DELTA VIRTUAL AIRLINES
FLIGHT ACADEMY

PRIVATE PILOT (PPL)
GROUND SCHOOL MANUAL

2nd EDITION

4 May 2008

NOT FOR REAL WORLD AVIATION USE

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Welcome to the Delta Virtual Airlines Flight Academy

On behalf of Delta Virtual Airlines, we would like to thank you for taking the time to download this manual and enroll in this course. We think you will find the information clear and easy to understand.

This is the Delta Virtual Flight Academy Private Pilot (PPL) Course Ground School Manual, 2nd edition. It is intended to teach the basics of flying and was written with the flight simulation pilot in mind. This PPL ground school manual, the course TASK outline, the FAA "Pilot's Handbook of Aeronautical Knowledge" and the Aeronautical Information Manual (AIM), make up some of the study materials to help you, the student, learn the basics of aviation and flight simulation flying. We will provide you with an avenue for asking questions and flight instruction to teach you how to fly the flight simulation airplane in a way that resembles the type of flight instruction you could receive in the real world.

Our instructors will fly with you and teach you the basics – how to fly the airplane in straight and level flight without the use of an autopilot, how to properly climb and descend, turns, slow flight, stalls, takeoffs and landings, cross country navigation, flight planning and other basics of flying that will help you further your enjoyment and understanding of aviation and flight simulation.

You will be asked to dedicate yourself to study and practice on your own. To be a good pilot you must always keep learning and practicing the procedures and techniques of flying. This course will give you some of the basics that you will need to increase your knowledge of aviation.

This 2nd edition is a complete update to our previous course material and manuals. We have updated our aircraft, moved our training location and added more information and training about flying on VATSIM.

If you spot a typo or notice something that doesn't seem correct, let us know. We sincerely hope you enjoy this course and it helped you to continue your aviation education.

Happy Flying!

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Meteorology

Meteorology, or the study of weather, is very important when flying. Even when the skies are clear, there can be invisible forces at work that can affect your flight and plans.

Meteorology is a big broad subject within itself - rather than getting into everything that makes up the atmosphere and how all of that works, we will just say that we have an atmosphere that has constantly changing weather in it.

Meteorology and Flying

Pilots are interested in these items:

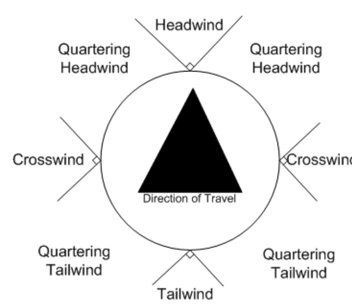
- Winds
- Visibility
- Clouds
- Barometric pressure
- Temperature
- Dew point
- Density altitude
- Precipitation
- Convective activity.

There are many other things we could worry about, but for simplicity's sake, let's concentrate on these for now.

Winds

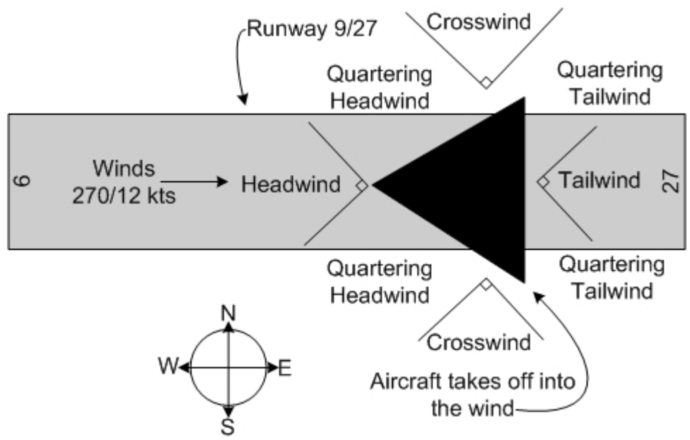
There are 2 kinds of winds – *Surface winds* and *Winds aloft*. *Surface winds* affect the aircraft when taxiing, taking off, on final approach and landing. *Winds aloft* affect the airplane everywhere else; they can push the airplane off course, slow it down or speed it up. We typically want to takeoff and land into the wind. A tailwind tends to make the takeoff run longer. It can make the airplane float and push it further down the runway on landing and slow the braking process down. Usually big airports allow a tailwind to reach 10 knots before they change the active runway to the opposite direction.

When the wind is blowing straight to us, it is called a headwind. When it is blowing from behind us, it is called a tailwind. Of course, the wind doesn't always blow straight down the runway. When the wind comes in at less than a 45 degree angle, it is called a quartering wind. There are quartering headwinds and quartering tailwinds. When the wind is more than 45 degrees off of our nose to either side, it is called a crosswind.



Airplanes are not indestructible. They have limits to the amount of crosswind they can handle safely. Generally, the heavier the airplane, the more crosswind it can handle as the wind has a harder time pushing a 10 ton object than a ½ ton object. You should refer to the Aircraft Operations Manual (AOM) for the aircraft you are flying to determine its crosswind limitations.

Wind forecasts and reports are with wind coming **from** the direction listed. So, a wind of 090 @ 12 knots means that the wind is coming **from** a heading 090. If you are flying a heading 090, you would be flying into a headwind and flying a heading of 270, would give you a tailwind.



Visibility: The better you can see, the less chance you will hit something – it is as simple as that. It is no different than driving a car on a nice clear day or a wet, drizzly rainy day or a foggy morning or at night. You increase your awareness with better visibility. If you have the visibility numbers at your departure and destination airports, you will be better prepared. In real world aviation, visibility means the difference between VFR and IFR flying. Flying for Delta Virtual Airlines, you are expected to be able to land in pretty much any weather conditions depending on your experience, flying ability and equipment. Some of the fleet airplanes are equipped to auto-land in zero visibility conditions.

Clouds: To avoid major confusion, stick to the basics with clouds. You need to know about the cloud coverage (sky cover) and the altitude of the cloud layer (ceiling) at your departure and arrival airport. The type of cloud, while important, will be discussed later. Sky cover is measured in 1/8th increments.

- Clear (**SKC** for Skies Clear) – 0/8 – clear skies – no clouds
- Few –(**FEW**) – 1/8 to 2/8 of the sky is covered with clouds
- Scattered (**SCT**) – 3/8 to 4/8 of the sky is covered with clouds
- Broken (**BKN**) – 5/7 to 7/8 of the sky is covered with clouds – this comes with a ceiling
- Overcast (**OVC**) – 8/8 – the whole sky is covered with clouds – this comes with a ceiling

The ceiling is the altitude at the bottom of the cloud layer – just like the ceiling in your house – when you hit this altitude, you are at the bottom of the cloud layer and going any higher will place you into the clouds.

Barometric Pressure: This is how much the atmosphere weighs. You will use this setting to properly adjust your aircraft altimeter to the correct altitude based upon this pressure. In the USA, you will use 29.92 inches of mercury for sea level but in Europe, they use 1013.2 millibars, which means the same thing. When you fly, you need to know what the barometric pressure is. If you don't have the proper setting, your aircraft altimeter will indicate the wrong altitude. This could cause major problems. You could be at 4,500 ft instead of 5,000 ft and hit a mountain or another airplane. As you descend into the clouds near the ground, if the aircraft altimeter is not correct you could have a fatal collision with a radio tower, building or the ground.

Transition Altitude: Once you cross 18,000 ft (which you will most likely never do when flying VFR) you switch to a transition altitude, which means you will use 29.92 as the standard altimeter setting. In Europe, they have different transition altitudes in every country, typically around 4,000 to 5,000 ft. Once you transition, you use the word Flight Level (FL) instead of altitude, since you are no longer using the real barometric pressure. This will be covered in greater detail in the Commercial Course.

AGL and MSL: AGL means *above ground level* and MSL means *mean sea level*. The difference in the terminology from 5,000 ft AGL and 5,000 ft MSL is that if you have an airport or object elevation of 1,500 ft, then 5,000 ft AGL is really 6,500 ft MSL (because at 0 feet AGL we are at 1,500 ft MSL) and 5,000 ft MSL, it would be at 3,500 ft AGL since we are subtracting the 1,500 ft of elevation you started at.

Temperature: Temperature is important because air is less dense when it is hot, creating less lift. You will use this to help determine the expected performance of your airplane.

Dew Point: This is the temperature that dew is formed. You have probably seen the wet grass look in the morning and you know it didn't rain. This is dew and it was formed because the air temperature lowered to the dew point. When the temperature gets close to the dew point, the most likely result will be fog, not dew or rain.

Density Altitude: This is the adjusted altitude based upon the barometric pressure, temperature and humidity. In the higher elevations, density altitude has a serious impact on the performance of any aircraft. Air is less dense the higher the density altitude is, and as a result, less lift is created, making your airplane a lot less efficient than normal.

There are three major factors to consider for air density – pressure, temperature and humidity.

Pressure
The air is less dense as you go higher into the sky due to the lower pressure of the air. The current air pressure could be lower or higher than the standard 29.92 inches of mercury as well.

Temperature
The temperature of the air can also affect density. Remember that air expands when heated. Hot air is less dense than cold air. Therefore, hot air will produce less lift than cold air.

Humidity
Humid air is less dense than dry air and as a result humid conditions means less lift and arid (dry) conditions mean more lift.

Aircraft engines are also affected by density altitude and produce less power the less denser the air is. Add this up and you can see that cold, dry air is better to fly in than hot, humid air. It is so important that you need to determine the density altitude, which is the actual altitude of the air you will be flying in, adjusted for pressure, temperature and humidity. It is very important and if you fail to adjust for this, you could have a very short flight experience. Engines need air to operate. The less dense the air, the less power the engine can produce. To see the effect of density altitude, fly a Cessna 172 out of KTEX (Telluride Regional Airport) Colorado, elevation 9078 feet and fly it around. Compare it to flying out of KMCO (Orlando International Airport) Florida where the elevation is 96 feet.

Precipitation/Ice: Rain reduces visibility, decreases traction on the runway making takeoff and landing distances longer.

If the temperature is cold enough, rain can turn into ice. Ice forming on the leading edge of your airplane's wings can end the flight prematurely – the ice forms and reduces the lifting ability of the wing and with enough ice, it can actually lose the ability to create lift. This has to do with disrupting the airflow over the surface of the wing and not the actual weight of the ice, although the additional weight can also be a factor.

Convective Activity: Avoid thunderstorms and lightning **at all costs**! Do not attempt to fly over or under a thunderstorm – fly way around it, land or delay your trip. Real world thunderstorms can rip any airplane apart in seconds. It has been proven that lightning shoots up out of the top of the thundercell and into the atmosphere. Even the high flying military airplanes avoid these storms.

Weather Information for the Pilot

There are many weather reports that you will be able to use to plan your flight.

1. METAR Reports
2. TAF Forecast
3. Weather Charts
    a. Winds Aloft
    b. Surface Winds

METAR Reports

METAR reports are meteorological reports – the official USA METAR website is run by NOAA and you can access it here: http://weather.noaa.gov/weather/metar.shtml - the website has instructions on how to read METAR reports. METAR reports in the USA are taken every hour within a 10 minute window and reflect current weather conditions.

TAF Forecasts

Terminal Aerodrome Forecasts (TAF) in the USA are also managed by the NOAA and you can access it here: http://weather.noaa.gov/weather/taf.shtml - the website has instructions on reading TAF reports. These forecasts differ from a METAR in that they are forecasts, whereas a METAR is actual weather conditions.

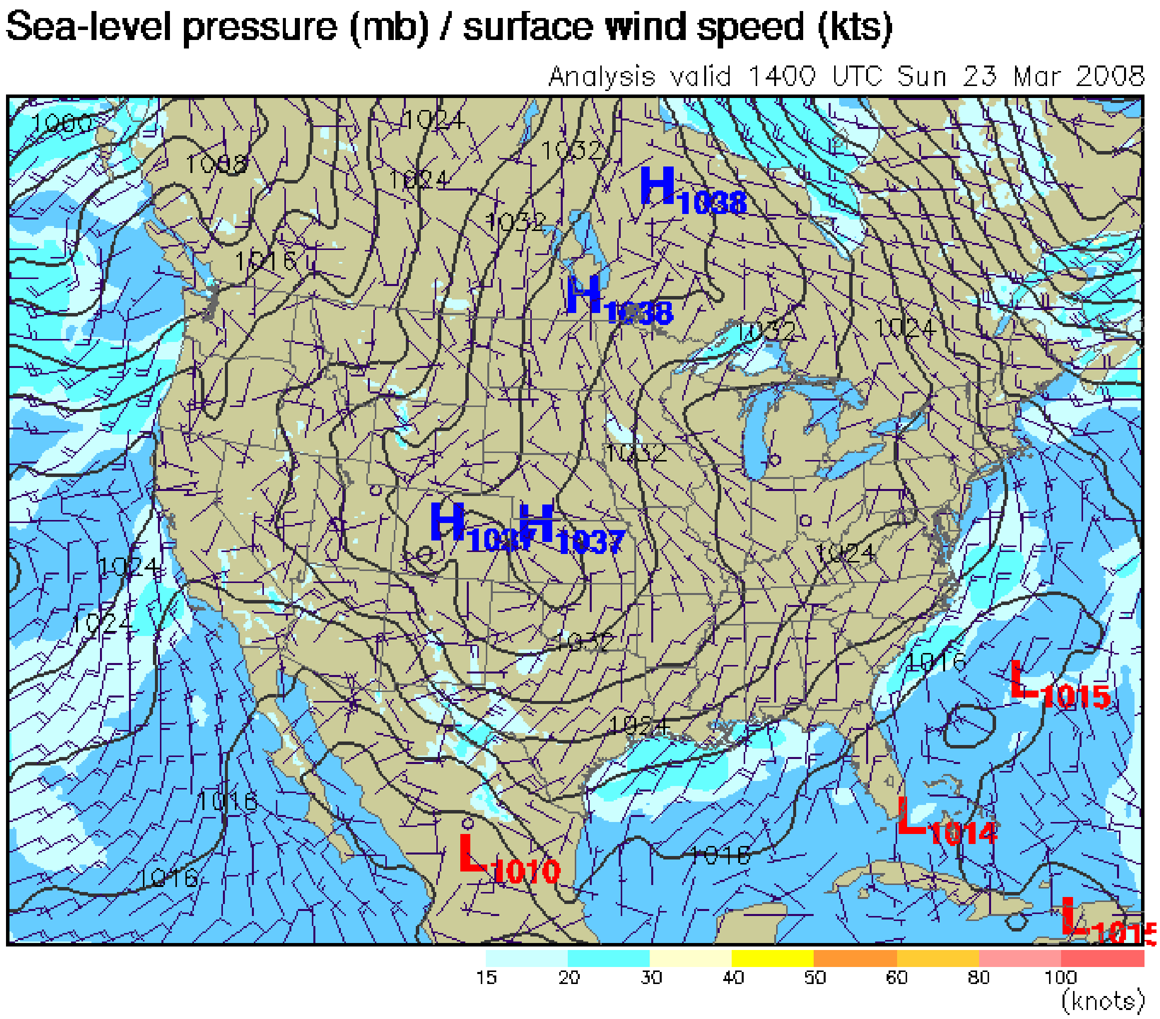
The TAF is updated 4 times a day starting at 0000 GMT, then every 6 hours after that – 0600 GMT, 1200 GMT and 1800 GMT.

