and execute the missed approach procedures while remaining clear of terrain and obstacles.

8.1.3 Reasons for Go Around

The go-around procedure may be initiated either by ATC or by the captain of the aircraft. The air traffic controller will instruct the pilot to go around if there is an aircraft, vehicle or object on the runway. or there are other hazards that could bring the aircraft into a dangerous situation unless instructed to go around. The captain will decide to go around if the aircraft is not lined up or configured properly for the approach, a landing aircraft has not cleared the runway, no landing clearance was issued, the runway is not visible by the time the aircraft reaches the decision height because of low visibility, or if other dangerous meteorological conditions are experienced on final approach.

A go-around in itself does not constitute any sort of emergency. In other words:
An aircraft shall be instructed by ATC to carry out a missed approach in any of the following cases:

- On Instructions from TWR ATC if no landing clearance is received at the MAWP or DH
- On Instructions from TWR ATC if the aircraft appears to be wrongly positioned on final approach.
- On Instructions from TWR ATC if the aircraft is not visible on radar during final approach.
- On instructions from TWR ATC if the landing runway is not cleared by other aircraft"s.

An Aircraft can initiate a Go Around on his own if:

- The pilot arrives at DH and is still in the clouds and does not have any visual references
- The pilot has not received Landing Clearance at the DH In this situation actually the pilot HAS to go around except if the pilot decides that going around would bring the aircraft into a more dangerous situation than landing (for example if low on fuel)
- The pilot deems that to continue the approach would endanger the aircraft.

8.1.4 The Procedure

When the captain is instructed, or decides himself to go around, he will apply full power to the engines, adopt an appropriate climb attitude and airspeed, retract landing gear, retract flaps as necessary and follow the published missed approach procedure (a set path to follow in the event of a go-around) or the instructions of the air traffic controller.

A common mistake, which again and again is heard by ATC from different countries instructing an aircraft executing a missed approach, is the following command:

EX123 climb to 3000ft on runway heading.

<u>This is wrong</u>; there is no need to tell the pilot to climb! The pilot is already climbing

as per the prescribed Missed Approach Procedures.

The correct command should be something like this:

EX123 execute missed approach for runway xx
Or
EX123 continue missed approach, stand by for vectors.
Or
EX123 Roger

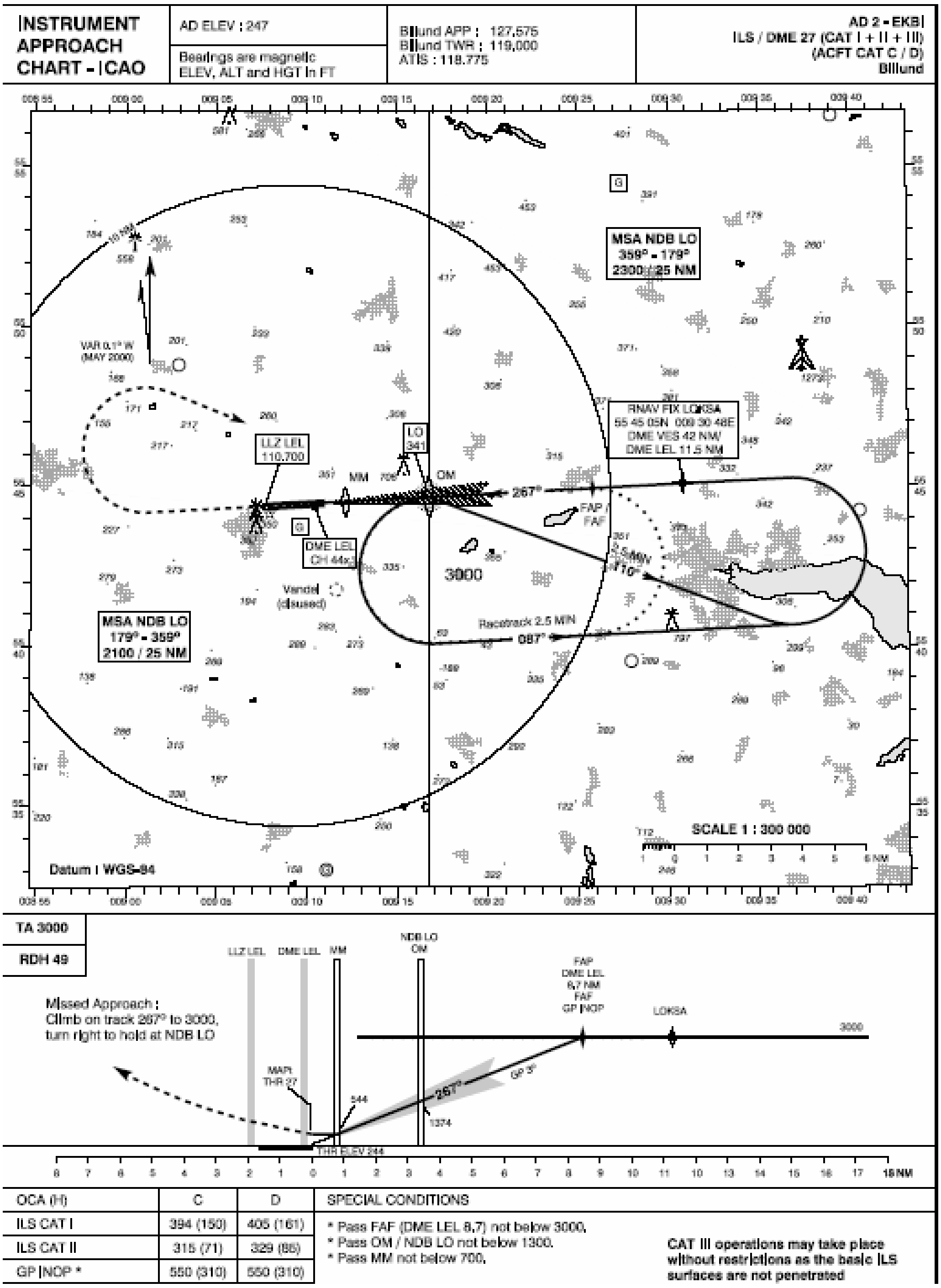
However many pilots on VATSIM are not prepared for a possible missed approach and do know the missed approach procedures. ATC should ask the pilot whether he is able to follow standard missed approach. If he does not then vectors similar to the example.

8.1.5 Practical Examples

Choose any local approach chart from your VACC and get familiar with the missed approach procedures. The example below illustrates a simple missed approach procedure and the impact this may have on ATC.

Runway 27: The aircraft continues on a track of 267° to 3000ft and upon reaching 3000 feet (more or less 2nm from GE) the pilot would turn right toward the LO NDB on 314 and would enter the prescribed hold at LO.

The above procedure should happen automatically and unless ATC gives a different command.



As you can imagine we do not want an aircraft circling at 3000ft over LO for too long, especially if there is more traffic inbound the field. So, prior to the aircraft arriving at LO, you could instruct the aircraft to leave LO on heading 110 for a left hand procedural approach back to runway 27.

EX123, going around

Twr "somewhere" Copy Exair123 execute missed approach rwy 27, report inbound LOC

EX123, inbound LO

Twr "somewhere" Exair123 leave LO on Heading 110, maintain 3000ft vectors for LOC runway 27

From there onwards it is only a matter of vectoring to bring the aircraft back to the LOC as usual.

Different Fields use different procedures and these procedures again are different depending on the type of aircraft involved in the process. The main thing to bear in mind is that the missed approach procedure does involve a prescribed hold unless ATC instructs the pilot differently.

8.2 Loss of Radar Contact [C+]

There are two main methods to control traffic: Radar and Non-Radar.

Radar is used to accurately determine each aircraft"s position in order to separate and sequence traffic.

Non-radar uses time and distance to create blocks of protected airspace for each aircraft along its route.

In real-life, both methods are normally used together according to the situation and equipment limitations, as Radar coverage may not always be 100%. Especially over the ocean or in remote areas.

Procedural Approaches are normally used in NON RADAR environment; hence they will hardly (if ever) be of importance for us as VATSIM is a 100% radar environment.

8.2.1 VATSIM Limitations and Implications

However, having said this, we can if we so want to; simulate a Non Radar environment. Such a simulation may in fact be simulated during a Controller Practical Test

In earlier versions of the software we use it was possible for a pilot to disconnect from the servers whilst maintaining voice contact as the programs used were standalone applications. With voice now being integrated the moment a pilot disconnects he or she is totally gone. The only way to simulate a loss of radar contact is:

- For the pilot to disconnect but keep a pre agreed kind of voice communication open, for example team speak or Skype
- For the pilot to change his Squawk from C mode to Standby mode, as ATC you will lose all the vital data. Depending on radar mode used you may see an "x".
- For you as ATC to turn off the monitor, the problem here would be that all traffic in your area is blanked out.

In practice (if this situation should occur) then the most likely scenario will be the pilots continuing on line but in Standby mode.

Assuming however that a non-radar or radar loss occurs then you as ATC will have to reply mainly on the pilot being able to maintain non-radar separation minima: which is the minimum (visual) separation to be maintained by approaching aircraft following a published procedure approach.

8.2.2 How to Handle

Very straight forward, an aircraft is with you on voice and radar and cleared inbound your field the aircraft will be told to somehow do a magic disappearance trick and you as ATC loose the vital data.
However the aircraft is still there and is still moving at the same speed/heading and FL as when he disappeared from the scope and he is still with you on voice.

As ATC you will need to “talk” the aircraft in and the pilots need to be able to navigate using VOR, DME, NDB and ILS frequencies and radials.

This is a clear example of team coordination between ATC and a Pilot as ATC will rely solely on the position updates received from the pilot based on which ATC issues further lateral or vertical instructions and commands.

The example below follows a theoretical approach to rwy 04L at EKCH but the procedures and hints are similar where ever you control.
http://www.slv.dk/Dokumenter/dscgi/ds.py/View/Collection-344
Let us assume we are using runway 04L for arrival and the aircraft is coming in initially via the SVD VOR the pilot has just turned to heading 210 and you have cleared him to descend and maintain FL80 when he “disappears”
The following tools then become available.

- SVD vor
- KAS vor
- KOR vor
- RK ndb
- And finally the ILS frequency for 04L

Initially we want the pilot to tune into SVD and KAS VOR, you know at what FL the pilot is on and being under FL100 the pilot should be respecting speed restrictions.
In any case reiterate these restrictions to the pilot.

Next instruct the pilot to fly the outbound radial 210 from SVD and report when at 20nm from SVD, once he reports at that point you can descend him to FL60. You next reporting point will be when he is still on the outbound radial 210 from SVD but intercepting the outbound radial 300 from KAS (abeam the KAS VOR).

This will mean he is more or less 2 miles north/east of VLL, once he reports in, instruct the pilot to turn left heading 175.

If the pilot follows this to the letter he will be flying direct over EKRK, if the weather is clear instruct the pilot to report over EKRK. More often however the pilot should be instructed to report abeam the RK NDB. Once reported at EKRK or RK NDB as the case may be, descend the pilot to altitude 4500ft on the local QNH and instruct pilot to report at 15nm KAS on radial 75 and/or to report at 20nm KOR on radial 255.

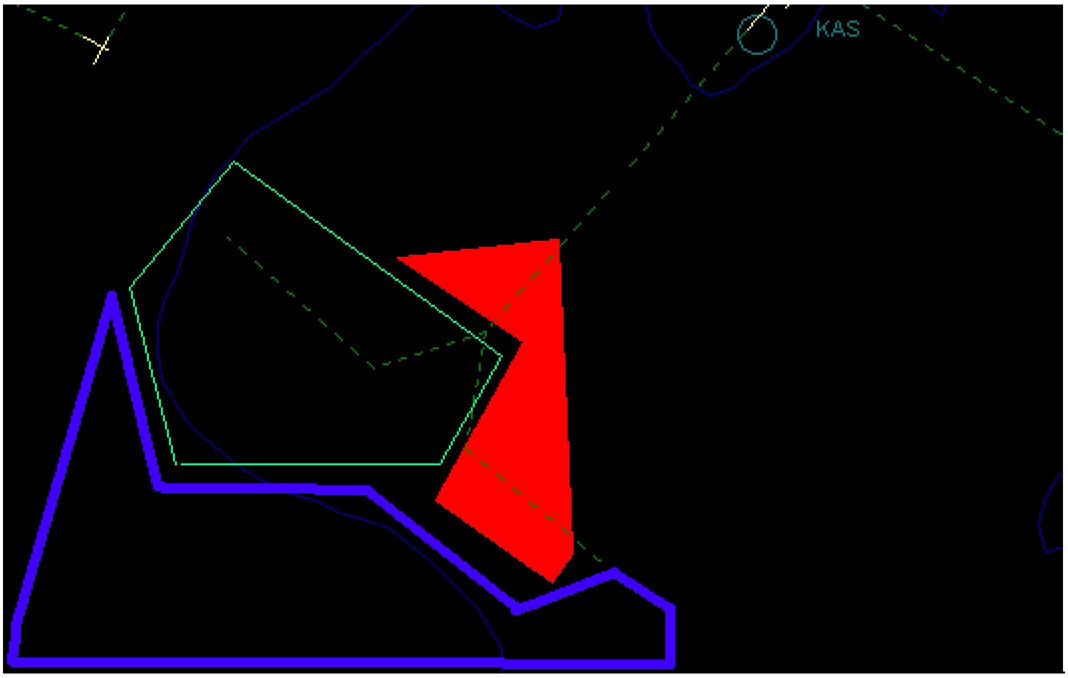
The moment he report in at either of these, turn him left base to heading 130, clear him to 2500feet, issue further speed restrictions setting him up for approach and then wait a minute or so until you clear further to heading 070 for ILS approach to 04L.

All this time; you have cleared all other traffic away from the possible conflict zone and relied on the pilots to issue visual contacts or TCAS alerts when necessary.

Easy! But wait! The above scenario assumes that the Winds are CALM, without drift, so once the wind factor comes into the equation, things will change and you need to compensate for this.

The trick is that the pilot needs to be able to triangulate where he is in relation to 2 VOR‟s, possibly combined with an NDB. Based on his progress reports you should be able to "picture" where he is and ensure other traffic is not overly inconvenienced.

As at some point you need to check your progress, ask the pilot to reconnect or Squawk C mode again or in the event you turned off your monitor power it up.



The target area in which you want him to appear is within the Green lines, as these puts him more or less in a safe approach position towards the runway, and in this case you have done well.

If he appears within the Red area then he is at an incorrect angle to intercept the ILS properly and should make a missed approach.
If he is in the Blue area then either the pilot needs to take a refreshment course into reading his instruments or ATC has been overly cautious and maintained far too much separation with preceding aircraft.

8.2.3 Phraseology

APP Somewhere, ExAir123 lost radar contact, do you copy on voice? ExAir123, Approach affirmative
APP Somewhere, ExAir123 report speed, heading and FL ExAir123 speed 310, heading 180, FL120
APP Somewhere, ExAir123, depart SVD on R-210, descend FL80, speed

250kias ExAir123, copy SVD on R-210, FL80 and speed 250kias
APP Somewhere, ExAir123 report DME 20 SVD VOR on R-210 ExAir 123, reporting at D20 SVD on 210
APP Somewhere, ExAir123 descend FL60, maintain present heading report abeam KAS VOR
ExAir123 copy FL60, hdg 210 will report abeam KAS
ExAir123 reporting abeam KAS
APP Somewhere, ExAir123 copy, turn left heading 175 for vectors ILS APP runway 04L, report over EKRK or RK NDB
ExAir123, left hdg 175 for 04L will report over EKRK or RK NDB ExAir123 reporting over EKRK, (or RK NDB) FL60
APP Somewhere, ExAir123 descend to 4500ft on QNH 1013 report D15 KAS on radial 075
ExAir123 Wilco.
ExAir123 at D15 on R-075 KAS

APP Somewhere, ExAir123 turn left for base hdg 130 descend to 2500ft, reduce speed to 190kias
ExAir123, 2500ft, 190kias on base leg
APP Somewhere, ExAir123 turn left hdg 070 cleared ILS app 04L please log back on SB now or Squawk C mode now
ExAir123 copy.

We should not ever use these procedures unless approved as part of a Practical test or upon request from a pilot wanting to test his flying skills making use of his IFR instruments or on request of an ATC wanting to gain more “spatial” knowledge. Having trained this kind of situation ATC hopefully have learned how to anticipate in their mind where an aircraft is in relation to other aircraft and in relation to the Airport and active runway.

8.3 Communication Failure [C]

In VATSIM, our environment, it is impossible to have a communication loss as we have redundancy since we can use both Voice and Text. In real life though a 7600 squawk signifies No Radio or Lost Verbal Communication.
This code lets controllers know that a radio failure has occurred on the plane. Planes with a radio failure are given priority over other, non- emergency traffic, and as long as the pilot has visual contact with the airfield, then ATC will communicate with them via aviation light signals.