Weather Charts

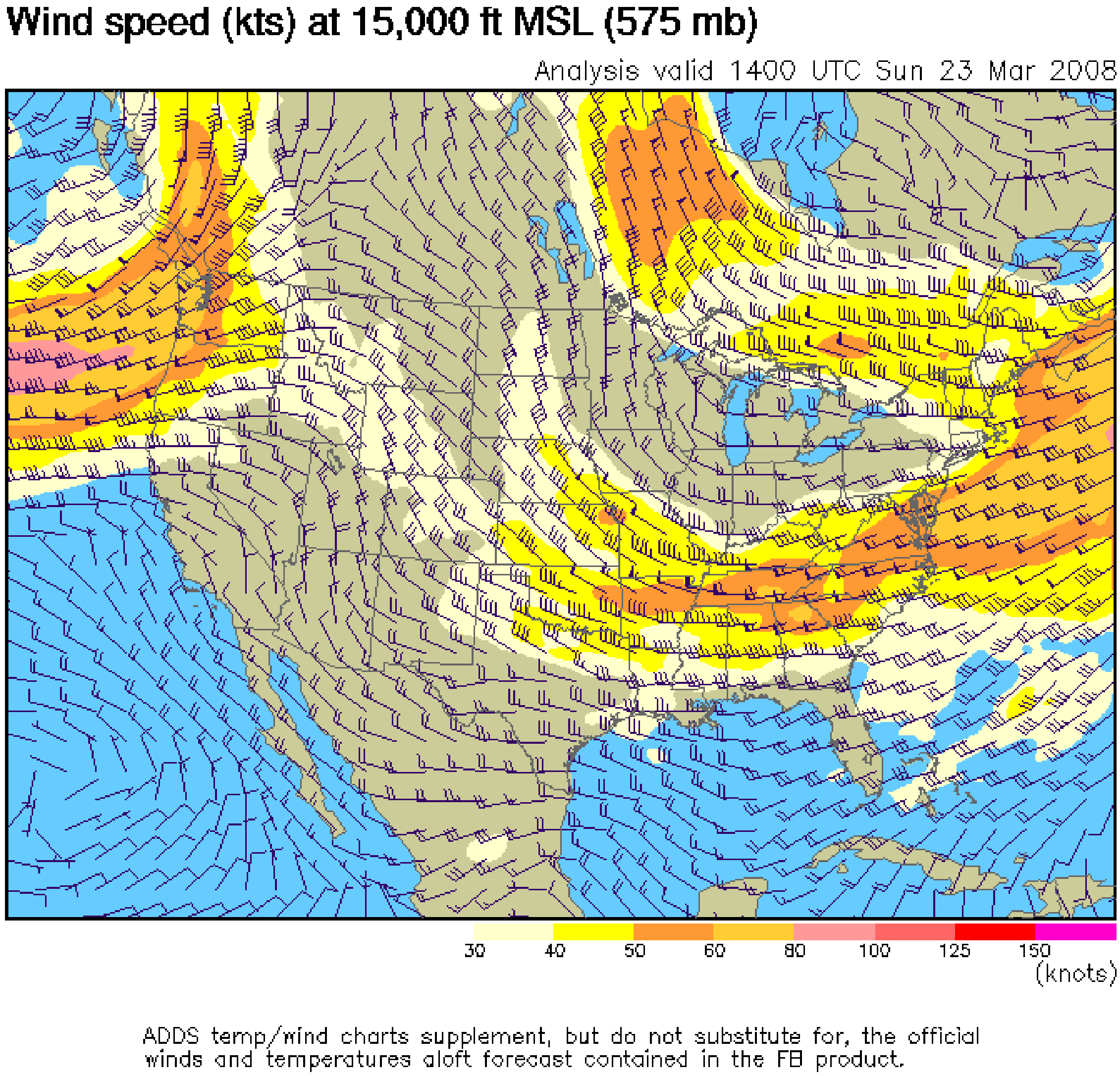
Many different weather charts on the NOAA website are available at http://weather.noaa.gov/fax/

To get a good Winds Aloft chart, go here: http://adds.aviationweather.gov/winds/

Here is a example of a Surface Winds charts which includes pressure in millibars



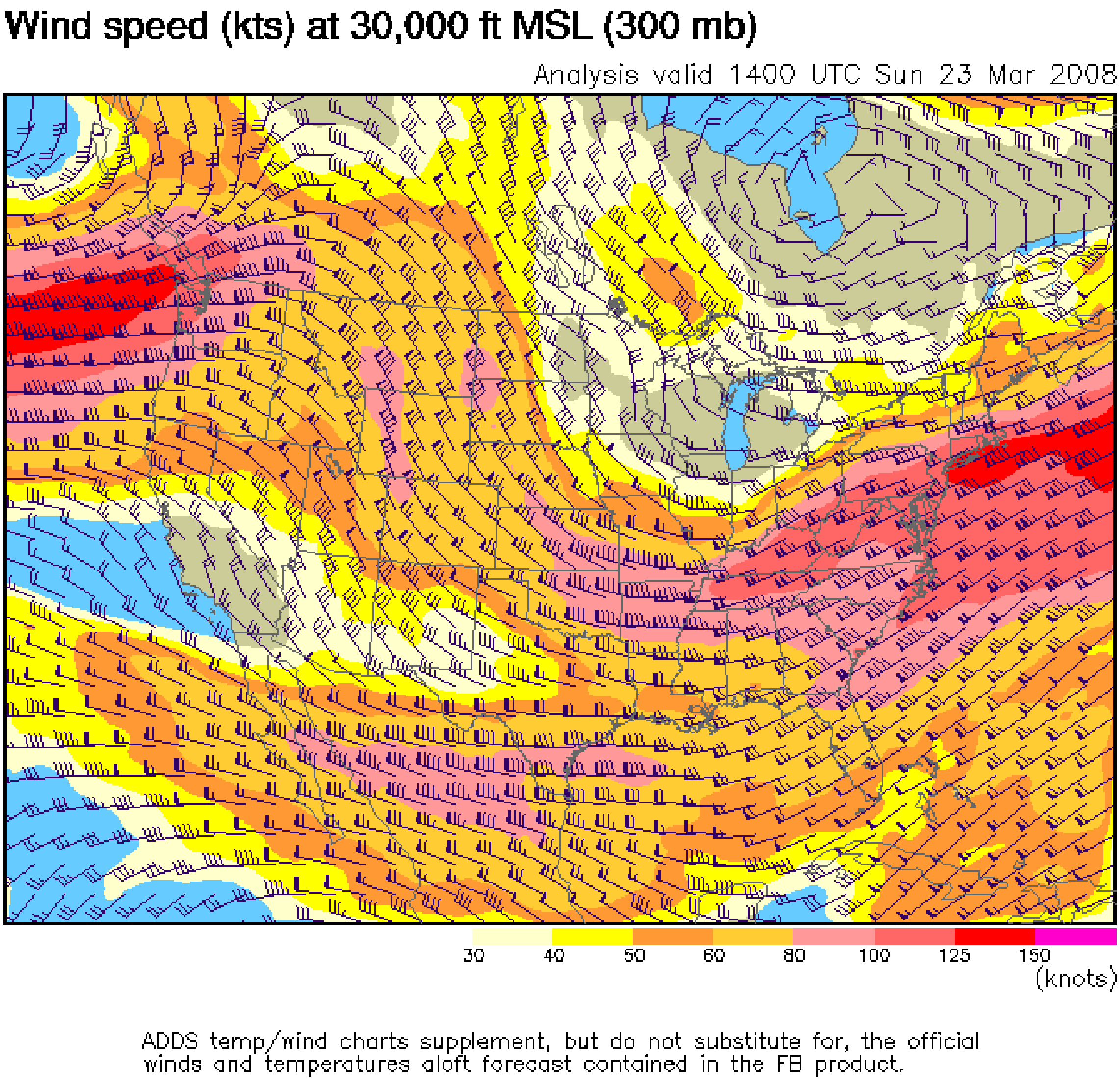
Here is a Winds Aloft Chart for 15,000 feet



This chart can quickly give you an indication of your winds. This one is for 15,000 feet, an altitude you will be using in the Flight Academy in the EMB-120ER. You can get a general idea of the winds in the area you are going to be flying. For example, a flight from Salt Lake to Missoula would encounter headwinds in the neighborhood of 30 knots, which would affect your groundspeed, fuel burn, flight length, etc.

Let's check the winds at FL300– the winds may be more favorable than at other altitudes.

Winds Aloft Chart for FL300



Here is FL300 for the entire USA. Note that the same flight from Salt Lake to Missoula at this altitude would result in winds aloft in the neighborhood of 50-60 knots, much higher than at 15,000 feet. Of course, your KTAS would offset this, as would your fuel burn.

Notice the winds in the upper northwest and northeast, where they are exceeding 125 knots!

You should also check other flight levels – the winds may be more favorable at other altitudes. Next time you notice an odd route that a commercial airliner took for a flight, you might consider they may have been taking weather and winds into account.

Jetstream

The jet stream is a really fast wind pattern which snakes its way around the USA. It is a great idea to get a Winds Aloft forecast before planning your flight route. You may want to fly north or south for a bit at an angle, taking the bite out of a very powerful jet stream, or if heading eastbound, plan your flight so you spend most of your time in the jet stream. The jet stream can significantly slow or speed up your flight or if you wish, you can save fuel or burn a lot of it up. If you plan it right, you could get a 100 knot tailwind pushing you from KSLC back to KATL. You could turn your 335 knot true airspeed (TAS) (as used in the previous example) into a 435 knot groundspeed just by altering your flight route. This will be covered in more detail in the flight planning section. For more information and to view current and forecasted jet stream paths see the following link: http://squall.sfsu.edu/crws/jetstream.html

Weight and Balance and Center of Gravity

Weight and balance is a very important part of flight planning that if you do not do it properly, it could kill you. It involves finding where the center of gravity (**CG**) or fulcrum point will be on the aircraft. Each aircraft has center of gravity (**CG**) limits and if you violate those limits, you will probably crash if you fly the airplane. It is like having an elephant sit on end of the teeter totter and you are on the other end – no amount of trying on your part will get the elephant off the ground. As a result, takeoff would result in a nose up situation that you could not correct and the airplane goes into a stall and crash.

Try taking a book and laying it on the palm of your hand and balance it. The book stays in one spot because you are within its center of gravity (**CG**) limits. Now slide the book out from the center of your hand. Eventually, the book will fall off your hand. You have just exceeded the center of gravity (**CG**) limits. This is what happens when you do not balance the weight and balance on an airplane.

There are four types of weights you need to consider when loading your aircraft:

1. **Empty weight** – what the airplane weighs before adding fuel, people, cargo, oil, etc.
2. **Useful load** – the weight of the aircrew, passengers, cargo, fuel and oil.
3. **Gross weight** – the total of the empty weight and the useful load
4. **Zero fuel weight** – the gross weight minus the fuel

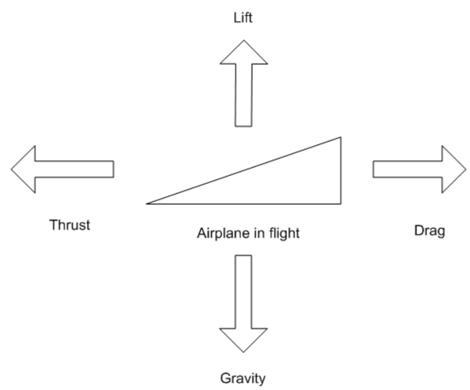
Forces of Flight

There are four forces of flight:

- **Thrust** – forward thrust makes the airplane go forward
- **Drag** – drag slows the airplane down
- **Lift** – lift makes the airplane fly
- **Gravity** – gravity makes the airplane fall

This is the building block for many other explanations later on: For an airplane to fly, it must produce lift to overcome gravity.

Here is an illustration showing the forces of flight



An airfoil (wing) creates **lift** when air is moved over its surface. The wings, elevators and rudder are all considered examples of an airfoil. If you have ever stuck your hand out the window of a moving car and angled your hand up, you noticed that it wanted to move up – this is the same principle when the airplane wants to climb. The bottom of your hand had positive pressure and the top of your hand had low pressure, therefore pushing it up.

Stalls

Without going into a whole lot of technical detail about angle of incidence, angle of attack (AOA) and other similar terminology, it is important to know that when the airfoil is at a certain angle it can exceed its angle of attack on the wind which causes the airfoil to lose lift. This also happens if the air flow slows down over the airfoil (wing). When this happens, the airfoil again loses lift. This is called a **stall**. The airplane's motor doesn't quit running when the airplane stalls, it only means the wing loses the ability to produce lift.

Technical explanation of stalls

When an airplane is flying, air is separated by the airfoil (wing) and 'sticks' to the wing surface to join again at the trailing edge after passing over the top and bottom of the wings surface (laminar airflow). When the air starts to 'burble' over the leading edge because of the increase in the angle of attack (AOA) and does not join up with the air at the trailing edge, a stall has begun. Different wings stall at different rates and different wing shapes affect where and when the stall will begin.

Other things that affect lift

Anytime you change the shape of the airfoil, you affect its lift. If an airfoil accumulates ice, they can lose lift and start falling from the sky – if the ice doesn't melt before hitting the ground, it will stop flying. This is one reason why de-icing is very important to commercial airliners. Icing is a very serious situation in real world flying. To prevent icing, aircraft are equipped with pitot heat and deicing equipment on the aircraft.

Another way to affect lift is to lower the flaps, producing **DRAG**. This changes the shape of the airfoil and as a result, **lift** will be increased but at the expense of drag, which requires more thrust (power) to overcome.

The raising and lowering of the ailerons can also affect lift. If you turn the yoke in one direction or the other, one aileron will rise and one will fall. As a result, the wing will rise on one side and fall on the other, creating a bank (turn).

The raising and lowering of the elevator will do the same thing. Raising the elevator will make the tail go down and the nose go up. Lowering the elevator will cause the tail to go up and the nose to go down.

If you fly your airplane banked at 90 degrees (sideways), then your fuselage becomes an airfoil and the rudder becomes an elevator. Your airplane is not as efficient when in a bank (turn) and as a result requires more lift from the elevator to compensate for the loss of lift.

Control Surfaces

There are three axis of control in an airplane:

1. Longitudinal Axis (Roll)
2. Lateral Axis (Pitch)
3. Vertical Axis (Yaw)

The Longitudinal Axis (Roll) is motion created by the ailerons which are located at the trailing edges of the wing and makes the airplane bank about the roll axis.

The Lateral Axis (Pitch) is motion created by the elevator which are the small looking wings at the rear of the airplane and makes the airplane pitch up or down on the pitch axis.

The Vertical Axis (Yaw) is motion created by the rudder which is the big tall vertical section at the rear of the airplane and makes the airplane swing from side to side on the yaw axis.

Trim

It is very important and should be printed at the top and bottom of every page: Learning how to use the trim correctly is **"TRIM-The key to hand flying the airplane!"**

Trim tabs are small surfaces on the aileron, rudder and elevator surfaces. The purpose of a trim tab is to save the pilot from constantly having to hold pressure on the control surfaces and can be controlled by trim tab controls in the cockpit.

The trim tab allows the pilot to make very small adjustments to the surface controls in order to allow the pilot to ease the pressure he may have on the control surfaces. Then, the pilot can fly with his/her thumb and index finger on the controls much like you would hold a pen in your hand for writing.

A small airplane such as a Cessna 172 would only have elevator trim and not aileron or rudder trim, but on the more sophisticated airplanes, all 3 control surfaces would have trim surface controls. So if the airplane has a tendency to yaw to the left because of propeller torque making it veer to the left, you can adjust rudder trim and make the airplane yaw in the opposite direction to counter this effect to remain in straight and level flight.

Trim is the key to hand flying the airplane! Many new pilots experience difficulty flying their aircraft because they are not using and adjusting the trim correctly. If an aircraft did not have trim tabs, hand flying an airplane would be very difficult for long periods of time.

To summarize: Learn how to correctly use the trim controls in your aircraft.

Trim is the key to hand flying the airplane!

Magnetic Compass

The magnetic compass is a simple instrument whose basic component consists of two magnetized steel needles mounted on a float, around which is mounted the compass card. You need to know how to read the direction on a compass – 12 means a heading of 120 degrees, W means west, or a heading of 270 degrees. However what you may not know is that most of the time when you are looking at what the compass is reading it isn't even close to being accurate.

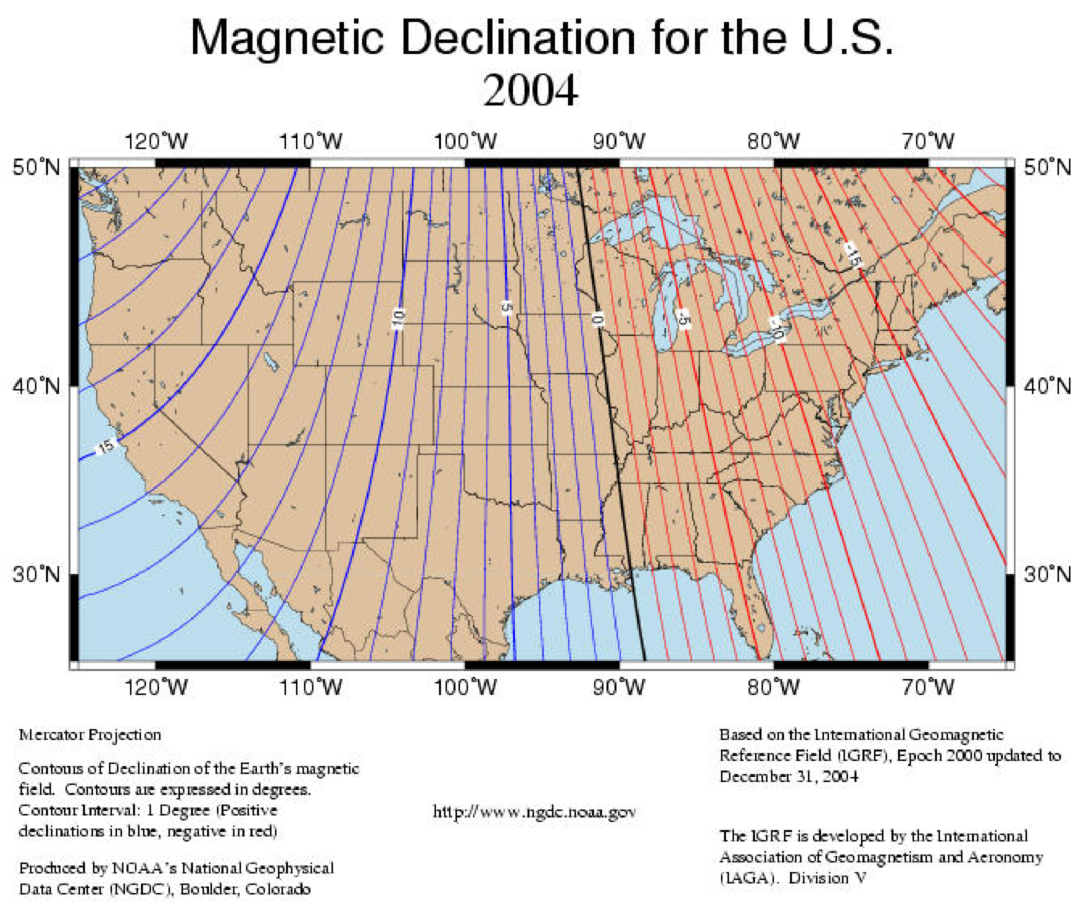
The magnetic compass has two big problems: – **Variation** and **Deviation**.