8.3.1 Light Signals

Neither Flight Simulator nor our on line programs are capable of mimicking the use of aviation light signals so this will never occur at the present time in VATSIM but assuming it could.

In the case of a radio failure or aircraft not equipped with a radio, air traffic control may use a light gun to direct the aircraft. The light gun has a focused bright beam and is capable of emitting three different colors: Red, white and green. These colors may be flashed or steady, and have different meanings to aircraft in flight or on the ground. Planes can acknowledge the instruction by wiggling their wings, moving the ailerons if on the ground, or by flashing their landing or navigation lights during hours of darkness.

	Aircraft In Flight	Aircraft On the Ground	Ground Vehicles or Personnel
Flashing White	N/A	Return to engine start-up point	
Steady Green	Cleared to land	Cleared for takeoff	Cleared to cross/proceed
Flashing Green	cleared to approach airport, or return to land	Cleared to taxi	N/A
Steady Red	Continue circling, give way to other aircraft	Stop	
Flashing Red	Airport unsafe, do not land	Immediately taxi clear of runway in use	Clear the taxiway/runway
Alternating Red and Green	Danger, continue current action with caution		
Red-red-green sequence	Nearing restricted airspace	N/A	
Blinking Runway Lights	vehicles, planes, and pedestrians immediately clear landing area in use		

8.3.2 Procedural Approach

In the event a “simulated” radio communication failure should occur, you as ATC will be able to track the aircraft and vector possible conflicting traffic away from the stricken aircraft which in the absence of instructions will follow a procedure similar to lost radar contact.

Instrument approaches are generally designed such that a pilot of an aircraft in instrument meteorological conditions (IMC), by the means of navigation with no assistance from air traffic control, can navigate to the airport, hold in the vicinity of the airport if required, then fly to a position from where he or she can obtain sufficient visual reference of the runway for a safe landing to be made, or execute a missed approach if the visibility is below the minimums required to execute a safe landing. The whole of the approach is defined and published in this way so that aircraft can land if they suffer from radio failure; it also allows instrument approaches to be made procedurally at airports where air traffic control does not use radar or in the case of radar failure.

- **PROCEDURE**: A recommended or optional directive or a mode of operation.
- **PROCEDURE TURN**: A maneuver in which a turn is made away from a designated track followed by a turn in the opposite direction, both turns being executed so as to permit the aircraft to intercept and proceed along

the reciprocal of the designated track. Procedure turns are designated "left" or "right" according to the direction of the initial turn. However, if possible, the procedure turn is designated "left."(also called a "teardrop")

- **SEPARATION MINIMA**: Minimum (visual) separation to be maintained by approaching aircraft following a published procedure approach.

8.3.3 ATC Action

As ATC you will not have any further involvement with this aircraft and your job is limited to ensuring that all other aircraft in the area are advised that there is an aircraft in distress in the vicinity and that they may expect vectors or holds or delays due to the present situation.

ATC will ensure that the airspace and the primary landing runway are kept free of any conflicting traffic to ease the approach of the aircraft in question simulating 7600.

Code 7600 is frowned upon in VATSIM as it is not realistic in our simulated environment. in the simulation. As such unless this was pre-arranged and part of a practical test as ATC you should call for supervisor assistance and in the absence of any supervisor on line you should file an incident report.

8.4 Emergencies [C]

Ending this series of the "unexpected" we focus on Emergencies
An emergency condition is classified in accordance with the degree of danger or hazard present.

(a) **Distress** is a situation where safety is being threatened by grave and imminent danger and requires immediate assistance. The spoken word for distress is MAYDAY and is pronounced 3 times.

(b) **Urgency** is a situation where the safety of an aircraft or other vehicle or of some person on board or within sight is threatened, but does not require immediate assistance. The spoken word for urgency is PAN- PAN, and is pronounced 3 times..

The first transmission of the distress call and message by an aircraft should be on the air-to- ground frequency in use at the time. If the aircraft is unable to establish communication on the frequency in use, the distress call and message should be repeated on the general calling and distress frequency 121.500 MHz, or any other frequency available, in an effort to establish communications with any ground or other aircraft station.

The distress call shall have absolute priority over all other transmissions. All stations hearing it shall immediately cease any transmission which may interfere with it and shall listen on the frequency used for the distress call.

8.4.1 Example of a Distress Message

MAYDAY, MAYDAY, MAYDAY, THIS IS EX123, FIVE ZERO MILES SOUTH OF BUDAPEST AT ONE SEVEN TWO FIVE ZULU, FLIGHT LEVEL TWO HUNDRED, AIRBUS 320, OUT OF FUEL, WILL ATTEMPT CRASH LANDING AT LHBP, EX123 OVER

8.4.2 Example of an Urgency Message

PAN-PAN,PAN-PAN,PAN-PAN, ALL STATIONS, ALL STATIONS, , THIS IS BORDEAUX APPROACH, REPEAT THIS IS BORDEAUX APPROACH, EMERGENCY DESCENT AT BORDEAUX AIRPORT, ATC INSTRUCTS ALL AIRCRAFT BELOW FLIGHT LEVEL 70 WITHIN RADIUS OF ONE FIVE MILES OF XYZ VOR LEAVE WEST AND NORTH COURSES IMMEDIATELY, THIS IS BORDEAUX APPROACH OUT.

8.4.3 Contingencies

(a) The following general procedures are intended as guidance only. Although all possible contingencies cannot be covered, they provide for cases of inability to maintain assigned level due to:

(i) Weather;
(ii) Aircraft performance; and
(iii) Pressurization failure.

The pilot‟s judgment shall determine the sequence of actions to be taken, taking into account specific circumstances, and ATC shall render all possible assistance.
(b) If an aircraft is unable to continue flight in accordance with its ATC clearance, a revised clearance shall, whenever possible, be obtained prior to initiating any action, using a distress or urgency signal if appropriate. If prior clearance cannot be obtained, an ATC clearance shall be obtained at the earliest possible time. The pilot should take the following actions until a revised ATC clearance is received:

(i) Establish communications with and alert nearby aircraft by broadcasting, at suitable intervals: flight identification, flight level, aircraft position, (including the ATS route designator or the track code) and intentions on the frequency in use.
(ii) Initiate such action as necessary to ensure safety. If the pilot determines that there is another aircraft at or near the same flight level, which might conflict, the pilot is expected to adjust the path of the aircraft, as necessary, to avoid conflict.

8.4.4 ATC Action and Reaction

This is the most serious of the 3 codes, as it signals that the aircraft is either in distress or in an unsafe condition requiring urgent action from both ATC as pilot.

The first thing to do is to react on the “Mayday” (Distress) or “Pan-Pan” (Serious Emergency) messages broadcast by the pilot.

- Acknowledge receipt of Emergency.
- Inquire as to the nature of the Emergency.
- Inquire as to the number of souls (persons) on board.
- Inquire as to the fuel on board, in terms of minutes of flight time.
- Let the PIC state his intentions or request.

ExAir123, Mayday received, when able Advise Nature of Emergency, Pax and Fuel on board and Intentions.

Remember that the pilot has a lot to do in trying to control an unresponsive aircraft and he may not be in a position to give you an immediate answer, don‟t get upset or press for a reply.

Assist the pilot as best as you can, ensure that ALL traffic in the area is well clear of the code 7700 aircraft both horizontally and laterally. If it looks like the code 7700 is approaching an airfield in order to attempt a landing, ensure the approach to and the runway is free of conflicting traffic.

If you have other inbound IFR or VFR traffic, vector them around and away from the Code 7700 aircraft.

A 7700 code takes precedence over ALL other traffic, ATC need to give this code 7700 its utmost time and attention without forgetting all other traffic under its area of control.

If you encounter a 7700 on route requesting deviation to a nearest airfield which happens to lie outside of your FIR, advise pilot that nearest airfield is ABC at XX nautical miles in the ABC FIR. Or nearest local Field is XYZ at YY nautical miles, let the pilot choose which one he wants.

If he chooses the one outside of your FIR, co-ordinate the hand over with the appropriate ATC and hand the flight over in normal manner.

If possible, keep the pilot advised of the actions taken. Inform other traffic of the situation in order to prevent the transfer of traffic to the frequency used for the distress communication.

Assist the aircraft in emergency by the following action with respect to voice communication:

Impose silence on stations interfering with the distress communication. Address such instruction to "all stations" or to a particular station, according to circumstances.
Madrid Tower, To All Stations, stop transmitting, mayday in progress.

When distress communication has ended or when silence is no longer required on the frequency used for distress communication, transmit a message to "all stations" indicating that normal operations can be continued.
Madrid Tower, To All Stations, distress traffic ended

9 VFR FLIGHT

9.1 Visual Flight Rules [C]

As both navigation and phraseology is different than when dealing with IFR pilots we hope you will find this guide interesting.