Variation is the difference between True North and Magnetic North. The Magnetic North Pole is not in the same spot as the True North Pole. *Magnetic variation is also called magnetic declination.* The variation changes over time and by location.

Some examples using the heading of 130 degrees as shown by the compass picture above are listed in the table below. The map on the next page displays the magnetic variation for the entire continental USA.

Location	**Variation**	**Actual Heading**
Atlanta	-5 degrees	125 degrees
Dallas	6 degrees	136 degrees
Salt Lake City	13 degrees	143 degrees
Seattle	18 degrees	148 degrees

Here is a map of the USA from 2004



Source: http://www.ngdc.noaa.gov/seg/geomag/declination.shtml

Deviation is all of the other factors taken into consideration – everything you have inside of your airplane – metallic and electrical equipment – can influence the compass. Turning the aircraft can also mess up the compass. You may have at one time or another used a compass in a car and noticed that is was not as accurate as outside of the vehicle – this is the same scenario. If you drove with a compass in your car and turned, you probably saw it turning all over the place. This is also the same kind of problem in the airplane.

The airplane has a deviation card that is placed in the cockpit in view of the pilot that shows compass card correction information. With the deviation card and the variation differences computed, the pilot can now use the compass more accurately to point to true north.

Aside from these two main issues, the magnetic compass possesses certain traits that need to be understood in order to use this compass correctly.

Compass Traits

1. If the aircraft is on a northerly heading and a turn is made to the east or west, the indication on the compass lags or indicates a turn in the **opposite** direction.
2. If the aircraft is on a southerly heading and a turn is made, the compass needle will indicate a greater amount of turn then is actually made.
3. If the aircraft is on an east or west heading, no error is apparent while entering a turn to the north or south.
4. If the aircraft is on an east or west heading, an increase in airspeed causes the compass to indicate a turn to the north.
5. If the aircraft is on an east or west heading, a decrease in airspeed causes the compass to indicate a turn to the south.
6. If the aircraft is on a north or south heading, no error is apparent while climbing, diving or changing airspeed.

You must thoroughly understand the errors and characteristics of the magnetic compass in order for this instrument to become one of your most reliable means of determining heading.

In many general aviation and light aircraft, there are three instruments that work on gyroscopes – heading indicator (directional gyro), attitude indicator (artificial horizon) and the turn and bank indicator (turn coordinator). They have a vacuum pump that runs off the engine when it is running that provides a vacuum to run the gyroscopes in the instruments. Let's look at the Directional Gyro (DG).

Directional Gyro

The magnetic compass is really difficult to use reliably unless you understand all of the problems it has, especially in turns. The directional gyro was developed to fix these problems. However, the directional gyro has some of its own problems you need to be aware of when flying.

The directional gyro has a tendency to drift *(which you may want to turn off in Flight Simulator. This setting is found in the realism settings in Flight Simulator 2004)*. You should check the directional gyro every 15 minutes against the magnetic compass. However, only adjust the gyro heading (**PUSH** knob on the left) to match the magnetic compass when the airplane is in wings-level, un-accelerated flight! In Flight Simulator you can calibrate it by pressing the "**D**" key on your keyboard.

There are accuracy limits to the directional gyro. The basic limit is about 55° of pitch and 55° of bank. When either of these attitude limits is exceeded, the instrument "tumbles" and no longer gives the correction indication until reset.

The artificial horizon and turn and bank indicator will be discussed in a later section.

The Pitot Static System

This system is the source of air pressure for the operation of three critical instruments – the Altimeter, VSI and Airspeed Indicator. If the temperature gets too cold and you do not have the pitot heat on, these instruments will read erroneously and may not display any information at all. Blockage of the pitot system by dirt, paper or other items will cause major problems and should be checked during your "Pre-Flight" walk around.

Airspeeds

We need to discuss four kinds of airspeed – indicated airspeed, calibrated airspeed, true airspeed and groundspeed.

Indicated Airspeed (IAS) – is what you see on the airspeed indicator – this is pretty straightforward. We call this **IAS** and since we are reading the airspeed indicator in knots, it is called "knots indicated airspeed" or KIAS. Indicated airspeed is not corrected for variations in atmospheric density, installation error or instrument error.

Calibrated Airspeed (CAS) –is the indicated airspeed corrected for instrument and position errors. It is not entirely possible to entirely eliminate errors due to the fact that we are getting air from the pitot system. Changes in the aircraft at lower airspeed and with certain operations such as flaps, yawing or slipping or a nose-high attitude may result in an error in the airspeed indication. This is because of the angle that the air enters into the pitot system. In the cruising and high airspeed range, the error amount is negligible. The pilot can find an airspeed calibration chart near the airspeed indicator or in the Aircraft Operation Manual (AOM).

What can cause an airspeed indicator to read incorrectly? Leaks in the tubing, moisture, vibrations, dirt, dust, ice and snow at the mouth of the tube obstructing the air passage.

True Airspeed (TAS) – the airspeed indicator registers true airspeed but only under standard sea level conditions – that is, when the pressure is 29.92 and the temperature is 15°C.

As altitude increases, air becomes less dense, which means that the airspeed indicated is not the same as the real airspeed. Since the pitot system is driven by pressure, you can see that this can cause some problems. You may have noticed that as you climb to altitude and cruise, your indicated airspeed may show you flying at 250 knots while your aircraft is really flying much faster than this. True airspeed is different than the groundspeed of the aircraft.

To figure out your true airspeed, you can get yourself a flight computer or do it on paper. This involves knowing the temperature, altitude and airspeed. There is an easy method that is somewhat accurate: **Add 2% of the indicated airspeed (IAS) for each 1,000 feet of altitude.**

For example: If the airspeed indicator shows 250 knots at 17,000 feet, the true airspeed (TAS) would be calculated by taking 2% of 250, which equals 5 and multiplying it by 17, which would be 85 knots. Add the 85 knots to the 250 knots = 335 knots true airspeed (**TAS**).

More examples of calculating KTAS are in the Flight Encyclopedia.

Groundspeed

Airspeed is how fast you are moving through the air, but groundspeed is how fast you are moving over the ground. To figure this out, you have to factor in the winds. Factoring the winds can take some work, but you can hit ***shift+z*** and get the current winds, or use wind forecasts. Suppose you are traveling at 250 knots at 17,000 ft as indicated above, which turns out to be a true airspeed (**TAS**) of 335 knots. Suppose you are heading 090 and the winds are 270 at 40 knots. This gives you a 40 knot tailwind. This is pretty easy to figure out – your groundspeed is 375 knots. If you had a headwind out of 090 at 40 knots, your groundspeed would be 295 knots.

The problem is figuring out winds when they are not a direct headwind or tailwind. You could simply click on the GPS and look at what the groundspeed is. This is a great use of the GPS. Flight Simulator weather changes so much if you are using real world weather, it is nearly impossible to keep up with your groundspeed.

When you plan your flights you will need to know how much time it will take to travel to each waypoint. To do this you will need to know your groundspeed. If you know the amount of wind and what direction it is coming from, you can approximate the percentage of the wind based upon the angle you'll be hitting it with.

For example, if the wind is 25 knots and it is off your nose at a 45 degree angle, you won't be getting the full force of the 25 knot headwind. You may only be getting half the force of the wind.

If it is a direct crosswind, you might think that the wind won't affect your airplane because there is no direct wind (headwind) hitting the nose of your airplane or pushing on the tail of your airplane. However, keep in mind that you will have to crab your airplane into the wind to compensate for the crosswind to keep you on a straight ground track. This is called *wind correction angle*. This also requires a flight computer to figure out or if you are navigating via a radio navigation aid, you can use your flight director to determine the wind correction angle.

If you really want to figure out your groundspeed manually, look it up on the internet or get yourself a flight computer. The math involved requires trigonometry for wind vector angles and the formulas can be found on the internet or computed using a flight computer.

Ideally, you want to plan your flights so you spend the majority of the flight time out of a headwind condition.

Primary Instruments

The Six Primary Instruments

There are six (6) basic instruments that are the key to keeping your airplane in stable flight. Whether you fly straight and level, turn, climb or descend, these six (6) primary instruments are the instruments that you need to ***continuously*** scan while flying the airplane. Do not stare at any of them too long. Learn them and what they tell you. They are:

1. Attitude Indicator

2. Horizontal Situation Indicator (HSI)

3. Airspeed Indicator

4. Altimeter

5. Turn and Bank

6. Vertical Speed Indicator (VSI)

1 <u>Attitude Indicator</u> – Also called "artificial horizon" it displays pitch and bank information to the pilot. This instrument is highly accurate and very responsive and is your # 1 flight instrument.

The yellow triangle represents your airplane and the two straight white lines on either side represent the earth's horizon. The position of the triangle to these two white lines will tell you where you are in the sky, straight and level, turning, climbing or descending.

2 <u>Horizontal Situation Indicator</u> (HSI) – Displays heading, directional gyro, heading bug, course selector, course deviation indicator (CDI), VOR/ILS/NDB navigation information, to/from indicator, glide slope indicators all in one instrument.

<u>Heading</u> The white upside down triangle mark at the top. It is known as a "lubber line". This is your heading which is 340.

<u>Directional Gyro</u> A basic DG with a compass rose. There is not a knob to set the heading of the DG to match that of your magnetic compass. It is slaved to an electronic compass in the plane, making it very accurate, not subject to the vagrancies of the regular magnetic compass and is constantly being corrected for drift. On some aircraft, this signal is also used to slave the ADF heading card.

<u>Heading bug</u> It is the maroon (red) colored M on the top of the compass rose. You can move this "bug" around the compass rose by rotating the knob on the lower left. You will use this when hand flying the aircraft to remember your desired heading. When flying with the autopilot in the HEADING mode, the autopilot will track on the heading selected with this heading bug.

<u>Course selector</u> The course selector is the green arrow that is pointing at 330 degrees. Note the "**tail**" of the course selector is at the reciprocal (opposite direction) at 150 degree mark. You can move the course selector around the compass rose of the DG by rotating the ***<u>green</u>*** knob in the lower right corner. There are several modes of navigation tracking that the course selector can be used: RNAV, VOR, and ILS to name a few.

When in the navigation mode, the center "***<u>green line</u>***" of the course selector, called the **CDI** (Course Deviation Indicator) moves off of center to indicate the direction of the desired course that you have selected into the course selector to fly. If you want to "intercept" your selected course, turn your airplane toward the center "green line". Example: If the green line is to the left, turn your airplane to the left 15 degrees until the center "green line" returns to the center. You would turn to the right 15 degrees to bring the center "green line" back to center if the line was off to the right.

TO/FROM triangle The white triangle above or below the little airplane in the center is the indicator to tell you if you are **TO** (above) or **FROM** (below) the VOR station.

Glide slope indicator The white small dots on the right side are the glide slope indicators. The white triangle will move up or down the dots to tell you if you are above (above the center rectangle) or below (below the center rectangle) the glide slope.

3 Airspeed Indicator The airspeed indicator shows the indicated airspeed (IAS). The red and white barber pole is the *Never Exceed* speed V_{NE} (Piston aircraft) or V_{MO} for jets. The V_{NE} is displaying 268 KIAS and the current airspeed is 224 KIAS.

The thin **red** line on the right side indicates 88 KIAS, or Vmc (*minimum control speed* with critical engine inoperative). Do not fly below this speed when in flight.

The **blue line** is Vyse (best rate of climb speed with a single operating engine).

4 Altimeter It is a pressure altimeter. It measures the barometric pressure of the atmosphere and is calibrated to show this pressure as altitude above mean sea level. The ***black knob*** in the left bottom corner allows you to adjust this instrument to the sea level reference pressure that you would receive from a current METAR or ATIS.

5 Turn and Bank - The turn and bank indicator is another of your primary instruments. The turn and bank indicator is actually **two** instruments in one – a ball and a **turn needle**. No pitch information is given by this instrument.

The ball portion works by natural forces, while the turn indicator works off of a gyroscope. The **ball portion** of the instrument tells the pilot the **quality of the turn** – the coordination (slip or skid) of the turn the aircraft is in.

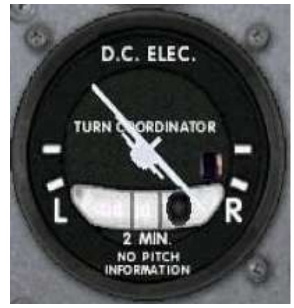
Types of Turns

Skid

In a skid, the ball moves to the outside of the turn. In a skid, the rate of the turn is too fast for the angle of the bank.
<u>To correct</u>: increase bank or decrease the rate of the turn or both(step on the ball with your left foot pedal)

Coordinated Turn

In a coordinated turn, the ball is in the center. In coordinated flight, the rate of the turn is correct for the angle of bank.



Slip

In a slip, the ball moves to the inside of the turn. In a slip, the rate of the turn is too slow for the angle of the bank.
<u>To correct</u>: decrease the bank or increase the rate of the turn or both (step on the ball with your right foot pedal)

Note: If you don't have rudder pedals it will be difficult to maintain coordinated flight. *If you don't have rudder pedals, you may want to turn* ***ON*** *the auto-coordination option in flight simulation. However, if you do this, you will lose the ability to purposely skid or slip your airplane. The best solution is to buy a joystick with a twist grip that acts as rudder pedals, or purchase rudder pedals.*

The Turn Needle

The turn needle indicates the rate (number of degrees per second) that the aircraft is turning about its vertical axis. You don't need to know the bank angle of the aircraft. The turn needle on this instrument will let you know when you have the proper bank angle for the rate of the turn.

For any given airspeed, there is a specific angle of bank necessary to maintain a **coordinated turn at a given rate**. The faster the airspeed, the greater the angle of bank required to maintain a given rate of turn.

Since the turn and bank indicator is one of the most reliable flight instruments used for recovery from unusual attitudes, the pilot should understand and learn to interpret its indications.

This is a **standard rate turn**.

Notice that the airplane wings are lined up on the "mark" just above the L. This means you are turning at a rate of three (3) degrees per second. Keep in mind that the faster you fly, the steeper the bank you will need to make to accomplish the three (3) degrees per second turn.

What is so important about three (3) degrees per second turn? Three (3) degrees per second means that in 30 seconds (1/2 of a minute) you will turn 90 degrees. In 60 seconds (1 minute) you will turn 180 degrees and in 120 seconds (2 minutes) you will turn 360 degrees. Used with a clock, you will be able to time your turns. This is important to remember. You can turn the airplane using this instrument and know when you will complete the turn. This is one of the reasons why the Turn and Bank Indicator is one of the six primary instruments.

Vertical Speed Indicator (VSI) This instrument shows you the rate of climb or descent in feet per second. The white needle is pointing at 9 o'clock shows you are in level flight. If the needle was below this line, you are descending, if above you are climbing. The big numbers are 1,000, 2000, 4000 and 6000 feet. The little 5 number represents 500 feet.

Electrical System

You now know which aircraft instruments use the pitot system and the gyroscope system. Everything else in the airplane uses the aircraft electrical system.

Transponder

The transponder allows ATC to see us. It reports our airspeed, altitude, heading, etc. to ATC.

To do this, we have to enter a unique four digit code into the transponder, usually provided by ATC.

ATC will give you a command to squawk **mode C, Charlie** or **Normal**. This means to turn your transponder ON. If you are asked to squawk **Standby**, turn your transponder to the standby mode or OFF. If you are flying online, pay attention and know how to operate your aircraft transponder. ATC uses C and Charlie interchangeably because Charlie is what is used for the letter C in the aviation phonetic alphabet (see page 85 for complete aviation alphabet).

When your aircraft transponder is ON, it will report your flight information to the controller – altitude, speed, and position.

The **Ident** (identify) button doesn't need to be pushed unless ATC asks you to **Ident**. This will send an **ID** flashing mark on the controllers' radar scope, identifying your aircraft.

When you fly with ATC you will be assigned a unique four digit transponder code. When you are flying VFR in class B, C or D airspace or request flight following, you will use 1200 as your transponder code.

Some important default transponder codes you should know are:

- In the USA, the default VFR squawk code is 1200
- In Europe the VFR default squawk code is 7000
- However in Germany you squawk 0021 if you are flying 5000' and below and you squawk 0022 if you are flying VFR above FL050.

Reserved codes:

- 0000 – Military Escort.
- 7600 – No radio. This lets ATC know that a failure of your radio has occurred. ATC will resort to a light system to guide you in.
- 7700 – Basic In-Flight Emergency code

If your airplane is ever hijacked you can change your code to 7500 which will inform ATC that you are being hijacked. Do NOT use this code on VATSIM or IVAO – they take this very seriously

The Rules of Flying

In the world of flying there are different types of rules – Visual Flight Rules (VFR) and Instrument Flight Rules (IFR) are the main ones. There are others, such as MVFR (Marginal VFR) or SVFR (Special VFR), etc.

This course focuses on primary flying skills and navigation so it concentrates on VFR flying. The quick definition of VFR flying is that it is *visual flying* – you must be able to see visually outside your aircraft at any given time. VFR is defined with two definitions: flight rules and weather conditions. And depending on which airspace you are in, you have different separation rules that will determine whether it is a VFR or IFR flight.

IFR flying is instrument flying – you rely solely on your instruments and you can literally fly with no visual reference to the ground until just before you are ready to touchdown on the runway. IFR flying is a complete subject matter in itself and will be covered in the IFR course.

There is no easy way to discuss the flight rules or airspace other than to simply learn them. You must understand these rules and regulations. The current legal definition of VFR is located here: http://www.faa.gov/airports_airtraffic/air_traffic/publications/ATpubs/AIM/Chap3/aim0301.html in the AIM (Aeronautical Information Manual). This is a must-read for all pilots and is one of the main sources for aviation information.

Here is the current information as of February, 2008:

Basic VFR Weather Minimums

a. 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.

b. Except as provided in 14 CFR Section 91.157, Special VFR Weather Minimums, no person may operate an aircraft beneath the ceiling under VFR within the lateral boundaries of controlled airspace designated to the surface for an airport when the ceiling is less than 1,000 feet (See 14 CFR Section 91.155(c).

Basic VFR Weather Minimums

Airspace	Flight Visibility	Distance from Clouds
Class A	Not Applicable	Not Applicable
Class B	3 statute miles	Clear of Clouds
Class C	3 statute miles	500 feet below 1,000 feet above 2,000 feet horizontal
Class D	3 statute miles	500 feet below 1,000 feet above 2,000 feet horizontal
Class E Less than 10,000 feet MSL	3 statute miles	500 feet below 1,000 feet above 2,000 feet horizontal
At or above 10,000 feet MSL	5 statute miles	1,000 feet below 1,000 feet above 1 statute mile horizontal
Class G 1,200 feet or less above the surface (regardless of MSL altitude).		
Day, except as provided in section 91.155(b)	1 statute mile	Clear of clouds
Night, except as provided in section 91.155(b)	3 statute miles	500 feet below 1,000 feet above 2,000 feet horizontal
More than 1,200 feet above the surface but less than 10,000 feet MSL.		
Day	1 statute mile	500 feet below 1,000 feet above 2,000 feet horizontal
Night	3 statute miles	500 feet below 1,000 feet above 2,000 feet horizontal
More than 1,200 feet above the surface and at or above 10,000 feet MSL.	5 statute miles	1,000 feet below 1,000 feet above 1 statute mile horizontal

VFR Cruising Altitudes and Flight Levels

If your magnetic course (ground track) is:	And you are more than 3,000 feet above the surface but below 18,000 feet MSL, fly:	And you are above 18,000 feet MSL to FL 290, fly:
0° to 179°	Odd thousands MSL, plus 500 feet (3,500; 5,500; 7,500, etc.)	Odd Flight Levels plus 500 feet (FL 195; FL 215; FL 235, etc.)
180° to 359°	Even thousands MSL, plus 500 feet (4,500; 6,500; 8,500, etc.)	Even Flight Levels plus 500 feet (FL 185; FL 205; FL 225, etc.)

Note that on the VFR Cruising Altitudes and Flight Levels that they included flight above 18,000 feet MSL to FL 290. This is in Class A airspace, which is airspace from 18,000 MSL to FL600, ***VFR flight is not allowed in Class A airspace unless authorized in advance.*** Speaking of airspace, it is now time to learn all about how airspace is defined in the USA.

Airspace

The official link from the Aeronautical Information Manual (AIM):
http://www.faa.gov/airports_airtraffic/air_traffic/publications/ATpubs/AIM/chap3toc.htm

There is a lot of information available at this link. Read and review this information of the airspace system.

Controlled Airspace A generic term that covers the different classification of airspace (Class A, Class B, Class C, Class D, and Class E) and defined dimensions within which air traffic control service is provided to IFR and VFR flights in accordance with the airspace classification.

IFR Requirements- An IFR operation in any class of controlled airspace requires that a pilot must file an IFR flight plan and receive an appropriate ATC clearance.

IFR Separation- Standard IFR separation is provided to all aircraft operating IFR in controlled airspace.

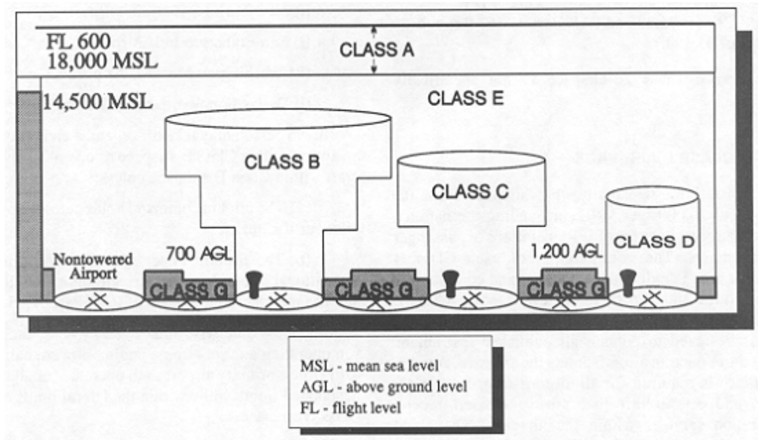
VFR Requirements- It is the responsibility of the pilot to insure that an ATC clearance or the radio communication requirements are met prior to entry into Class B, Class C or Class D airspace. The pilot retains this responsibility when receiving ATC radar advisories.

Traffic Advisories- Traffic advisories will be provided to all aircraft as the controller's work situation permits.

Safety Alerts- Safety Alerts are mandatory services and are provided to ALL aircraft. There are two types of Safety Alerts:

1. **Terrain/Obstruction Alert-** A Terrain/Obstruction Alert is issued when, in the controller's judgment, an aircraft's altitude places it in unsafe proximity to terrain and/or obstructions
2. **Aircraft Conflict/Mode C Intruder Alert-** An Aircraft Conflict/Mode C Intruder Alert is issued if the controller observes another aircraft which places it in an unsafe proximity. When feasible, the controller will offer the pilot an alternative course of action.

Airspace Classes



Class A Airspace

Definition- Generally, that airspace from 18,000 ft MSL up to and including FL 600, including the airspace overlying the waters within 12 nautical miles of the coast of the 48 contiguous States and Alaska; and designated international airspace beyond 12 nautical miles of the coast of the 48 contiguous States and Alaska within areas of domestic radio navigational signal or ATC radar coverage, and within which domestic procedures are applied.

Operating Rules and Pilot/Equipment Requirements- Unless otherwise authorized, all persons must operate their aircraft under IFR rules and regulations.

Charts- Class A airspace is not specifically charted.

Now on to Class B airspace – This is the airspace for the major airports where Delta Virtual Airlines operates – see the AIM link for the specific locations, but places such as Los Angeles, Atlanta, Dallas-Fort Worth, Chicago, Washington D.C., Boston, Salt Lake City are in the Class B airspace system.

Class B Airspace

Definition- Generally, that airspace from the surface to 10,000 feet MSL surrounding the nation's busiest airports in terms of IFR operations or passenger enplanements. The configuration of each Class B airspace area is individually tailored and consists of a surface area and two or more layers (some Class B airspace areas resemble upside-down wedding cakes), and is designed to contain all published instrument procedures once an aircraft enters the airspace. An ATC clearance is required for **ALL** aircraft to operate in this airspace and all aircraft that are so cleared receive separation services within the airspace. The cloud clearance requirement for VFR operations is "clear of clouds".

Operating Rules and Pilot/Equipment Requirements for VFR Operations- Regardless of weather conditions, an ATC clearance is required prior to operating within Class B airspace. Pilots should not request a clearance to operate within Class B airspace unless the requirements of 14 CFR Section 91.215 and 14 CFR Section 91.131 are met.

To see what these requirements are, refer to the web link, as this is way too much information for this document. However, note items of interest that are required for everyone operating in Class B airspace:

Unless otherwise authorized by ATC, each aircraft must be equipped as follows:

- For IFR operations, an operable VOR or TACAN receiver
- **Charts-** Class B airspace is charted on Sectional Charts, IFR En Route Low Altitude and Terminal Area Charts.

Class C Airspace

Definition- Generally, that airspace from the surface to 4,000 ft above the airport elevation (charted in MSL) surrounding those airports that have an operational control tower, are serviced by a radar approach control and that have a certain number of IFR operations or passenger enplanements. Although the configuration of each Class C airspace area is individually tailored, the airspace usually consists of a 5 NM radius core surface area that extends from the surface up to 4,000 ft above the airport elevation, and a 10 NM radius shelf area that extends no lower than 1,200 feet up to 4,000 feet above the airport elevation.

Charts- Class C airspace is charted on Sectional Charts, IFR En Route Low Altitude, and Terminal Area Charts where appropriate.

Aircraft Speed- Unless otherwise authorized or required by ATC, no person may operate an aircraft at or below 2,500 feet above the surface within 4 nautical miles of the primary airport of a Class C airspace area at an indicated airspeed of more than 200 knots (230 mph).

Examples of Class C airports are Daytona Beach, Florida, Albuquerque, New Mexico, Buffalo, New York, Columbus, Ohio, Allentown, Pennsylvania, Myrtle Beach, South Carolina, Knoxville, Tennessee, Richmond, Virginia and Milwaukee, Wisconsin. Refer to the AIM link for all the locations.

Class D Airspace

Definition- Generally, that airspace from the surface to 2,500 ft above the airport elevation (charted in MSL) surrounding those airports that have an operational control tower. The configuration of each Class D airspace area is individually tailored and when instrument procedures are published, the airspace will normally be designed to contain the procedures.

Aircraft Speed- Unless otherwise authorized or required by ATC, no person may operate an aircraft at or below 2,500 feet above the surface within 4 nautical miles of the primary airport of a Class D airspace area at an indicated airspeed of more than 200 knots (230 mph).

Class D airspace areas are depicted on Sectional and Terminal charts with blue segmented lines, and on IFR En Route Lows with a boxed [D].

Class E Airspace

Definition- Generally, if the airspace is not Class A, Class B, Class C, or Class D and it is controlled airspace, it is Class E airspace.

Charts- Class E airspace below 14,500 feet MSL is charted on Sectional, Terminal, and IFR Enroute Low Altitude charts.

Vertical limits- Except for 18,000 feet MSL, Class E airspace has no defined vertical limit but rather it extends upward from either the surface or a designated altitude to the overlying or adjacent controlled airspace.

Unless designated at a lower altitude, Class E airspace begins at 14,500 feet MSL to, but not including, 18,000 ft MSL overlying the 48 contiguous States including the waters within 12 miles from the coast of the 48 contiguous States; the District of Columbia; Alaska, including the waters within 12 miles from the coast of Alaska, and that airspace above FL 600; excluding the Alaska peninsula west of long. 160°00'00''W, and the airspace below 1,500 feet above the surface of the earth unless specifically so designated.

Emergency Procedures

We could write an entire book on actual emergency procedures. Most emergency procedures are aircraft specific. The physical act of learning how to fly the airplane is fairly simple. Knowing what to do in case something goes wrong is not. You usually don't have very much time to react to an emergency and therefore you have to know the basics of what to do quickly to avoid serious injury or death to yourself and others.

There are several scenarios that may come up where you need to know procedures of what to do. You should always be thinking "what if something goes wrong right now?"

Takeoffs are the most dangerous part of the flight

Remember this: The landing may be considered to be the most difficult part of the flight, but the takeoff is the most dangerous part of the flight. Why? Because as soon as you takeoff, you will find out if there is a problem with the airplane. Also, if you encounter an engine failure – suppose the engine intake sucked in a flock of birds on takeoff – then you are now in a critical situation – you have the runway behind you and you are low and slow.

Other scenarios

Besides engine failures, you have the possibility of running low or out of fuel, getting lost, flying into weather that you cannot handle, radio communications failure (both voice and navigational), failure of a hydraulic or electrical system or a sudden loss of cabin pressurization, requiring a rapid descent to a lower altitude.

Know your aircraft – simulate failures

You should learn your aircraft systems inside and out. Instead of going out to fly another flight, practice a failure in the simulator in offline mode to see what happens and how you handle it. Shut off one or more of your engines at V_1 or V_R on takeoff with a maximum payload and fuel and see what happens and what you have to do to safely fly your aircraft.

If your airplane supports fuel systems such as the Level D Simulations 763, pause the sim and drain all the fuel out one of the fuel tanks to simulate a fuel leak. Do you know your fuel systems well enough to equalize out the weight on the airplane should you discover this problem?

In-flight, simulate an emergency landing **now** – turn off the engines or the hydraulic system and find an airport or suitable landing place. What is the minimum runway length that you would need to land safely? You may land your aircraft into the airport safely but it might become a permanent airport static display if you make a mistake.

Checklists are very important. If you follow the checklist, you won't forget something which might later become an emergency. You might forget to turn off your APU and it may use more fuel than you planned for on this flight. This could turn into an emergency.

Flying at Night

Flying at night is a lot of fun, but it can also be extremely dangerous. If you are flying over rural areas of the country where there aren't a lot of lights below to help you keep your orientation to the horizon, you could become confused and lose control of your aircraft. You cannot see the terrain around you and you could easily fly into a mountain – something you probably wouldn't do during the daytime when you could see where you are going.

We normally fly at night with red lights in the cockpit since it is easier for your eyes to adjust to the outside lights. If you are going to fly at night, turn down the lights in your room where the computer you are using is located – this will help you better see your flight simulation.

The Traffic Pattern

The traffic pattern is a critical element that you must learn and be able to fly. Once you learn the basics of flying the traffic pattern, you will be able to handle ATC requests such as "report left base Runway 6" with no difficulty. You will use the traffic pattern for VFR local touch-and-go practice and arrivals at an airport.

Keep in mind that the actual execution of this part of the course is best performed with your instructor. This will allow you can work out any problems with immediate two-way communication and feedback.

What is the Traffic Pattern?

When you fly the traffic pattern, what you are doing is making a rectangle shaped course around the airport. See the Traffic Pattern graphic below.

Left hand traffic and right hand traffic

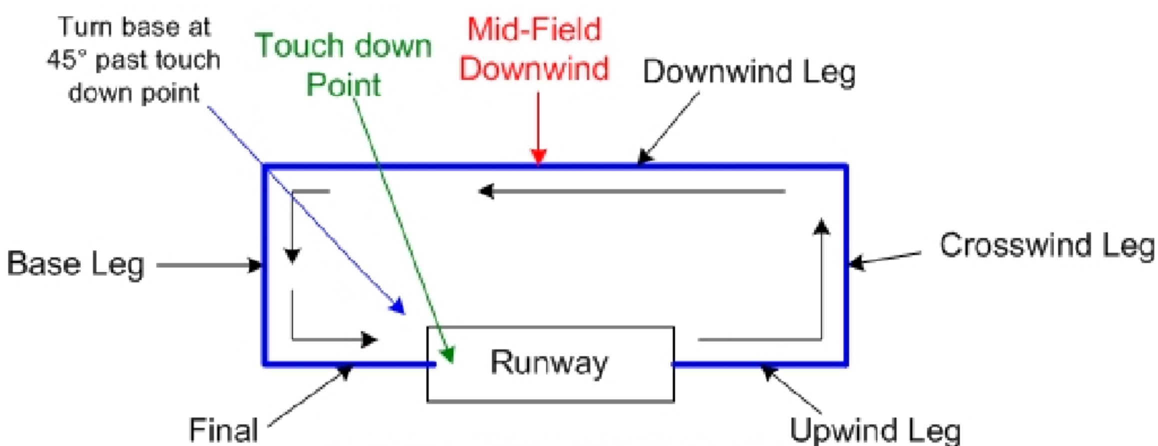
The traffic pattern is usually *left hand*, meaning all turns are made to the left.

Sometimes the traffic pattern is *right hand*. Right hand traffic patterns are usually used when there are two parallel runways. The left runway will fly a left hand pattern and the right runway will fly a right hand pattern.

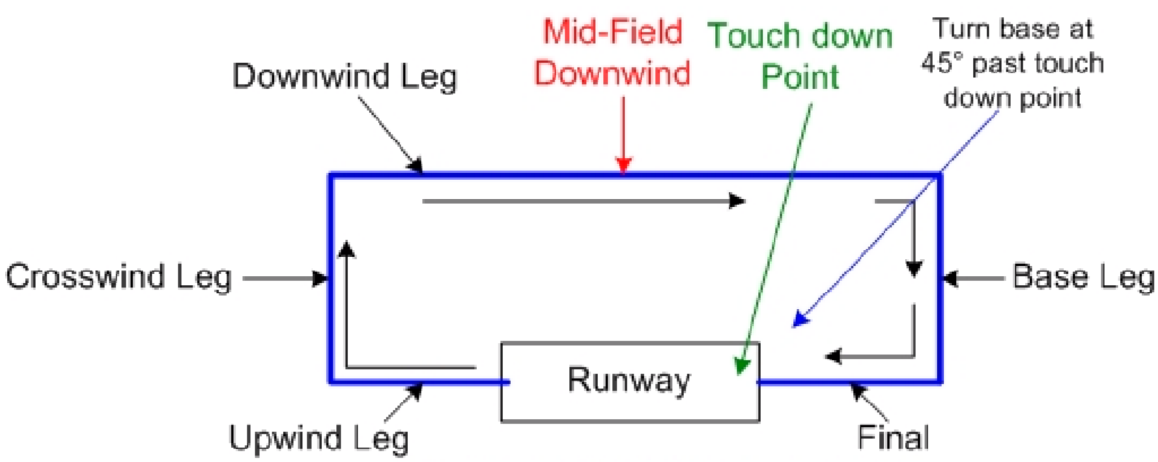
You should assume a left hand traffic pattern for single runway airports and for parallel runways you can expect a left or right traffic pattern depending on which runway you are landing on. You can look this up on http://skyvector.com/airport/search or ATC will inform you if the pattern is a left or right hand traffic pattern.