The last few years have seen an ever increasing number of VFR scenery add-on packages and VFR flights are becoming more popular. As a controller you will sooner or later have one or more VFR aircraft in your area.

VFR contrary to popular belief does not mean a pilot can take off from where ever he wants and criss cross a FIR to a destination aerodrome.

Pilots flying under VFR assume responsibility for their separation from all other aircraft and are not assigned routes or altitudes by ATC. They fly on their own using a "see and be seen" separation criteria. In busier controlled airspace, VFR aircraft are required to have a transponder this amplifies the radar signal (as well broadcasting altitude level and a transponder code), and is used to allow controllers to warn IFR aircraft of any potential conflict. Governing agencies establish strict VFR "weather minima" for visibility, distance from clouds, and altitude to ensure that VFR pilots can be seen from a far enough distance.

In airspace „C‟ ATC separates all aircrafts from each other (including VFR from VFR). ATC can assign VFR routings or altitudes (minimum or maximum or both) to aircrafts in airspace C and D.

Whilst the VFR pilot does not “need” to rely on radar for navigation or separation the fact is that the VFR aircraft in VATSIM is tagged on radar at all times. A pilot following a Visual Flight still has to adhere to a number of rules, follow specific VFR routes and report at specific VFR reporting points.

9.1.1 Basic Radar Service to VFR Traffic [C]

VFR pilots can request, and ATC can elect to provide "VFR Advisory Services," if the controllers' workload permits. This is also referred to as "Flight following." Under this environment, the controllers will radar identify the VFR aircraft and provide traffic information and weather advisory services for the VFR pilot. Controllers do not provide any instructions concerning direction of flight, altitude, or speed to the VFR pilot receiving advisory services, and they do not provide separation services. This is an optional service and may be discontinued by ATC or the pilot at any time. Other optional service provided can be:

- **Safety alerts**
- **Traffic advisories**
- **Limited radar vectoring, when requested by the pilot and ATC workload is low.**
- **Sequencing at locations where procedures have been established for this purpose and/or when covered by a letter of agreement**

9.1.2 Visual Meteorological Conditions [C]

Needless to mention that the weather needs to meet minimum VMC at all times to allow a VFR flight from taking place.

No person may operate an aircraft under basic VFR when the flight visibility is less, or at a distance from clouds that is less, than that prescribed for the corresponding altitude and class of airspace. if they are not met then the flight must be flown under IFR

	Class B	Class C, D, E
Visibility	At or above FL100: 8km Below FL100: 5 km	At or above FL100: 8 km Below FL100: 5 km
Clouds	Clear of clouds	Horizontal distance minimum:1500m Vertical distance minimum: 300m (1000ft)

	Class F & G	
	Above 3000ft MSL or 1000ft AGL whichever is higher	At or below 3000ft MSL or 1000ft AGL whichever is higher
Visibility	5 km	3 km
Clouds	Horizontal distance minimum: 1500m Vertical distance minimum: 300m	Clear of clouds and ground in sight

9.1.3 VFR Waypoints [C]

In real life operations VFR Waypoints exist, these ease navigation for VFR pilots, using GPS systems for additional information to that contained in their VFR charts. The primary reason they were introduced was to enhance navigation when aircraft operate around congested airspace requiring route restrictions or mandatory reporting points

VFR Waypoints are assigned a discrete five-letter designator, which will be added to navigation databases. The waypoints will all begin with the letters "VP" and then have an additional three letters. The "VP" letters will provide immediate recognition that the waypoint is for VFR purposes only.

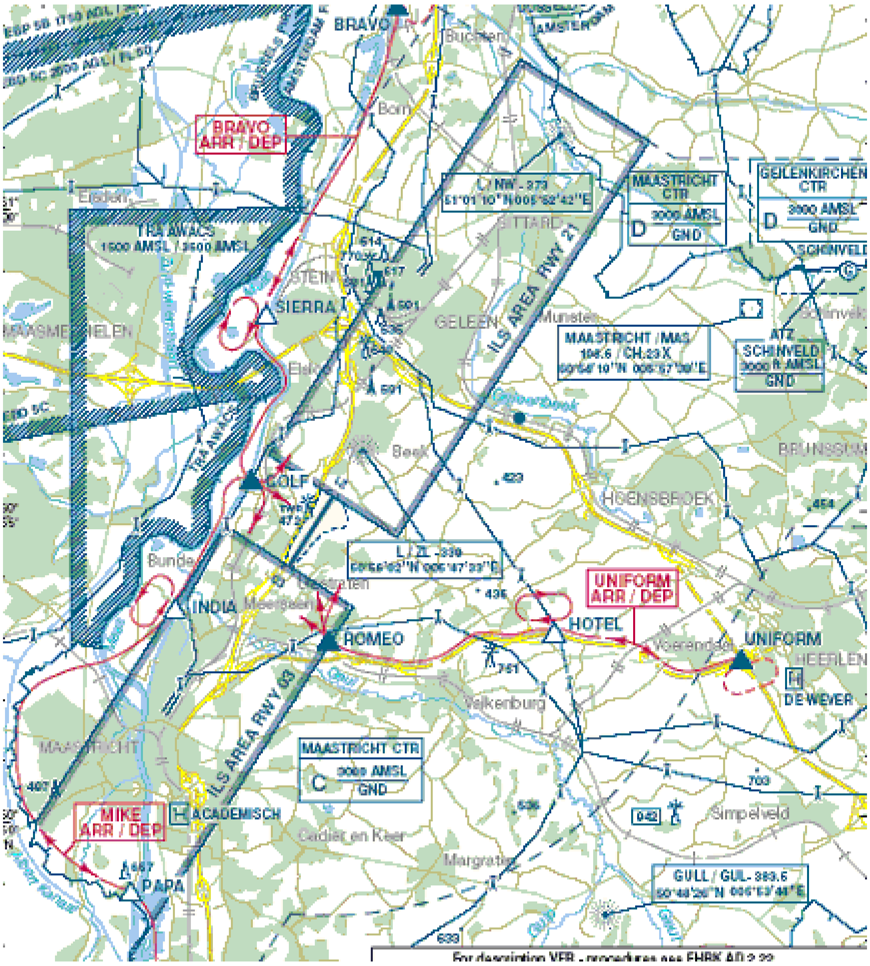
VFR Waypoints will also be used in conjunction with Visual Reporting Points. These points are used by air traffic control (ATC) for position reporting purposes. These VFR Waypoints will also be assigned a five-letter identifier. However, in communications with ATC, the reporting point will still be referred to by the full name and VFR Waypoints should be used as a tool to supplement current navigation procedures. Pilots are strongly encouraged to rely on aeronautical charts published specifically for visual navigation. If operating in a terminal area, pilots should take advantage of the charts available for that area.

Pilots must use the waypoints only when operating under VFR conditions. Anytime cloud clearance or flight visibility diminishes below minimums, VFR flight should be terminated immediately.

VFR Waypoints should not be used as a sole or primary means of visual navigation. Use of these waypoints, as one of many supplemental sources to navigation will increase proper situational awareness.

The five-letter identifier shall not be used in communications with ATC facilities. ATC will not be required to be familiar with VFR Waypoint's positions or identifiers. However, in communications with ATC, those waypoints used in conjunction with VFR reporting points shall be referred to by the Visual Reporting Point name.

To explain the concept we use as an example the VFR charts for EHBK (Maastricht Airport) in The Netherlands.



9.1.4 Reporting Points [C]

To avoid VFR traffic from flying criss-cross within a Control Zone which is also used for IFR traffic and to enable ATC to mix and match these various flights into and out from an aerodrome a VFR pilot has to follow standard VFR Arriving and Departing Routes which begin, end or are intersected by Reporting Points.

Usually these Reporting Points are distinctive natural or man-made landmarks, or buildings. The VFR Arrival and Departure Routes usually follow a road or a river. All aircraft flying under VFR conditions have to follow these routes with the exception of Police and Search and Rescue Helicopters.

The reporting points can be either compulsory reporting points or on request reporting points. A pilot has to report over the compulsory reporting point at all times except if ATC has issued an instruction invalidating this requirement. A pilot does not need to report over the on request reporting point, except if ATC has instructed to the contrary.

As you can see on the charts bellow the Compulsory Reporting Points are shown as a Solid Triangle whilst the on request reporting points are shown as an Non-filled-in Triangle, for example ROMEO is a Compulsory Reporting Point whilst HOTEL is an on request reporting point.

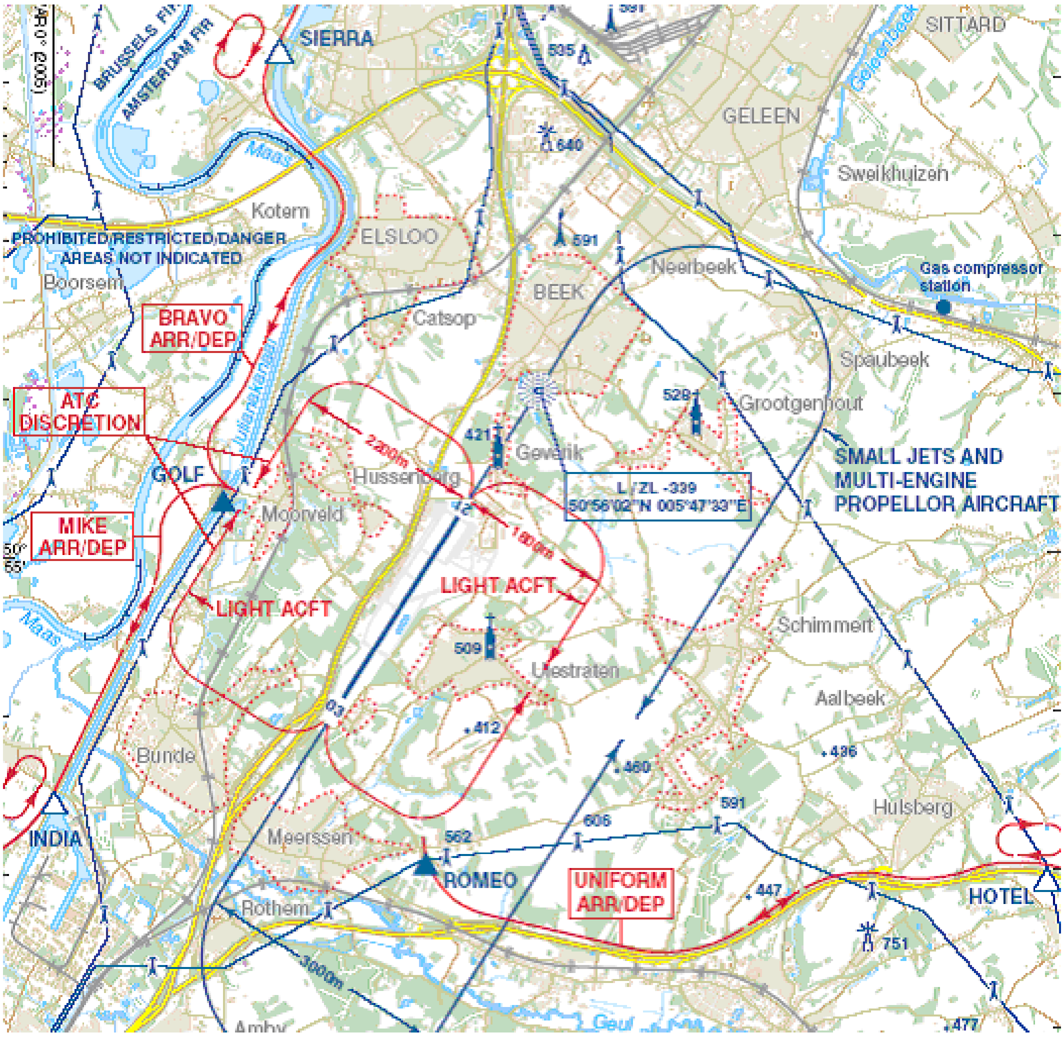
As you can see on the chart for Maastricht there are 3 Compulsory Reporting Points, BRAVO, MIKE and UNIFORM. Each of these points also designates the beginning or the end of the VFR departure or arrival routes.

The VFR routes are useable for VFR traffic regardless if arriving or departing and regardless of which runway is in use. If you look at the BRAVO route you will see that a pilot would have to report over BRAVO and proceed to the next compulsory reporting point which is GOLF via a non compulsory reporting point called SIERRA, or vice versa. This route clearly follows a river, in this case the Juliana Canal.

GOLF and ROMEO are the two exit or entry points into the Traffic Circuit which can only be accessed at the discretion of ATC. In practice if ATC is unable to provide a direct entry into the pattern then the VFR traffic would have been asked to circle at one of the four visual holding points, which as you can see are next to HOTEL, INDIA PAPA and SIERRA.

9.1.5 Sector Files[S+]

The VFR routes and reporting points can either be added to the regular sector file as part of the SID/STAR section and Fixes section or a standalone dedicated VFR sector file can be created.



9.1.6 ATC VFR instructions and phraseology [C]

A VFR pilot usually calls Ground or Tower directly, in real life they should call APRON or DELIVERY for their start up approval, assuming the pilot has done his pre-flight check and has started his engine(s), let us follow a flight from Start up to Engine shut. Bear in mind that VFR traffic does not have to listen in on ATIS, therefore the initial taxi clearance shall include the QNH.

As we are using the chart for Maastricht as the example, let us assume that our VFR pilot is PH-2GY a PA31 and that all ATC positions belong to Maastricht,

Pilot: Maastricht Ground, PH-2GY, good afternoon
GND: PH-2GY Maastricht Ground, good afternoon

Pilot: PH-2GY, PA31, General Aviation Apron VFR to Rotterdam via MIKE, request taxi
GND: PH-2GY, taxi to holding position runway 21 via, W and W1, QNH 1017
Pilot: PH-2GY, taxiing to runway 03 via W and W1, QNH 1017

The Pilot in the above example clearly stated his intention to fly VFR to Rotterdam via MIKE. The pilot could also have stated VFR to Rotterdam, or VFR via MIKE all three are possible, but stating the destination as well as the VFR departure route is the most complete manner.

Pilot: PH-2GY, ready for departure
GND: PH-2GY, contact Tower on 135.450
Pilot: PH-2GY, contacting Tower on 135.450

Pilot: Maastricht Tower, PH-2GY, at W1, ready for departure
TWR: PH-2GY, Maastricht Tower, line-up runway 21
Pilot: PH-2GY, lining up runway 21

TWR: PH-2GY, leave control zone via GOLF right turn approved, wind 175 degrees 11 knots, cleared for takeoff runway 21
Pilot: PH-2GY, leaving control zone via GOLF, right turn approved, cleared for takeoff runway 21

The clearance tells the pilot that he can take off, enter the right hand traffic pattern and leave the control zone over GOLF as Compulsory Reporting Point from where he would continue following the MIKE departure route.

Pilot: PH-2GY position GOLF at 1500 feet for 2500 ft
TWR: PH-2GY roger, continue
Pilot: PH-2GY, position MIKE, at 2500 feet
TWR: PH-2GY approved to leave the frequency, bye
Pilot: PH-2GY, Good bye

At this point the pilot would leave the frequency but could ask for VFR advisory service in which case the pilot would normally be asked to switch frequency to a radar controller. Or the pilot would continue on his own route to Rotterdam.

Half way to Rotterdam however the pilot decides to turn around and return to Maastricht. The aircraft is approaching the aerodrome from the South and the pilot will need to report his intentions before arriving over the compulsory reporting point UNIFORM.

Pilot: Maastricht Tower, PH-2GY
TWR: PH-2GY, Maastricht Tower go ahead
Pilot: PH-2GY, PA13, VFR, 10 miles South of UNIFORM, 2500 ft, for landing
TWR: PH-2GY, enter control zone via UNIFORM, runway 03, QNH 1009
Pilot: PH-2GY, entering control zone via UNIFORM, runway 03, QNH 1009

The pilot now knows he can enter the Control Zone and approach the aerodrome via the UNIFORM arrival route, and will need to report over ROMEO next. However further ATC clearance is required before the pilot can enter the actual traffic circuit after ROMEO.

Pilot: PH-2GY, position UNIFORM, 2500 feet
TWR: PH-2GY, roger

Pilot: PH-2GY, position ROMEO, 2500 feet

TWR: PH-2GY, join traffic circuit RWY 03
Pilot: PH-2GY, joining traffic circuit RWY 03

TWR: PH-2GY, wind 050 degrees 8 knots, cleared to land RWY03
Pilot: PH-2GY, cleared to land RWY 03

As you see the Pilot needs the clearance by ATC before entering the traffic pattern after ROMEO. In the event no such clearance is received then the pilot should enter the circling pattern as indicated on the charts or as instructed to by ATC.