There are six (6) parts to a traffic pattern. You are expected to know what they are and be able to fly them correctly for all different runway headings.

1. Upwind leg
2. Crosswind leg
3. Downwind leg
4. Mid-Field Downwind
5. Base leg
6. Final leg (Landing)



Left Hand Traffic Pattern



Right Hand Traffic Pattern

Traffic pattern facts:

1. Pattern altitude will vary depending on the airport:

Airport	Light Aircraft	Heavy Aircraft	Left Pattern	Right Pattern
KLGU	5454 MSL	5454 MSL	Left	
KOGD	5270 MSL	5270 MSL	Rwy 3, 7, 34	Rwy 16,21,25
KPIH	5249 MSL	5448 MSL	Left	
KPVU	5491 MSL	5491 MSL	Rwy 31, 36	Rwy 13,18
KTVY	5316 MSL	5316 MSL	Left	
KTWF	4950 MSL	5150 MSL	Left	

Here is an explanation of each leg of the traffic pattern (using a left hand traffic pattern):

1. **Upwind Leg** – This is the first leg of the pattern, which is from right after takeoff until you turn crosswind. Turn to crosswind around 900-1000 ft above the runway.

2. **Crosswind Leg** – Once you takeoff and gain some altitude, you will turn to the left 90 degrees from the runway heading. This is the crosswind leg. This is a climbing left turn. This is an important leg – the amount of crosswind leg you fly is the amount of base leg you will fly. A quick crosswind leg means a quick base leg. A long crosswind leg means a long base leg. Plan your pattern, control your speed and headings.

3. **Downwind Leg** – When you are sufficiently away from the runway, you will turn left 90 degrees from your crosswind heading to place you on a course parallel to the runway on a heading that is 180 degrees opposite of your landing runway heading. *You are flying "downwind"*.

4. **Mid-Field Downwind** - As you fly past the middle of the landing runway, look to the left and note where your touchdown point will be on the runway. At this point you will begin setting up for the approach, unless your downwind is extended for traffic. Control your altitude, heading and airspeed. Slow down to your approach speed.

5. **Base Leg** – Once you are about 45 degrees past your touchdown point, you can begin your left turn to base leg. This is a 90 degree from your downwind heading. You are now on your base leg. This will be a descending left turn to 1200 ft above the airport elevation.

6. **Final Leg** – You will fly the base leg of the traffic pattern until you can turn and line up with the landing runway. This is probably the most difficult part. Turn left 90 degrees from your base leg heading and line up with the extended runway centerline. You will be on a descent path to land on your touchdown point. Control your airspeed, heading and descent rate.

Landing

Most people associate landing with the most dangerous part of the flight, but this isn't true. The takeoff is the most dangerous part of the flight, because, you are in an awkward situation with low airspeed, low altitude, nose up attitude or exceeding your maximum landing weight. If something goes wrong, you may not be able to make it safely back to the runway to land.

After turning on to the final leg, look for the VASI lights on the left side of the runway. Note the color of these lights. If you see all RED, your airplane is ***below*** the visual glide path. To correct this, continue the approach in level flight with a zero rate of descent/climb on the VSI until the VASI colors change from red to white and then begin a 500 ft/min descent. If you see all white lights, your airplane is ***above*** the glide path. To correct this, change your descent rate to 1000 ft/min until you see red over white (on the glide slope) and then begin a normal 500 ft/min descent to the runway. Rule of Thumb: "Red over Red, you're dead or Red over White, you're alright".

The key to landing is learning the basics – this is why you are taught how to fly straight and level using the trim. This is why you are taught how to climb and descend and maintain control at slow airspeeds with and without the gear and flaps extended. If you cannot fly the airplane in level flight, at approach speeds, or make a controlled descent at 500 fpm at 130 KIAS, you will not be able to descend and land your airplane correctly.

Your landing is really set up in the approach. Here is an outline of the common errors that a pilot will do:

- Not descending soon enough/entering the pattern at the wrong altitude makes you too high
- Coming in too high means you will overshoot the runway, so you lower the nose of the airplane to make up for it.
- As a result of lowering the nose, you increased your rate of descent past 500 fpm and are descending too fast
- Because of this extra airspeed, you pull the throttle back.
- Now the airplane is descending too fast and you have too much airspeed.
- Suddenly the VASI lights go from ALL white to ALL RED..you are dead.
- Now you pull back on the yoke and the airplane starts to climb.
- Because you are now in a climb, with throttle back, your airspeed declines.
- Because you are in a nose up pitch attitude, you are unable to see in front of you.
- Your airplane stalls and hits the ground or you can hit the tail or you hit the ground so hard you leave the landing gear on the runway or you bounce, float off the runway.

Could this happen to you? It has happened to all of us at one time or another. For some, it is a normal situation and they have reverted to autoland, allowing the aircraft to land itself.

To make a good landing: Practice, Practice, and Practice. It is important to practice the pattern and approach using the recommended V speeds of the aircraft you are piloting. Practice consistency and flying the pattern and approach, correctly the same way each time.

The Basics of the Landing

In most light weight single engine aircraft, you approach the touchdown point with your descent changing from 500 fpm to almost nothing – gradually and smoothly. While you are gradually adjusting your descent to near level flight, your speed will go from approach speed to touchdown speed, but not instantly. You hold the airplane just a few feet above the runway until the airplane slows down enough to almost quit flying.

In keeping the airplane a few feet off the ground, it will slow down. You will need to apply smooth back pressure on the yoke as it slows down. As you do, the airplane will "flare" – meaning the nose will come up just a bit – not a lot – and as the airplane slows down, it will float to the runway as it reaches a point where the wings will no longer support lift.

Your landing technique is different when flying heavier multi-engine, turbo prop or jet aircraft. These heavier aircraft usually need to land at a reference landing speed (VREF) with the pitch attitude held slightly (2-4 degrees) above the horizon until touchdown. Some are actually flown "ON" to the runway. The combination of correct landing speed and pitch allows the aircraft to make a smooth landing without excessive float which in turn minimizes the amount of runway required to safely stop.

Altitudes + Airspeeds + Flaps + Gear = Flying the Pattern in the EMB-120ER

- Takeoff and accelerate to 180 KIAS
- Between 700-1000 feet AGL, make a 90 degree turn (30 degree bank) to **crosswind**
- Level off at pattern altitude for selected airport – maintain 180 KIAS
- Turn **downwind** by making a 90 degree turn (30 degree bank) from your crosswind heading
- **Mid-field downwind**, pilot reports "(Airport) mid-field (left/right) downwind RWY (Number) touch & go or full stop" runway number
- At **mid-field downwind**, flaps 15 (1 notch) and reduce power and begin slowing to 145 KIAS, maintain pattern altitude
- Maintain 145 KIAS with flaps 15 until reaching a 45 degree point from the runway numbers, maintain pattern altitude
- At this 45 degree point, flaps 25 (2 notches) and turn **base** by making a 90 degree turn (30 degree bank) from your downwind heading – maintain 145 KIAS
- Fly **base** leg descending to 1200 feet AGL, maintain 145 KIAS
- Turn **final** leg onto extended runway centerline maintain 140 KIAS, making a 90 degree turn (30 degree bank) from base heading – extend landing gear and slow to 130 KIAS
- Maintain 130 KIAS with pitch and 500 fpm descent rate with power, trimming as needed until touchdown on your runway.

Extending the Downwind

Sometimes you will have to extend the downwind – maybe there is traffic on final and for spacing purposes you will fly a longer than normal downwind. Plan accordingly and maintain your downwind heading, altitude and airspeed. When clear, turn base, then final. Judge how far away you are from the runway and maintain your altitude until you are at the normal distance from the runway when doing a normal approach. Then start your descent at the appropriate rate and time.

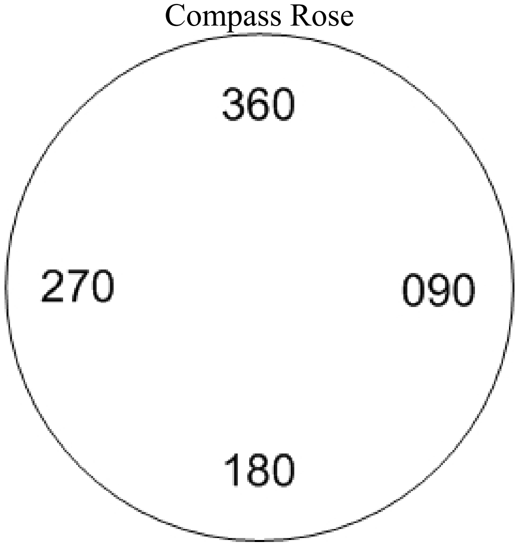
Touch and Goes
When you fly the traffic pattern, instead of slowing after landing and turning off the runway to taxi to the ramp, you set the flaps and trim to the takeoff configuration, apply full power and takeoff while still rolling down the runway, a touch and go.

Stop and Goes
A stop and go is when you stop on the runway, configure the flaps and trim for takeoff, apply full power and take off. You should announce you will be doing a stop and go so ATC and traffic knows you will be stopping on the runway and then taking off again.

Exercising good judgment
Anytime you land long and you do not feel you can make another takeoff safely, simply turn off at the nearest taxiway and tell ATC you will taxi back to the runway for more touch and goes.

Figure out the numbers
There is a method to flying a correct traffic pattern. You need to learn how to use your compass/heading indicator to figure out your headings for the pattern.

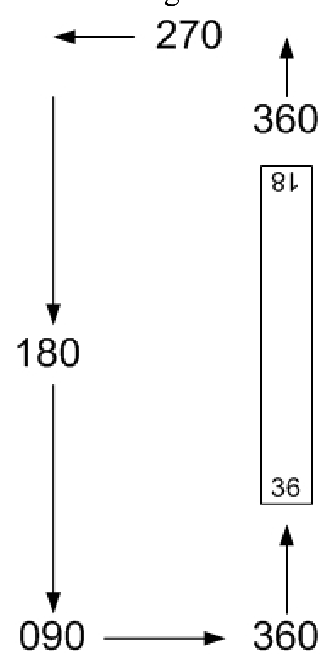
Compass Rose



There are 360 degrees in a compass rose. As we turn clockwise, we see the numbers going to 090 (east), 180 (south), 270 (west) and 360 (north). Each point is 90 degrees away from the last one.

You may not always turn north, west, south, east, but we will always turn in 90 degree increments in flying any pattern, regardless of the runway heading.

Aircraft Headings in the Pattern



You turn left 90 degrees for crosswind. This heading is 270. Downwind is a 90 degree left turn to 180, base is another 90 degrees to 090, and final is another 90 degrees to 360. Each heading is 90 degrees from each other.

Now let's look at the same situation in the cockpit with the HSI.

Upwind and Final - Runway 11 is heading 110

- You are on a heading of 110 degrees. There are 8 marks around the compass – every 45 degrees (65 deg, 20 deg, 335 deg, 290 deg, 245 deg, 200 deg, and 155 deg.
- To the left there is a little white mark (90 degrees left of 110). It is on 020 degree.
- At the bottom there is another white mark (180 degrees left of 110). It is on 290 deg.
- 90 degrees to the right of 110, we have a white mark spot. It is on 200 degrees.

Crosswind heading is 020

Downwind heading is 290

Base heading is 200

Final (RWY) heading is 110

If you notice in all pictures, the mark for 110 degrees is always at or near one of the 90 degree marks on the compass rose. You can simply turn the airplane until you see the mark for 110 arrive at a 90 degree position. Note the headings you will need to fly in advance of the turn, as it makes it easier for you to figure out when to roll out of each turn. It is harder to fly the pattern in flight simulator than in real life because of the poor peripheral vision in flight simulation.

Pattern altitude

It is important to know the field elevation of the airport you are flying around the traffic pattern. Typically smaller, lighter aircraft (Cessna 172) will fly the pattern at 1000 feet AGL (above ground level) and larger, heavier aircraft (EMB-120) will fly the pattern at 1500 feet AGL.

In the real world the pattern altitude varies from airport to airport. In the flight simulator world you can use these altitudes with no problem unless you have high terrain in the pattern area, in which case you may want to fly higher than normal.

If you want to keep it real, you can purchase an airport guide, look it up on the internet or join AOPA (Aircraft Owners and Pilots Association) who publishes an airport guide.

Entering the traffic pattern

You know what the standard traffic pattern is and how to fly it. How do you enter it? There are several methods – but it depends on whether you know the winds at the airport or not. You can't simply click *Shift+z* and use these winds. They are winds aloft and surface winds are usually totally different.

If there is no tower and you don't know the winds, you can fly over the airport and look for the windsock. **It always points downwind!** Simply look at which way the windsock is blowing and how hard it is blowing to get a good idea of the winds. Then turn the airplane so it is flying in the direction that the windsock is pointing and you are on downwind.

If you are flying online, a METAR from a nearby airport will usually have the same surface conditions and may help you better prepare your landing.

Once you know the winds, you can simply announce your intentions – *Vero Beach traffic, Delta 2253 is 5 miles northwest – request active runway.*
Note: Vero Beach has two 11 runways with the 11 heading, 11L and 11R. You should download the airport/runway layout in the DVA Pilot Center via the Approach Charts link.

Variations

You can enter the pattern from downwind by entering the downwind on a 45 degree angle. You can enter the pattern on a base leg, just make sure there is no downwind traffic.

You will not generally want to enter the traffic pattern in the crosswind, but instead cross the airport in the middle of the field at an altitude above the traffic pattern altitude, then enter the downwind leg. Always announce your intentions on Unicom or request permission from ATC for clearance.

Crosswinds

Crosswinds can be challenging but remember this – simply crab the airplane into the wind with enough of an angle that the wind can't push it off the runway centerline. You may not be flying the runway heading at all – you may be on a 095 heading for a runway with a heading of 110, but if the wind is strong enough, it can be pushing your airplane away from the runway centerline and you have to correct for this.

Pitch, Power and Trim

To have proper control of the airplane, you need to understand pitch, power and trim and how you use these techniques to fly the airplane properly. If you learn these techniques, your approaches landings and even your flying will improve dramatically.

Pitch

Pitch controls your indicated airspeed (KIAS), not the throttles. If you lower the nose of your aircraft, your speed will increase and if you raise the nose it will slow down. Basically, if you are supposed to fly the approach at 110 KIAS and you are at 100 KIAS, you should lower the nose to get to 110 KIAS. If you are flying at 120 KIAS and you need to get to 110 KIAS, you need to raise the nose of the aircraft. But, watch your altitude; you do not want to hit something.

Power

Power controls your climb/descent rate. If you are descending too fast, increase power to slow/stop the descent. If you are not descending enough, reduce power to increase the descent rate, do not lower the nose. Understand that the components of pitch, power and speed are interactive. A change in power will affect speed, pitch and altitude, especially at lower approach speeds.

Trim

Trim is used to help you maintain the pitch of the airplane. There are times when you will need to use the full forward or backward motion of the yoke and it isn't enough. Keeping the trim properly set will give you more elevator control, making controlling the pitch easier. Once the aircraft is properly trimmed with minimum pressure on the yoke or joystick, small corrections can be made with slight forward or backward pressure. This is particularly effective in maintaining level flight or during level, climbing, or descending turns.

Summary

Back to the botched landing attempt, let's see what you have learned.

- You are too high in the pattern. You are at 1,800 feet AGL instead of 1,500 feet AGL.
- Because you are too high, pull the throttle back, hold the nose level, slowing the airplane and starting a controlled descent.
- It is very difficult to slow down when descending. Remember you will lose more altitude at a slower ground speed than at a higher ground speed. Trim the airplane as needed to remove any backpressure on the yoke and help you hold the required pitch.
- Now you have a controlled descent of 500 fpm, airspeed set and pitch set.
- As the VASI lights go from all white to red over white, increase the throttle to increase the power to slow the descent rate, holding the pitch (use the trim as needed) to maintain the proper approach airspeed and rate of descent.
- As a result of controlling your speed, pitch and rate of descent, you will approach the runway at the proper speed and descent rate.
- When the airplane comes over the runway at about 10 feet high, level off, pitch nose up 2-4 degrees and slowly reduces the power to idle.
- Hold the airplane level. Touchdown on the runway.

Flight Maneuvers

The following screenshots will show some basic flight maneuvers using your primary instruments: attitude indicator, HSI, altimeter, turn n bank indicator and airspeed indicator.