TWR: PH-2GY, hold over HOTEL
TWR: PH-2GY, hold south of the field

For the rest the approach and landing clearances are similar to those used when dealing with IFR.

As TWR controller in VATSIM you most likely will have a mix of VFR and IFR traffic at the same time, most VFR traffic will be slow and most IFR traffic will be heavy or fast, below find a number of traffic situations and the required action needed to make the flow and sequencing of VFR and IFR be as smooth as possible.

The IFR traffic is being vectored and sequenced by Approach and as Tower your influence in this process is non-existent. If you have VFR traffic under your control you will need to slot them into the landing pattern the one and only influence you as TOWER has over Approach is to request that the IFR inbound traffic be separated more than usual to allow the VFR plane to be slotted in between.

Here are a few examples; again we will use PH-2GY the PA13 for approach to rwy 03 in Maastricht. KL123 a B737 on his way in on the ILS for RWY 03. The most common and easiest way to increase separation is to issue an Orbit or 360 degree instruction. This automatically increases the separation between the traffic.
TWR: PH-2GY make a right three sixty
Note the differences bellow:
TWR PH-2GY Orbit over POINT
This results in a continuous circling until ATC instructs to the contrary.
TWR PH-2GY Fly 360° over POINT
This results in one complete 360 degree circle after which the pilot will resume his original course.

TWR PH-2GY Fly one orbit over POINT
This results in one complete 360 degree circle after which the pilot will resume his original course.
TWR PH-2GY Fly 360s over POINT until further instructions
This results in a continuous circling until ATC instructs to the contrary.
Once the VFR pilot has made a full circle he would normally continue his downwind leg, and by this time the IFR traffic will either be on short final or will already have landed. Hence the VFR traffic can be cleared for the approach
The thing to bear in mind is the Wake Turbulence factor between aircraft categories as explained earlier. The wake turbulence warning should be given when the VFR traffic is still on his downwind leg as the pilot of the VFR aircraft can then use best judgment in deciding to increase or decrease this leg before turning in to final.

TWR: PH-2GY, caution wake turbulence from just landed Boeing 737

TWR: PH-2GY, caution wake turbulence from Boeing 737 on short final

In the event one full circle should not suffice to ensure sufficient separation between the various aircraft in the pattern or on final ATC can instruct the VFR traffic to continue orbiting until cleared for the approach.

TWR: PH-2GY, orbit left

TWR: PH-2GY, continue approach

Short Approach

If the IFR traffic is further than 8 miles distant from the field then ATC can ask a VFR pilot
if he can follow a short approach. This in essence means that the VFR aircraft will shorten his final approach to less than 1nm and land before the IFR traffic.

TWR: PH-2GY, can you accept a short approach?
Pilot: PH-2GY, affirm
TWR: PH-2GY, make a short approach, wind 090 at 5 knots, cleared to land rwy 03

ATC would then provide the pilot of the IFR flight with the required traffic information

Extended Approach

In the event that a pilot cannot execute a short final approach or if there is other traffic on short final, ATC can instruct the VFR traffic to extend the downwind leg thereby ensuring that the traffic is sequenced and sufficient separation exist between the different approaching aircraft. Remember as ATC, if you are sequencing a light propeller type aircraft in after a medium or heavy jet that wake turbulence will most probably be a factor.

TWR: PH-2GY; fly extended right downwind, standby for base.
TWR: PH-2GY; continue approach, caution wake turbulence from preceding *737.*

Pilot in Command

Another manner to deal with the situation is to pass the entire process to the pilots. In essence ATC advises the VFR pilot to follow and maintain visual separation with the IFR traffic **TWR: PH-2GY, Number two, follow Boeing 737 on 5 miles final, caution wake turbulence**

Bear in mind that it is good practice to advise the IFR flight crew of the existence of the VFR traffic in the area.
TWR: KL123, PA13 on downwind runway 03 at your 3 o'clock, report traffic in sight

The pilot in turn has the responsibility to inform ATC of having the preceding traffic in sight and indeed also report if he does not have traffic in sight, in which case the responsibility for separation returns to ATC.

9.1.7 Special Visual Flight Rules [C]

We have mentioned these before and whilst these are no relevant to VATSIM on line flying we thought it would be interesting to briefly explain what this is.

Special visual flight rules (SVFR) are a set of aviation regulations under which a pilot may operate an aircraft. A pilot can request an SVFR clearance from air traffic control to operate within an area of controlled airspace when the local weather is less than the minimums required for flight under visual flight rules. Like flight under instrument flight rules, air traffic control will provide separation from other aircraft; unlike IFR flight, the pilot does not require an instrument rating (for daytime SVFR flight) and the aircraft must remain clear of clouds and must maintain at least one mile of flight visibility. The pilot continues to be responsible for obstacle and terrain clearance.

SVFR clearances only apply within CTR‟s once the aircraft leaves the CTR the flight reverts to visual flight rules and weather requirements.

An example of a use for special visual flight rules would be ground fog or mist obscuring the ground visibility at a controlled airport while visual meteorological conditions exist above, or at to fly visually at night in control zones in countries that do not allow VFR night flights.

9.1.8 Composite Flight Plans [S]

The type of flight plan which a pilot intends to file and fly forms part of the flight plan in VATSIM you can identify these by looking at the Target or by looking at the flight plan. VATSIM only allows for I, V and S. in real life there are two other types the so called composites being Y and Z as outlined bellow.

I	IFR Instrument Flight Rules
V	VFR Visual Flight Rules
Y	Composite IFR/VFR aircraft will commence flight under IFR and change to VFR during the flight
Z	Composite VFR/IFR aircraft will commence flight under VFR and change to IFR during the flight.
S	Special VFR, an aircraft that will fly VFR when weather is under the normal VFR minima.

9.1.9 Non Charts on Board (VATSIM) [S]

It does happen on VATSIM that the pilot having filed the VFR flight has no charts what so ever on board and as such has no knowledge or ability to follow VFR routings, or report over VFR reporting points etc.

In these cases, ATC should monitor the progress and guide the traffic if required during the flight.

The main interaction will be on departure or approach where the pilot will not be able to follow the prescribed VFR routes. As such a departure clearance would normally be

TWR: PH-2GY; winds 240 at 11, runway 22R, depart runway heading cleared for take off

Or

TWR: PH-2GY; winds 240 at 11, runway 22R, straight out departure runway heading cleared for take off

Or

TWR: PH-2GY; winds 240 at 11, runway 22R, 45 degree left/right Departure cleared for take off

Similarly during Approach, instead of having the pilot report at the normal VFR reporting points, the pilot will most probably be flying direct to the airport; therefore ATC would limit the instructions to the basic.

TWR: PH-2GY; report filed in sight

10 SPECIAL OPERATIONS

From time to time as an on line VATSIM ATC Controller you will get traffic which falls into one of the categories below. It is surprising sometime to see how people panic or make things much more difficult than needed when dealing with "non-standard" traffic. We hope the following sections will make you feel more comfortable when confronted with this type of traffic in the future.

10.1 Military Flights

VATSIM is primarily a civilian airspace simulation however military simulation procedures are allowed as long as they conform to specific rules and regulations as approved from time to time by the VATSIM board.

10.1.1 What is allowed and what is not allowed [C]

It is allowed to simulate on-line peacetime military exercises, military transport operations; aircraft escort / intercept operations, any other non-hostile event or activity implied or expressed as military / para-military in nature. As well as Formation flying expressly for the purpose of simulating any military / para-military activity permitted under any Search & rescue, or fire-fighting and law enforcement operations.

See also http://vateud.net/default.php?section=0⊂=4#d13

In other words a member is not allowed to log on to the network fire up his F18 and start buzzing, intercepting, interfering, bombing, shorting at or otherwise hindering other traffic or hindering ATC.

All military or paramilitary traffic has to react at any given time to ATC command or instructions.

A few facilities on VATSIM have dedicated Military ATCO‟s with extensive and dedicated rules and regulations. It is not the scope of this guide to go into details but rather to give a brief overview of what can be expected.

The main thing to bear in mind if confronted by non-responding or interfering military traffic is to use your **".wallop"** command and ask for a Supervisor to assist you.

10.1.2 General

As a general rule the main concern of ATC when dealing with military traffic is to know the intentions of this traffic and to ensure that the standard separation between traffic is maintained at all times. All aircraft shall be coordinated before handoff if not laid down otherwise in local procedures all aircraft shall be routed and leveled according to ATC instructions

In general Military traffic is restricted from over flying the main airfields or TMA areas between certain Flight Levels and they have to adhere to speed restrictions, regardless if there is ATC on-line or not in the area.