Straight and Level Flight

This is what straight and level coordinated flight should look like. The attitude indicators shows level flight, no turns or pitch up or down. The turn n bank indicator is level and the ball is in the center. The altimeter is neither climbing nor descending. The airspeed indicator is not increasing or decreasing. The VSI shows no climb ad no descent trends.

Trim is the key to straight and level flight

When you level your airplane, you adjust the trim. This is the 7 and 1 key on the keypad without the number lock turned on. As you level the airplane, it will increase in airspeed and will want to climb. Trim it some more. If you apply too much trim, the airplane will start to descend. After the airplane stops accelerating, the airplane will be easier to trim. You have to keep playing with it, make small adjustments, until the airplane will fly level with no hands on the yoke.

It is possible to fly without using the autopilot – in fact most private pilots never use an autopilot. Real life straight and level flying is easier than in the simulator because the trim works on back pressure that you would feel on the yoke and in flight simulator you cannot feel this pressure. You must learn how to use the trim to make it easier to fly your aircraft. The EMB-120ER flies very well without the autopilot. The more you practice, the easier it will get. Once you master the trim, you will truly be in charge of your airplane. **Trim is the key to straight and level flight.**

It is not uncommon for new pilots to over control the aircraft, especially at slower maneuvering and approach speeds. The results are erratic attitudes and the inability to roll out on a given heading or altitude. The use of smooth incremental changes in ailerons control, power changes, and allowing for momentum prior to leveling off at a new altitude will add to your flying skills. While the use of autopilot is not permitted in the PPL cross-country flights, it can be a good self-teaching tool by noting the small and incremental changes to pitch and course during various flight maneuvers. Emulating the autopilot while manually flying your aircraft can help you to increase your feel and sensitivity needed to fly your airplane.

Climb

This is what a climb - straight & level looks like. You are flying straight ahead to an NDB, heading 130 and climbing at 1500 fpm @ 208 KIAS. You are passing through 5500 feet.

To put the airplane into a normal climb, you would do three things – apply climb power, pitch nose up to maintain 200 KIAS and adjust the trim to maintain this profile.

If you just apply power, airspeed will increase and the airplane will climb. Pitch for the airspeed and climb rate. You will need to adjust the trim to keep it there.

Trim is the key to hand flying the airplane!

Descent

This is what a descent looks like. The instruments here show a heading of 335 with a descent rate of 1500 fpm @ 220 KIAS.

To start a normal descent, reduce power and prop, lower the nose (pitch down) to control the airspeed and use the trim to allow you to do this hands free. Keep in mind that power on descents can quickly increase your airspeed to over-speed conditions, so monitor your power settings.

If you are beginning your descent for approach from your cruise altitude, you should reduce power to idle and maintain level flight at cruise altitude with back pressure on the yoke (trim as needed) until you reach your descent airspeed, then begin the descent at the rate required.

Proper descent planning requires knowing the distance traveled during the descent which can be approximated by the "3 mile rule". This rule states that the airplane will travel 3 nm for each 1,000 ft of descent at 1500 fpm. For example, if you were descending from a cruise altitude of 17,000 ft down to a Traffic Pattern Altitude of 6,000 ft, the descent would be (17000 – 6000= 11,000) 11,000ft. Applying the 3-mile rule, (11,000 ÷ 1,000= 11), you would travel (11 x 3 = 33) 33 nm during the descent. You should add up to 5nm to slow down before the descent begins.

Trim is the key to hand flying the airplane!

A Turn to the right – 30 degree banked turn

This is a 30 degree banked right turn. Note on the attitude indicator the 30 degree bank mark being pointed to by the white triangle that is above the pitch settings – this indicates the 30 degree bank. The altimeter is steady at 6,500 ft and the VSI indicates no climb or descent.

When you turn your airplane, it will start to descend. You will need to counteract this with back pressure on the yoke. Too much back pressure will make the airplane start to climb. The key to a level turn is to apply slight back pressure and then apply trim if necessary to maintain a level turn with no climb or descent.

Climbing 30 degree banked left turn

This is a climbing 30 degree banked left turn – climbing through 7,500 ft at a rate of 2000 fpm @ 186 KIAS. Note the turn n bank indicator shows the left wing on the line and the ball is pretty much in the center.

When you turn the airplane, it will want to descend. You need to counteract this with slight back pressure and then apply more back pressure to make the airplane climb. The key to a good climbing turn is to apply back pressure and apply trim as necessary along with aileron movement to maintain the turn with the proper climb rate and airspeed.

Descending 30 degree banked right turn

This is a 30 degree banked right turn descending through 7,400 ft at a rate of 1500 fpm @ 220 KIAS. Note the turn n bank indicator shows the ball is pretty much in the center.

When you turn the airplane, it will want to descend. Pitch the nose down to make the airplane descend at the airspeed and rate you want. The key to a good descending turn is to release back pressure, adjust the power for descent, apply trim as necessary along with aileron movement to maintain the turn with the proper descent rate and airspeed.

Slow level flight

You are in slow level flight. Your airspeed is 128 KIAS, the Minimum Controllable Airspeed (V_{MCA}) for final approach.

The descent rate is less than 500 fpm, which is acceptable. This aircraft flies very well at slow speeds if you remember to trim it out.

You will be practicing this maneuver at 4,500 feet AGL. Remember to practice slow flight maneuvers at least 3000 feet AGL.

Stall

This is a stall – look in the upper right corner and you will see a red "STALL" light. The airplane stalled at 109 KIAS with a nose high attitude. You are unable to maintain level flight and are falling at a rate of 1100 fpm. This is flown in the same configuration as the airplane on approach – flaps 2 notches and the gear is down.

To recover from a stall, immediately lower the nose to the horizon – this lowers the angle of attack (AOA) and the airplane's wing can bite into the wind and gain lift again. At the same time, apply full power IMMEDIATELY-do not hesitate. This will increase the speed of the wind over the wings and provide more lift. Once the airplane accelerates to above V_{MCA} (maneuvering speed), raise the nose up slightly to recover any lost altitude, retrim and climb back to your original altitude. As airspeed increases, reset the throttles to level flight and retrim again to maintain the original altitude.

Caution: Recovering too abruptly from a stall can put the aircraft in a secondary stall. Smooth deliberate and decisive actions are the key to a successful stall recovery. Keep it smooth.

The Checklist

The single most important thing to learn and use is your aircraft checklist. Your aircraft checklist was created for a reason – it will make sure that you don't forget something. If you don't have a checklist for your airplane type, check the aircraft operating manual that is available for download in the document library – there is one for every aircraft program.

The Flight Cycle

Delta Virtual Airlines is unique in that we value the flight cycle instead of the hours. This is a system that even the military uses. You probably never heard about the hours that a pilot flew in the war, but you may have heard of how many combat flights he flew.

Every flight has a cycle of events that happen and it is important for you to become familiar with events.

1. Flight planning
2. Pre-flight
3. Execution of the flight
4. Post-flight

Flight planning

The entire flight that you will fly will be put together in the flight planning stage. Flight planning is where you plan the route of your flight, review the current METAR and TAF, decide on your alternate airport, figure out the amount of fuel you'll need for the flight, determine your cruise altitude, descent planning, flight schedule information such as flight number, departure and expected arrival time.

Pre-Flight

This is where you go to the airplane and prepare for flight. You check all the systems on your checklist and make sure the airplane is safe for your flight. The external walk around preflight of the airplane isn't simulated in flight sim. But, the internal preflight of systems should be covered in your checklists. If you are flying a payware aircraft such as the PMDG 738, LDS 763, DF 722 or PMDG 744, then you will start your simulation in a cold and dark setup where you have to do all the preflight work according to the checklist. Miss something and it won't start.

Execution of the flight

This is an in-depth topic that we will cover more fully in a bit. Execution of the flight involves pre-start, clearance delivery, pushback and engine start, ground clearance to taxi to the active runway, tower clearance for takeoff, fly the departure procedure, climb to cruising altitude, fly the en-route flight plan, descend, fly the arrival route, execute the approach, land, taxi to the gate and shutdown the aircraft.

Post-flight

Proper shutdown of the aircraft is part of the execution of the flight. Post flight involves making an entry in your log book (filing your PIREP), posting screenshots, and reviewing how the flight went and what changes you should make next time. Nearly every flight is a learning experience, and you should take the time to make notes of what to do better next time, including posting questions in the Water Cooler, Help Desk or flight instructor.

Flying the flight

The execution of the flight involves quite a bit of steps so we will cover them all here. For this example, you will fly from KSLC to KPIH on VATSIM with ATC online:

1. **Pre-Start** – this is when you get your cockpit basically ready to go. You have connected to Vatsim or IVAO and hook up your headset for voice and file your flight plan. APUs should be running, battery switch should be on, and radios should be pre-tuned, and you should have already received a METAR or ATIS report and have noted the weather conditions at the departure, destination and alternate airports and if you have the active sky weather add-on, the weather at waypoints along the way. Once you are situated and are ready to go, contact Salt Lake clearance delivery.

2. Clearance Delivery – You contact him to obtain your IFR flight clearance. If you are flying VFR you will need a VFR flight plan as Salt Lake City is in Class B airspace. You will need to request it be activated at takeoff time by the tower controller.

3. ATC will reply with "clearance on request, standby" – there is no need to reply to this. If there is a problem with your flight plan ATC will either amend it or ask you to fix it before they give you a clearance. Make sure you have the correct departure for the winds at the airport.

4. Once you get your clearance, you should read it back to the controller make sure you got it right. This is a great time to ask a question to ATC if you didn't hear something or are confused. Generally ATC will clear you to an initial altitude, give you a runway to expect to departure from and assign you a transponder squawk code.

New IFR pilots often have difficulty copying and reading back a clearance. There is a simple and reliable way to overcome this problem as follows: The acronym "**C.R.A.F.T**" is often used to describe the various components of an ATC:

a. "**C**" refers to the authorized clearance – Cleared to KDAB
b. "**R**" refers to the cleared route – via OHM transition – then as filed
c. "**A**" refers to the initial and final cruise altitude – climb and maintain 7000 ft – expect final altitude 10 minutes after departure
d. "**F**" refers to frequency – contact departure control on 120.52
e. "**T**" refers to transponder code – Squawk 6320

Knowing the order of "**C.R.A.F.T**" formatted clearance, the pilot can write out the expected clearance beforehand using shorthand notations and blank spaces such as:

Delta 2253 cleared to (airport)via (departure transition) then as filed, climb/maintain (transition altitude) expect (final altitude) 10 minutes after departure, departure frequency ( ) Squawk ( )

Write down the airport, clearance route, transition altitude, final cruise altitude, departure frequency, and squawk code. Then read back to the controller. Learn this now.

5. Pushback and Engine Start – Although not required unless parked at a ramp controlled gate, Clearance Delivery or Ground Control may clear you for pushback and engine start – if you are not sure if you have pushback and engine start clearance, ask. Once you are

ready to go, use the IVAO pushback tool or shift+p to pushback. You will want to start your engines as well and perform any checklist items at this point as required.

6. Taxi to the runway – After contacting ATC ground controller, you will be cleared to taxi to a runway. It is important to understand that unless otherwise instructed, a ground controller issued taxi route automatically authorized the crossing of all runways ….except the active departure runway. You must always hold short at the active departure runway. During this taxi there are other pre-takeoff checklist items to take care of, including setting flaps and trim for takeoff, verifying how much fuel you have onboard and a last minute check to make sure you haven't forgotten anything. Once ready to go, contact Tower.
7. Takeoff –When all pre-takeoff items are completed, contact tower announcing where you are and you are ready for takeoff. Tower will then instruct you are cleared for takeoff along with current wind conditions and any takeoff departure instructions, such as fly runway heading. Start your takeoff roll immediately. Once you are rolling, your sole responsibility is to keep the airplane going straight down the runway and execute the takeoff. As the gear and flaps come up and you are departing the airport, tower will hand you off to departure.

8. Fly the Departure Procedure – after you contact departure they will usually vector you to the departure procedure waypoint on your flight plan, as well as give you additional climb instructions. The departure procedure is known as a SID for Standard Instrument Departure and will be covered in the IFR course.

9. Climb to Cruising Altitude – In this phase you are climbing to cruising altitude. Before you pass through 10,000 feet MSL there is a 250 KIAS speed limit. Once you pass it you can lower the nose a bit and pick up airspeed if you prefer. Crossing 18,000 feet MSL you will change the altimeter to 29.92 inches of mercury. This is called the transition altitude. This is the altitude where you change between actual barometric pressure of the atmosphere to the standard sea level rate of the altimeter. Altitudes are now referred to as FL (flight level). You will probably be handed off to Center before reaching your cruising altitude. You simply tell Center that you are climbing through FL210 for FL360. They will acknowledge your call and make sure no one runs into you in the sky.

10. Fly the En-route Flight Plan – Once you reach your cruising altitude, you will fly the en-route portion of the flight plan. Short flights have a really short en-route portion of the flight while longer flights have a lot of time at altitude. The en-route portion of the flight could be anywhere from 20 minutes to 14 hours. This is where you execute your flight route by flying the (J) jet airways via high altitude VOR's. Typically you will be on autopilot for most if not all of this part of the flight cycle.

11. Descend – Once you reach your calculated descent point, you will slow your aircraft to 245 KIAS and begin a 2500 fpm descent in time to reach your end of descent at the spot you planned. Typically an arrival route will have a predetermined altitude to arrive at a specified waypoint on your route. The idea during descent is to conserve fuel. The thought is that the climb uses a lot of fuel, but it evens out because the descent uses hardly any fuel at all. You will need to have worked out your descent plan during the flight planning stage as previously describe. This calculated distance covered during the descent will determine how far from your destination to start down.

12. Fly the Arrival Route – using either ATC vectors or a STAR (Standard Terminal Arrive Route) which is a traffic flow plan that ATC uses to make sure there is minimal disruption in traffic. Unlike the highway system, air traffic cannot stop at a traffic jam; however when traffic gets backed up, aircraft start to execute holds to space the traffic out. Holds are nothing more than turning big circles in the sky to gain separation from other traffic. The STAR will route you very close to the airport, at which time you will be handed off to approach control.

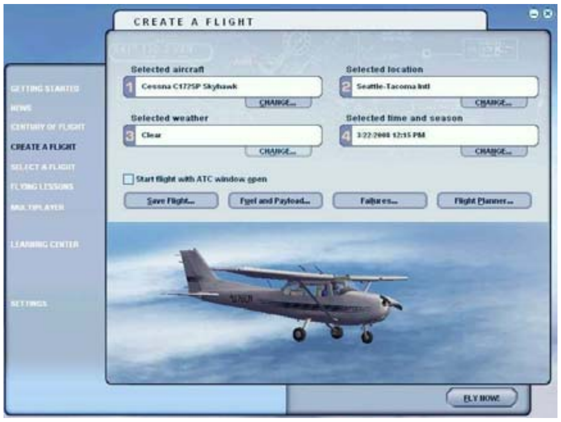
13. Approach – When flying IFR or with VFR flight following, ATC will give you vectors (they will tell you which direction to fly) to setup for your approach and landing. Typically you will use instrument approaches. These are covered in the IFR course.

14. Landing – While it may be the most difficult part of the flight, the landing is the most rewarding. Even though auto-land exists, you should know how to manually land an airplane. Just before landing, approach control will hand you off to tower, who will clear you to land. After landing, tower will hand you off to ground. They will provide instructions for you to follow.

15. Taxi to the gate – After you are clear of the runway, you will contact ground control on the radio. Time to clean up your airplane – flaps up, landing lights off and taxi lights on, wing strobe lights off, etc. Ground control will give you permission to taxi to the gate. If you are unfamiliar with the airport you can request “progressive taxi” instructions. This just means that ATC will give you step by step instructions on when and where to go until you get to your gate.

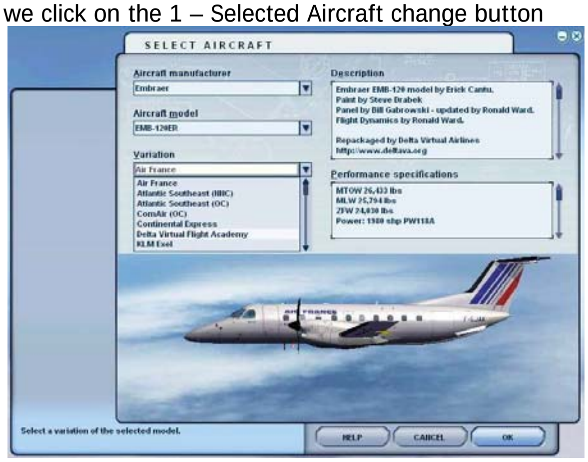
16. Shutdown the aircraft – when you shutdown the aircraft, you should note how much fuel you had left – Were you close to your reserves, way over or running on fumes? You should learn from each flight and make adjustments for your next flight.

How to select the EMB-120ER aircraft from the Flight Simulator 2004 menu

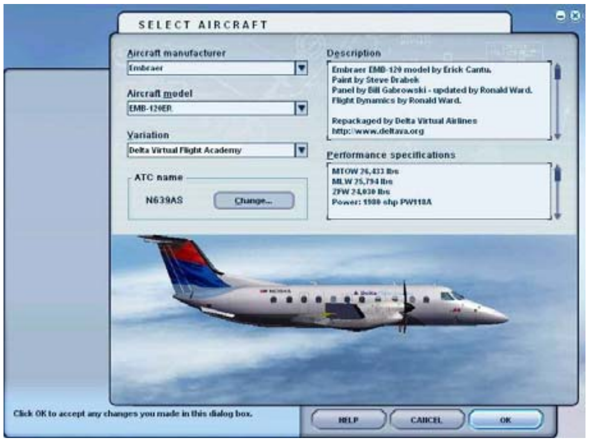


Here is the default FS9 Startup at CREATE A FLIGHT – we click on the 1 – Selected Aircraft change button

Next we choose Embraer from the drop down list and click OK.



If you want to choose a different livery, click in the drop down box and pick the one you want.

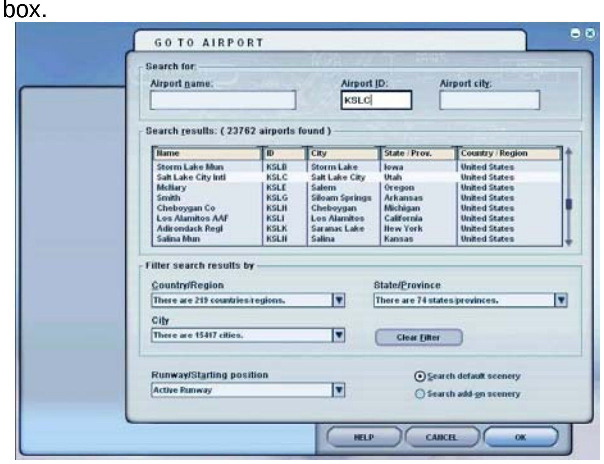


We have successfully changed our aircraft to the EMB-120ER with the Delta Flight Academy livery.

How to select the Salt Lake City Flight Academy Parking Spot from the Flight Simulator 2004 menu

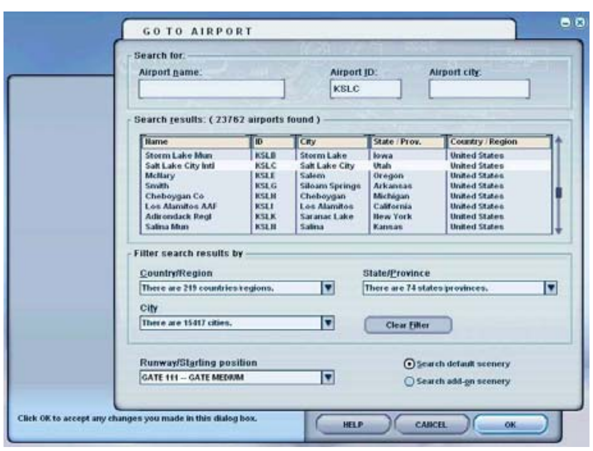
We start with our selected DVA Flight Academy aircraft, the EMB-120ER. Click on Selected Location's "Change" box.

Click the mouse in the box marked AirportID, which will probably say KSEA

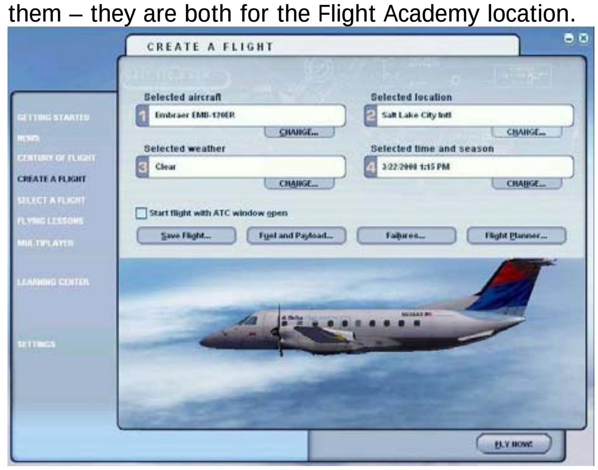


Type KSLC in the Airport ID box

Click on the bottom left hand Runway/Starting Location drop down list and scroll to almost the bottom. There are 2 choices for Gate 111 – Gate Medium. Choose one of them – they are both for the Flight Academy location.



Here we have KSLC in the airport ID box and the Runway/Starting position is Gate 111 – click OK

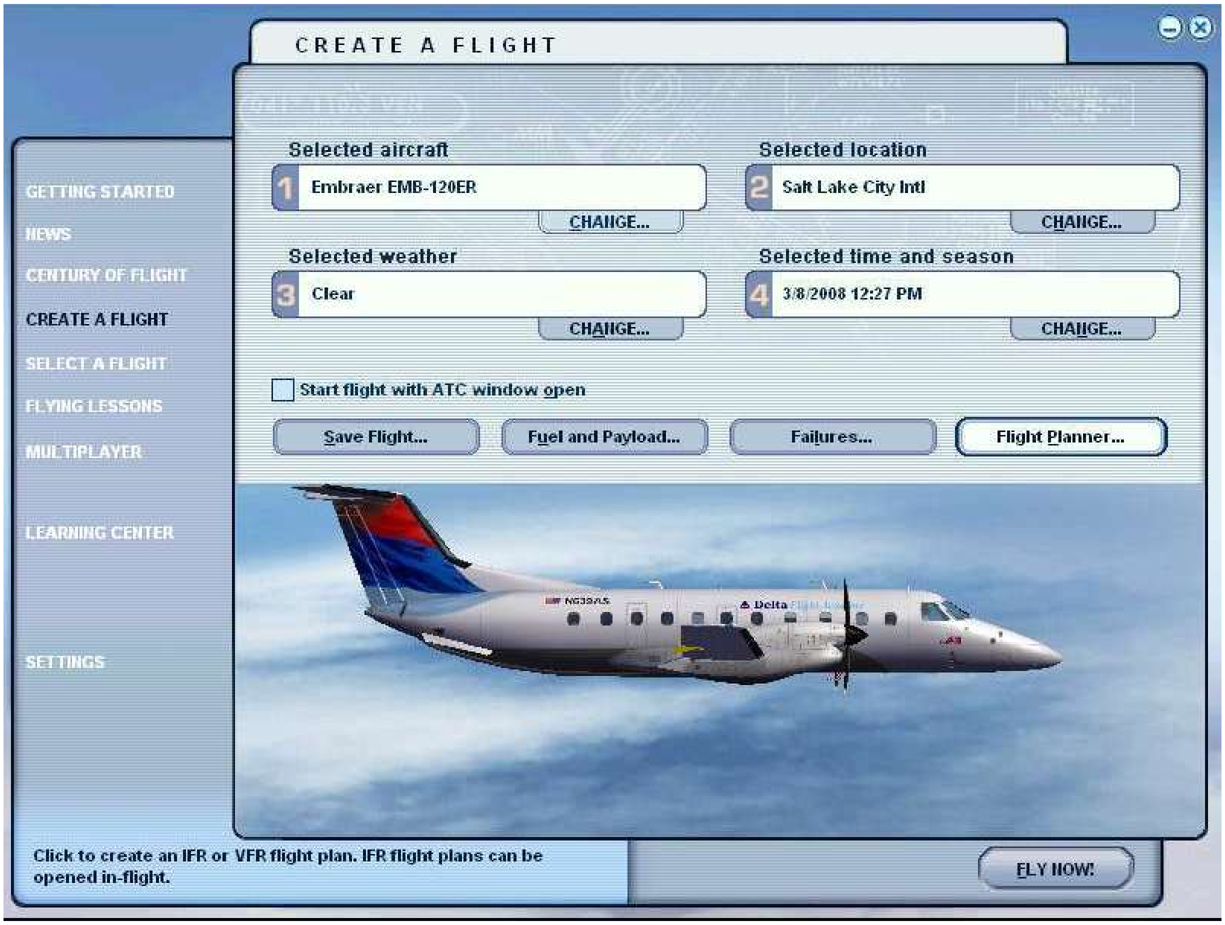


We're all set

Planning the Flight Route

Since this will be our first time using the FS2004 flight planner, we're going to go over every step on how to use the flight planner. There are a bunch of screenshots worth looking at so you do not get confused.

This flight is from Salt Lake City International airport (KSLC), the hub of the Delta Virtual Airlines Flight Academy, to Pocatello, Idaho (KPIH). It is a short flight that should take just around a half an hour to complete in the EMB-120ER.



Getting into the Flight Planner

Above is the Flight Simulator 2004 **Create A Flight** screen. You can see that we have selected the following:

- **Aircraft:** Embraer EMB-120ER aircraft in the Delta Flight Academy configuration.
- **Selected Location:** Salt Lake City Intl (KSLC)
- **Selected Weather:** Clear

Then, click on the **Flight Planner** button as shown highlighted (white) above.

After clicking on the flight planner, it will put you in this screen.

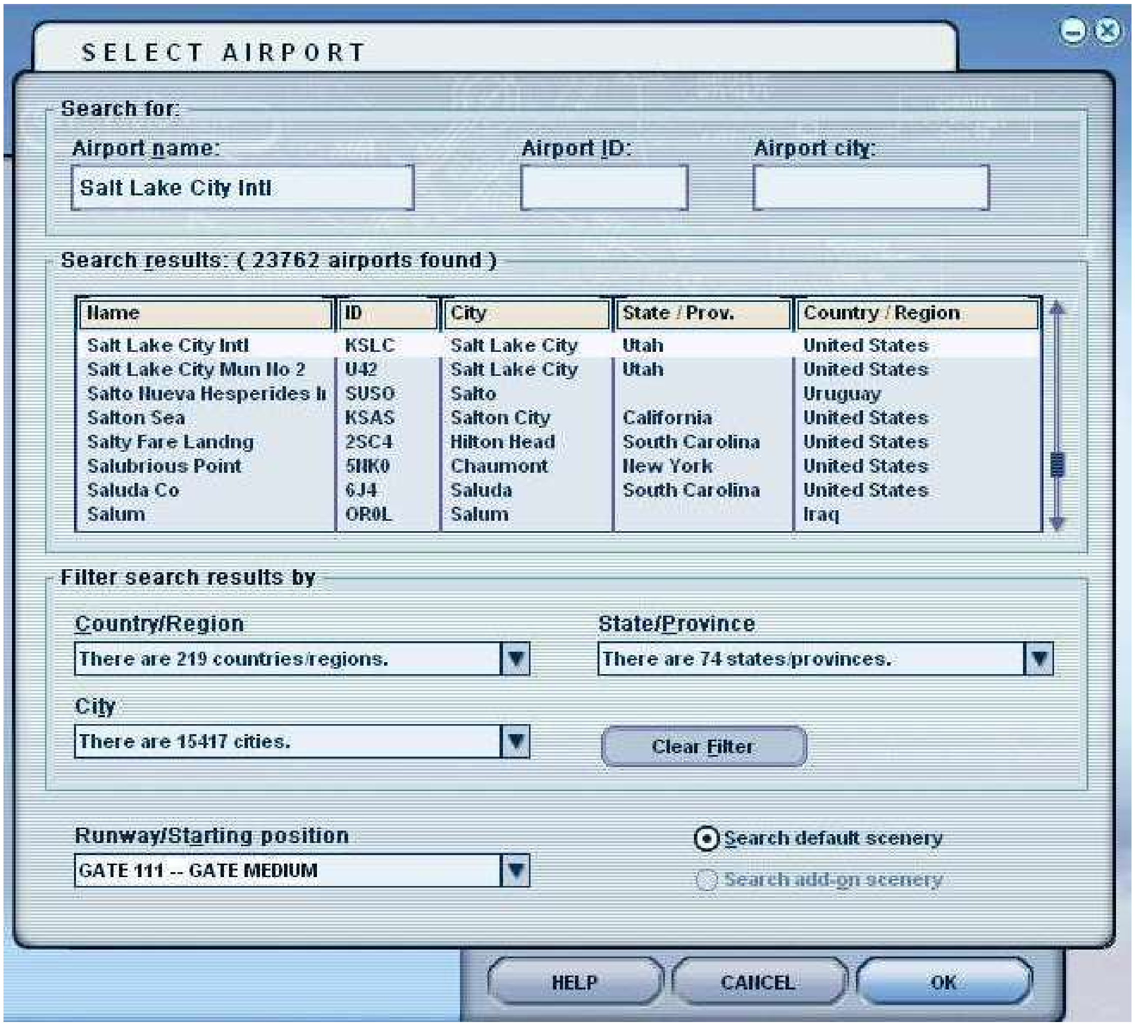
Setting up the Flight Planner

The departure and destinations should be obvious. You will be depart from KSLC and arrive at KPIH in this flight so you will set it for these two airports.

It doesn't matter if you choose a flight plan type of VFR or IFR, as we will be not be saving the flight plan – we are only utilizing the flight planner to come up with our navigation waypoints, frequencies, headings and distances.

Choose routing of **Direct-GPS** for the route type because we will want to build our own flight plan.

Click on the highlighted (white) "Select…" button in the "Choose departure location" option.



Setting Departure Location

The default airport to show up is the one in the first screenshot – Salt Lake City Intl which is KSLC located in Utah.

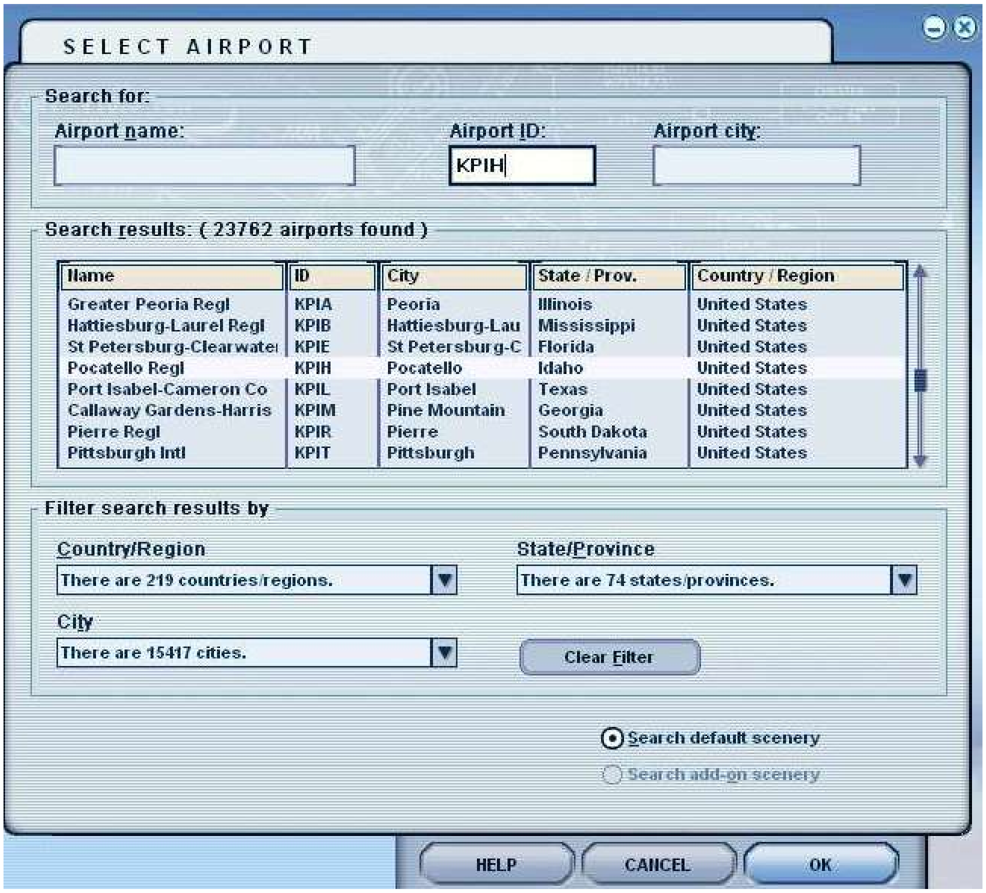
Notice it is not filtered by Country/Region, City or the State/Province. If you happen to have yours filtered, KSLC may not even show up. For example, suppose you have Michigan selected under State/Province. Salt Lake City Intl is not in Michigan so it won't show up on the list. To fix this, simply click on the State/Province option and choose "Any".

After verifying that KSLC shows up, choose OK and it will bring you back to the flight planner start screen.

Choose Destination

Now that you have chosen your departure location, you can see it shows up under "Choose departure location" – if yours does not show **Salt Lake City** (**KSLC**), you can click on select again and change it.

Now click on the highlighted (white) " Select..." button under "Choose destination"



Adding KPIH destination airport

Type in KPIH under Airport ID. You could type in the name of the airport or airport city if you would like to search for an airport if you do not know the its airport code.

You could also choose Airport Name or Airport City if you do not know the airport ID.