10.1.3 Dutch Example

Each VACC will have its own local restrictions, but for illustration purpose we list here the restrictions in use in the Dutch VACC.

For military traffic the following (extra) rules apply within the Amsterdam FIR area: Maximum speed is 350 kts IAS, unless permission from ATC was given

Avoid the **Schiphol TMA** area (1500 ft - FL95) even when no ATC present, VFR flights below 1500 ft are permitted, yet these have to remain at least 10 nm distance from SPL VOR.
Avoid **civil CTR** area's (GND-3000 ft) of the following airports EHAM, EHGG, EHRD & EHBK.

All VFR flights should be in contact with ATC Amsterdam Radar (EHAA) or Dutch Mil (EHMC) if present.

Minimum altitude above land 1200 ft AGL for jet aircraft (VFR/IFR)
Minimum altitude above land 1000 ft AGL for transport aircraft (VFR/IFR) Minimum altitude above land 500 ft AGL for helicopters (VFR/IFR)
Minimum altitude above sea 100 ft AGL all aircraft (min 1nm outside coastline)
Intercepts or escorts of other aircraft are NOT allowed, unless permission is given by ATC and the aircraft involved.
As you can see the clearer the ground rules are the less the chance of misunderstanding and the more enjoyment for all concerned participating in the event or operation both from the pilot's view as from the ATCO's view.

10.1.4 Temporary Reserved Airspace
Military Aircraft usually operate in Temporary Reserved Airspace (TRA) which is closed for civilian traffic. This is to ensure safe separation of regular IFR and VFR traffic and Military traffic operating under VMC conditions.

Military traffic is required to receive ATC clearance to enter and operate in this airspace.
DRAGON6, cleared to operate in TRA150 (Area)

Separation is 2.5 NM from both sides of the boundary. This airspace may be activated and deactivated as needed. It is usually not active unless especially requested by military aircraft. Upon leaving the TRA, aircraft have to be given an IFR clearance again, except if they drop out the TRA at a level that allows VFR flights. In any case, a clearance to ensure that the aircraft have left the TRA has to be given.
DRAGON6, cleared to EKYT via AAL maintain FL330, squawk 1500
Or
DRAGON6, cleared to leave TRA150, continue visually, squawk Military VFR, approved to leave my frequency.

10.1.5 AWACS (Airborne Early Warning and Control Systems)
An AWACS is an orbit area at one fixed level in which an AWACS-Aircraft (E3, E4, and RC135) is operating. The AWACS track is activated as soon as the aircraft begins his orbit in the area. The AWACS pattern is defined by two center points. Around these two points a pattern is flown either as a racetrack pattern or a figure 8 pattern. The Aircraft needs a clearance by ATC to enter the orbit.
Aircraft in the orbit adopt the callsign: AWACS. An AWACS-Aircraft on normal IFR

flight plans bear normal mission callsigns, ie NATO2.
AWACS02 cleared into orbit 14A at FL280.
When the orbit is finished, the aircraft has to be given an IFR clearance.
NATO02, cleared to ETNG via BUE and NOR, Squawk 1234.

10.1.6 Military Formation Flights

A formation is defined as a certain number of aircraft within 1 NM and 100ft from the leader. Deviations from this rule may be approved by ATC however in this case the last aircraft has to be assigned an individual squawk. ATC instructions are made to the formation leader only.

Coordination within the formation is made on the ATC frequency. Furthermore the formation leader will squawk "C" mode and be assigned a transponder code, the rest of the formation will be squawking Stand-By Mode.

Formations may be split for or when:

- Split into single elements for landing
- Adverse weather
- Split for safety reasons
- Technical problems
- Different mission objectives
- Different aircraft types and performance problems

Formations can be split either by a issuing speed constraints or instructions, lateral or vertical split instructions. The most common is the Vertical Split as the different aircraft are given a different Flight Level instruction.
As ATC you start by contacting the formation leader to advise them about the imminent split:
TIGER1 prepare for Vertical Split

The formation leader would now communicate via text or on the squadron channel with the rest of the formation and prepare accordingly.
The next ATC command is to instruct the target to either climb or descent. In the event the aircraft being instructed to climb or descent is not the formation leader then ATC needs to assign a correct Squawk to this aircraft which needs to squawk "C" mode.
TIGER2, Descend to FL120, Squawk 1234 and IDENT

The target now lights up on your scope and you issue it with an in-flight IFR Clearance.
NATO2, Cleared to EHVL, Proceed direct XXX, maintain FL 120

To split a formation using Speed corrections or Lateral instructions is also possible although this is used less frequently than a vertical split. However when used would follow the same principle as the above examples. The heading change given to the aircraft being targeted for a lateral split should be 30 degrees or more.

Formations can be joined for or when:

- for mission objectives
- lost wingman

- Emergency situations to shepherd aircraft
- Air-to-Air Refueling

For aircraft to join a formation as ATC you need to ensure:
The aircraft joining is kept up to date about the bearing and range of the leader.
NATO2, FOX2 is at bearing 270 distance 15nm.

That sufficient separation exists until the aircraft about to join have visual contact and confirm they are able to continue visually.
NATO2 cleared to join visually report joined up and in formation

The joining aircraft needs to be joined below the leader.
NATO2, FOX2 at FL330, join from below

The aircraft joining needs to squawk Standby once it has joined the formation.
NATO2 Squawk Standby

Once the formation is complete either by 2 or more aircraft, the leader advises ATC and the formation about the new Formation Call Sign to be used.

10.1.7 Air to Air Refueling

Dedicated airspace around the refueling track is blocked laterally as well as vertically. Separation must be established to the airspace. Distance to the edge of the tanker orbit has to be 10NM at least. The airspace is activated as soon as the tanker-aircraft enters the orbit. The pattern is always a racetrack. The tanker-aircraft needs a clearance to operate in the refueling pattern
SHELL68, cleared to operate in HEIDI-Anchor, base level 230.

Whilst it is unlikely you will ever have to deal with this as a civilian controller the most notable thing to bear in mind is that the refuel area racetrack consists of 4 different flight levels.

The highest level is the breakaway Level for the Tanker Aircraft.

The 2nd highest is the Base Level (this is the level which the tanker will be flying).

The 3rd highest is the breakaway level of the aircraft about to be refueled.

The lowest level is the level which the receiving aircraft is flying.

In practice ATC clears the receiving traffic in behind and below the tanker until it it some 3nm to 5nm behind it. At this time control is transferred to the tanker operator who instructs the receiving aircraft to squawk Standby and who slots it in behind the tanker aircraft.

When refueling is completed the receiver is handed back to ATC, who assigns a new clearance and instructs the receiver to squawk “C” mode.

Upon completion of refueling the tanker aircraft shall be given a new IFR clearance for return to the base or field.

10.1.8 Phraseology

The callsigns are the most obvious difference as they follow no set alfa-numerical sequence and one can expect to see callsigns which range from the rather

obvious NATO1 or RAF10 to the unorthodox HOTDOG1, DODGER2, COBRA3, etc
As Approach/Tower Controller there are two things which differ when dealing with inbound military traffic.
Persons on board is asked at military aerodromes, to all aircraft even civilian traffic, with the exception of fighter aircraft which have 1 or 2 persons on board by default.
Tower, "COBRA3, request persons on board"
The need to remind the pilot to perform a landing gear down check
Tower, COBRA3, Check Gear
Further Codes and phraseology can be found at:
http://en.wikipedia.org/wiki/Brevity_code

10.2 Helicopter Flights

A helicopter is an aircraft which is lifted and propelled by one or more horizontal rotors. Helicopters are classified as rotary-wing aircraft to distinguish them from conventional fixed- wing aircraft.
As ATC the main things to bear in mind when handling Helicopters relates to the manner in which they taxi, take of and land.
Most of the larger fields have dedicated Helicopter Route Charts depicting the published helicopter routes, ATC frequencies, obstacles, landmarks, heliports, airspace classification etc.

10.2.1 Taxi and Take Off

All helicopters may use "air taxiing" procedures as required. However, wheeled helicopters, where practicable, should be requested to "ground taxi" on prepared surfaced to minimize rotor wash and its effects.

At controlled aerodromes, helicopters may be granted a take-off clearance or simply instructed to report airborne, as appropriate, from any area nominated by ATC or the pilot, and assessed by the pilot as being suitable.

Helicopters taking off must proceed in accordance with ATC instructions. Subject to clearance, a turn after take-off may be commenced when the pilot considers that the helicopter is at a safe height to do so.

Prescribed exit "gates" and associated standard routes and/or altitudes may be provided to facilitate the flow of helicopter traffic. The use of these "gates" is not mandatory. Helicopters may, subject to an ATC clearance, revert to the standard traffic procedure in use at the field instead.

This option may be more appropriate when operating larger helicopters.

At night a helicopter should not take-off other than from a site which conforms with the requirements any illuminated runway or illuminated taxiway of dimensions sufficient with the size of the helicopter landing site applicable to the helicopter.

When the pilot elects to conduct the take-off from outside the runway in use by aeroplanes, the helicopter take-off path must not cross the runway.
Before take-off, the helicopter is to be positioned to the appropriate side of the runway in use so that the turn after take-off does not cross the extended centre line of that runway. The pre take-off position of the helicopter will be by air transit/taxi or by ground taxiing as appropriate.

The turn after take-off onto the desired departure track may be commenced when the pilot considers that the helicopter is at a safe height to do so. If the resultant departure track conflicts with the aeroplane traffic pattern, the helicopter should remain at 500FT above the surface until clear of that circuit pattern.

Where this procedure is not practicable the helicopter is to adopt the standard departure procedure applicable to aeroplanes.

Heli123, Request Air Taxiing From GA stand 12 to Taxi Way C for Take off

Heli123, Air Taxi to taxi way C via F and G avoid vehicles on F.

Heli123, Request Departure Instructions

Heli123, After Departure Turn Left to hdg 130, then climb to 4000ft

10.2.2 Helicopter Corridors and Lanes

The following procedures for operations in helicopter access corridors and lanes apply:

- Maximum 120 KIAS.
- Helicopters operating under VFR, usually not below 500FT above the surface by day subject to flight over populous areas.
- Visual procedures must be used.
- Radar service may be given at designated aerodromes;
- Continuous listening on the appropriate ATC frequency in access corridors or broadcast frequency in lanes is mandatory
- The pilot-in-command has the responsibility to ensure that operations are confirmed within the boundaries of the corridor or lane;
- The limits of corridors and lanes must be adhered to, with any transitional altitude requirements maintained within an accuracy of ± 100FT;
- A helicopter not confirming its operations to an access corridor will require ATC clearance and while outside the corridor will be subject to separation standards as applied by ATC.

10.2.3 Arrivals and Landing

At a controlled aerodrome, prescribed entry "gates" and associated standard routed and/or altitudes may be provided to facilitate the flow of helicopter traffic. Use of these "gates" is not mandatory.

Subject to the receipt of an ATC clearance, helicopters may, if required, conform to the standard traffic procedures applicable to aeroplanes.

At night a helicopter should not land at a site other than illuminated runway or illuminated taxiway of dimensions sufficient with the size of the helicopter landing site applicable to the helicopter

10.2.4 Pattern

At controlled aerodromes specific operating procedures apply to helicopter traffic. Bear in mind that aircraft and helicopters do not mix well in the traffic pattern. The following generally applies for Helicopters.

- Where possible, helicopter circuit traffic will be separated from the aeroplane traffic pattern by the use of contra-direction circuits, outside of and parallel to the flight strip of the runway in use, and at a lower altitude than other traffic, but not below 500FT above the aerodrome elevation.

- When separated circuit patterns are not practicable, helicopters may utilize the same traffic pattern direction as other traffic, and will normally operate inside and at a lower altitude than the traffic, but not below 500FT above the aerodrome elevation.

At non-controlled aerodromes the following circuit operating procedures apply;

- Helicopters may be operated on contra-direction circuits and parallel to the aeroplane traffic pattern at a lower altitude than that traffic; but not below 500FT above the aerodrome elevation. The landing site associated with the helicopter circuit is to be positioned outside the flight strip of the runway in use so the helicopter circuit traffic does not cross the extended centre line of that runway.
- If the procedure outlined above is not practicable the helicopter circuit patterns should be flown inside and parallel to the aeroplane traffic and at lower altitudes, but not below 500FT above aerodrome elevation. The landing site associated with the helicopter circuit must be positioned outside the flight strip of the runway in use so that the helicopter circuit traffic does not cross the extended centre line of that runway.
- The helicopter must follow the standard aeroplane traffic pattern and, in this case, may use the fight strip area of the runway in use.

10.3 Oceanic Procedures [C]

This is mainly if interest for VACC members from Portugal, Ireland, Norway and Iceland who have Oceanic Control Procedures and we will not go into any real detail in this guide Due to the fact that there are no radar systems available for oceanic control, oceanic controllers provide ATC services using "non-radar" procedures. These procedures use aircraft position reports, time, altitude, distance, and speed to ensure separation. Controllers record information on flight progress strips and in specially developed oceanic computer systems as aircraft report positions.
The North Atlantic (NAT) region includes the following flight information regions (FIR): Bodo Oceanic, Gander Oceanic, New York Oceanic, Reykjavik, Santa Maria Oceanic, Shanwick Oceanic, and Sondrestrom. Most of the airspace in these FIRs is high seas airspace, wherein the International Civil Aviation Organization (ICAO) Council has determined that all rules regarding flight and operation of aircraft apply without exception. However, responsibility for enforcement of these rules rests with the state of registry of the aircraft or the state of the operator. Flight rules are contained in Annex 2 to the Convention on International Civil Aviation, and procedural aspects are covered in ICAO Doc 7030, "NAT Regional Supplementary Procedures." The majority of the airspace is controlled airspace. Instrument flight rules (IFR) apply to all flights at or above flight level (FL) 60 or 2000 feet above ground level (AGL), whichever is higher. These airspaces include:

- The New York Oceanic, Gander Oceanic, Shanwick Oceanic, Santa Maria Oceanic
- The Bodo Oceanic FIR when operating more than 100 nautical miles (NM) seaward from the shoreline above FL 195
- Sondrestrom FIR when operating outside the shoreline of Greenland
- Reykjavik FIR when operating in the oceanic sector, or in the domestic sector at or above FL 200
- The Shannon Oceanic Transition Area (SOTA)

Shanwick Oceanic manages the airspace over the Eastern Atlantic between 30°W and landfall with the UK and Ireland, and from 45N to 61N.

For in depth information on the various procedures please visit the

following links: http://www.nat-pco.org/nat/CurrentASM.pdf

http://avstop.com/Seaplane/70/ch3.html

For Scanwick Oceanic: http://www.vatsimuk.org/oceanic/index.php?page=control

10.4 Euro Control [C+]

Eurocontrol in VATEUD was created in order to provide ATC service in upper airspace only (FL245 and above) in areas that are not covered by any local VACC CTR position at any given time.

Information on Euro Control can be found at: http://euc-vacc.org/index.htm

Euro Control has one restriction in place being that only members holding a Senior Controller Rating or above can man these positions.

The Euro Control Areas are subdivided into 5 sectors

EURN_FSS - Eurocontrol North

- Voice callsign: "**Eurocontrol North**"
- Frequency: 133.45
- Covering: Bodø ENBD, Bodø Oceanic ENOB, Trondheim ENTR, Stavanger ENSV, Oslo ENOS, Sweden ESAA, Rovaniemi EFPS, Tampere EFES, Tallinn EETT, Riga EVRR, Vilnius EYVL, København EKDK and Reykjavik BIRD

EURM_CTR - Maastricht Euro Control

- Voice callsign: "**Maastricht Radar**"
- Frequency: 135.45
- Covering: Brussels EBBU, Amsterdam EHAA, Luxembourg ELLX, Berlin EDBB, Frankfurt EDFF, Dusseldorf EDLL, Munich EDMM, Bremen EDWW, Vienna LOVV and Switzerland LSAS

EURE_FSS - Eurocontrol East

- Voice callsign: "**Eurocontrol East**"
- Frequency: 135.30
- Covering: Warszawa EPWW, Praha LKAA, Bratislava LZBB, Budapest LHCC, Ljubljana LJLA, Zagreb LDZO, Beograd LYBA (**above FL285**), Bucaresti LRBB, Chisinau LUKK, Tirana LAAA, Skopje LWSS, Sofia LBSR and Varna LBWR

EURS_FSS - Eurocontrol South

- Voice callsign: "**Eurocontrol South**"
- Frequency: 135.55
- Covering: Milano LIMM, Roma LIRR, Brandisi LIBB, Malta LMMM, Athinai LGGG, Istanbul LTBB and Nicosia LCCC

EURW_FSS - Eurocontrol West

- Voice callsign: "**Eurocontrol West**"
- Frequency: 135.25
- Covering: Lisboa LPPC, Madrid LECM, Barcelona LECB, France LFFF and Shannon EISN
- **Special considerations:** As VATUK is not part of EURW, flights between Ireland and the European continent have to be handed off to UK ATC (if present) while over UK airspace.