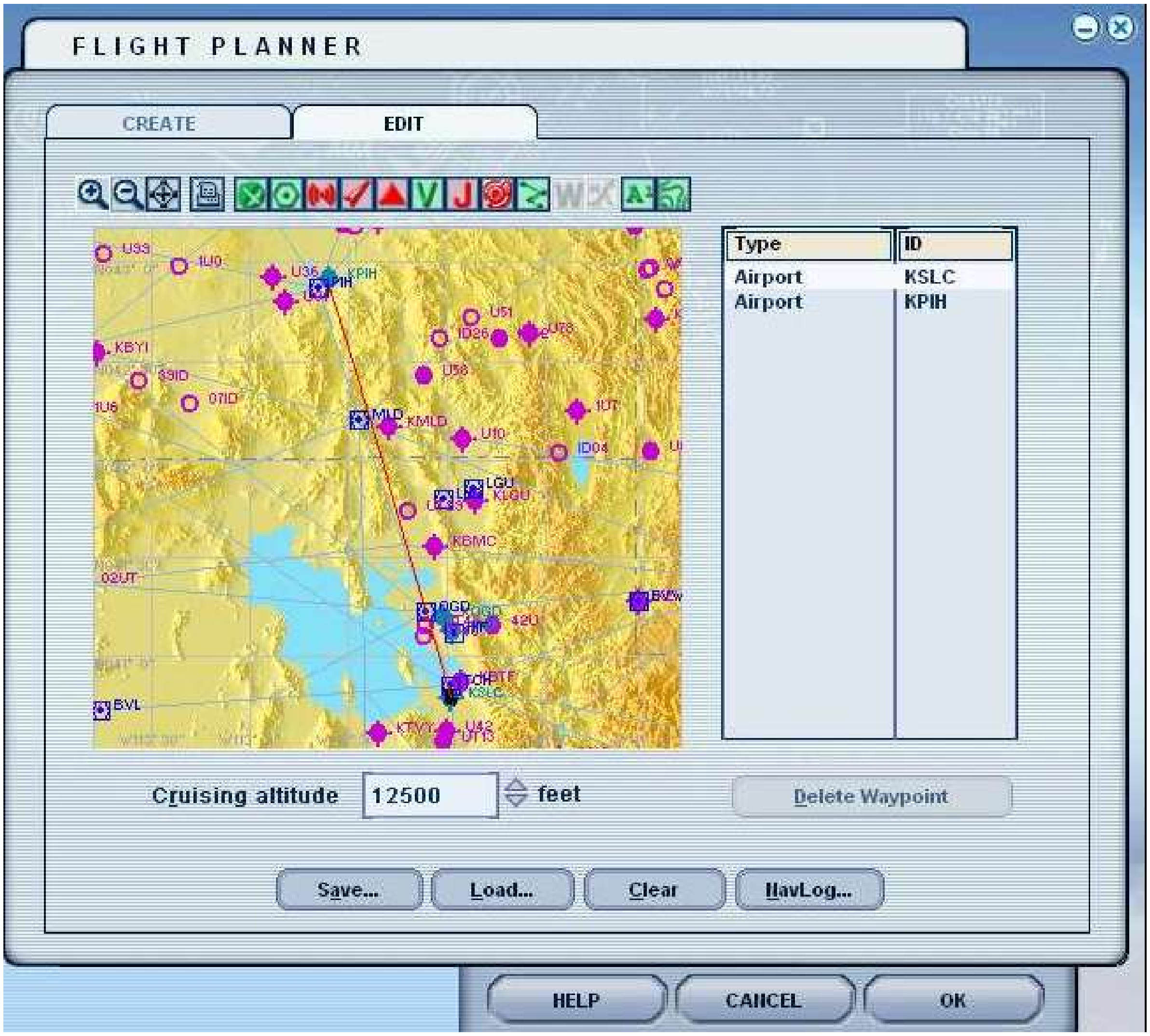
Ready to build our route

We now have our departure Salt Lake City and destination airport Pocatello Regional.

The flight plan type will remain VFR. The main reason to choose one or the other is that the flight planner will give you altitudes based upon the flight rules and also if you save the flight plan and use it, the built-in ATC in Flight Simulator will know that the flight is VFR or IFR and will treat it accordingly. You will be using the flight plan for information to be used in developing your flight.

Choose Direct-GPS. Why? Because we want to build your **own** flight route. If you chose one of the other options, it would add a bunch of waypoints that you would just need to delete. It is preferred to start with the straight line route and build the flight from there.

Click the **Find Route** (white) button.



The default route has been built

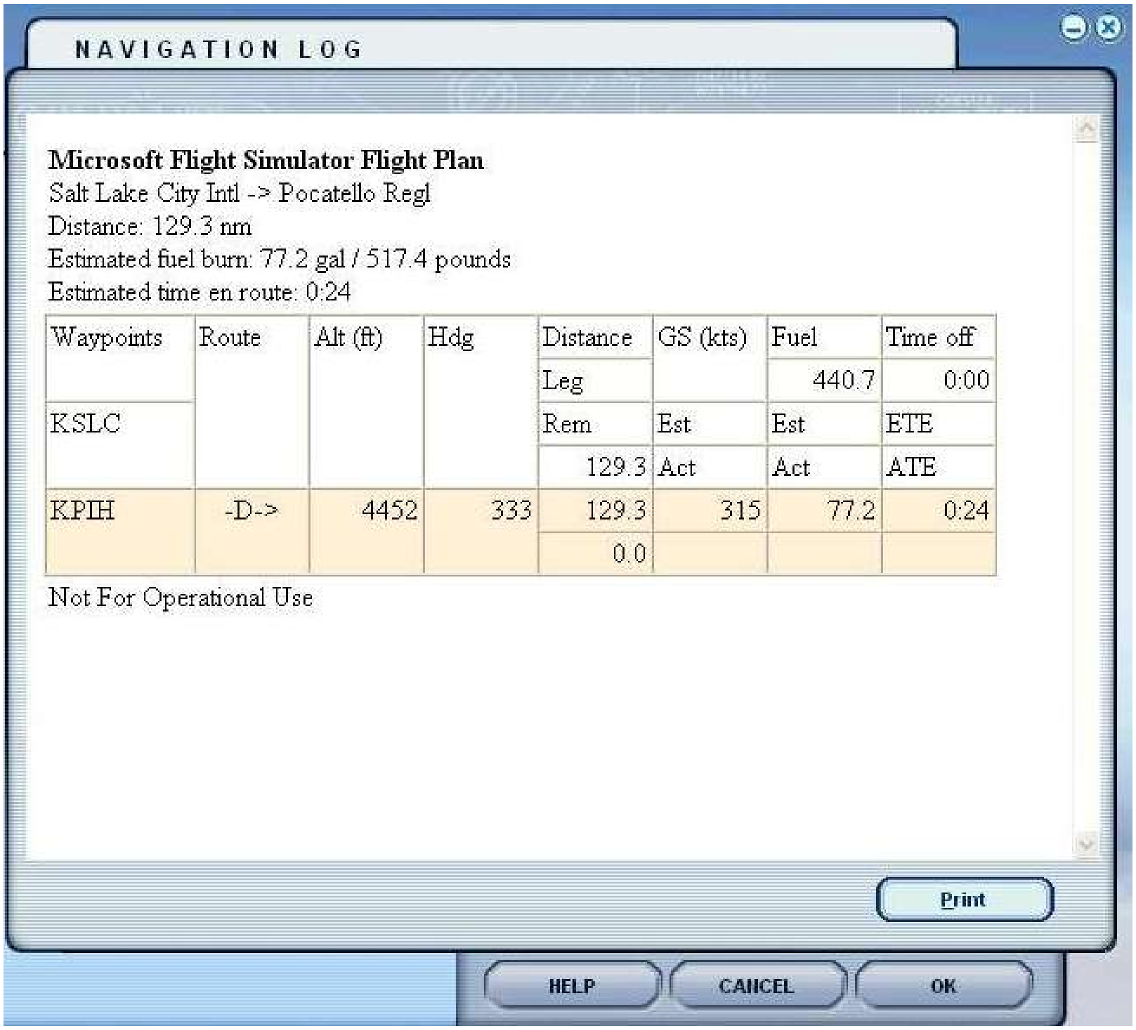
Here is the default flight route – this is the direct route, airport to airport from KSLC to KPIH.

Look at the icons at the top of the picture: You may notice that some of the icons are green and some are red.

The greens ones are activated, meaning they will show up on the map. The red ones are deactivated or filtered, meaning they will not show up the map. This is done to reduce clutter. Filtered are the ILS feathers, intersections and jet airways.

The cruising altitude of 12,500 feet is the minimum cruising altitude for a VFR flight direct between KSLC and KPIH. This means you would need to fly at a minimum of 12,500 feet on this direct route in order to avoid running into terrain. This will change on the (V) Victor 21 airway.

Click on the NavLog… button near the bottom of the screen.



The Navigation Log

This is the default **Navigation Log** – it has some important information that, when the flight is complete, you will need to extract and use for your flight plan.

You can see that the distance is 129.3 nm for the straight line route. The altitude at KPIH is 4,452 feet and the heading to go direct to KPIH is 333 degrees. The rest of the information is not important and in fact is probably not even accurate.

When you get done looking at this, click **Cancel** or **Ok** to return to the main flight planning screen.

Zoomed in to KSLC area

To zoom the map in, simply click on the icon at the top left of the picture that shows the (+) plus key on a magnifying glass.

Zoom into the KSLC area. Notice that Salt Lake City Muni No 2 (U42) and Skypark (KBTF) airports are magenta (red) colored – this means they are non-towered airports. Salt Lake City International is colored blue, meaning it is a towered airport.

If your display doesn't appear like the picture above, make sure you have the icons in red and green as depicted above turned on. Simply click on the icons to toggle between on and off.

Ready to add our first waypoint

The purpose of this tutorial is to teach you how to interact with the flight planner, but it wouldn't hurt to learn a few tips about flight planning.

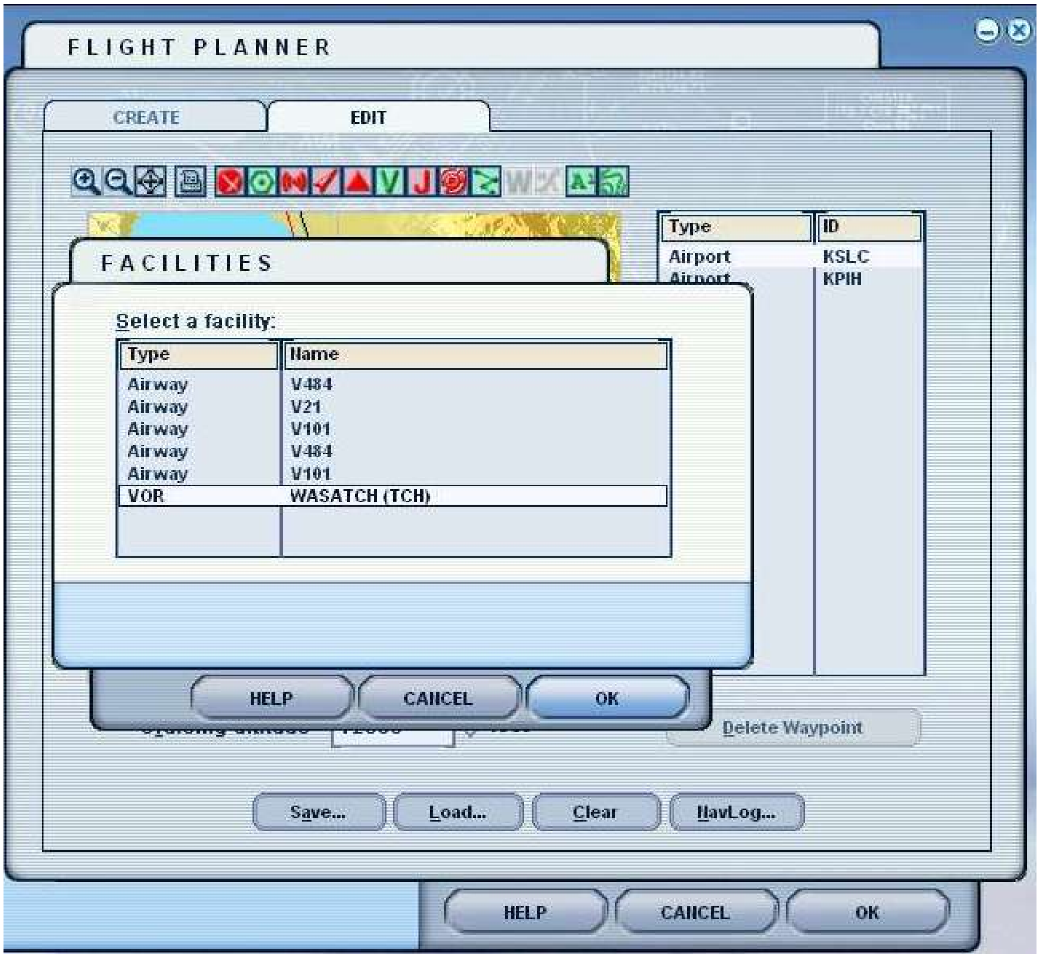
You will want to keep your route as close to the route line as possible to avoid detours. In this case, your first waypoint will be the Wasatch (TCH) VOR. To select the Wasatch (TCH) VOR, click on the red route line. It will change colors and look like the above picture. Now that you have selected it, drag it to anywhere you want to add a waypoint. Drag it towards the Wasatch (TCH) VOR

Notice: The airports icon is turned off to make it easier to see the other navigation aids.

Dragging the route line towards the waypoint

Drag the route line towards the Wasatch (TCH) VOR. Drag the line right over top of the Wasatch (TCH) VOR and let go of the mouse button to add the waypoint to the list.

Note that this is the nearest VOR along the route to where you are heading. You have to choose a navigational aid that is within range so that you can pick up the signal. In this case, the Wasatch (TCH) VOR is a high altitude VOR with a range of 194 NM (more on this later).



Choosing the TCH VOR in the pop-up box

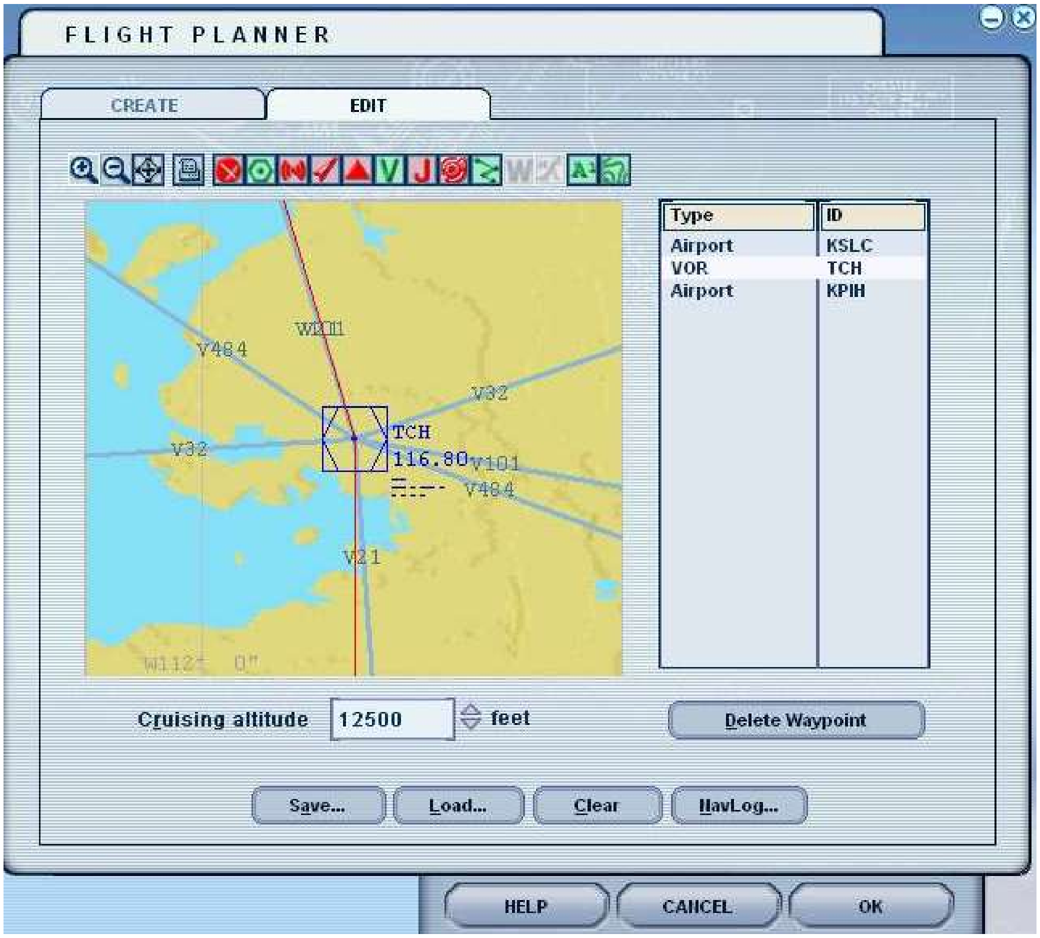
Since the Victor Airways are turned on, there will be multiple things the flight planner has to choose from to drop the route line on. A pop up box will appear asking you to choose. Simply choose the Wasatch (TCH) VOR. If the list has many options, there will be a scroll bar – simply scroll down till you find what you are looking for and select it.

Click OK to continue.

First Waypoint Added

You can see here that you have successfully added the waypoint Wasatch (TCH) VOR.

Notice in the right hand side of the flight plan that the Wasatch (TCH) VOR has been added between the KSLC airport and the KPIH airport.

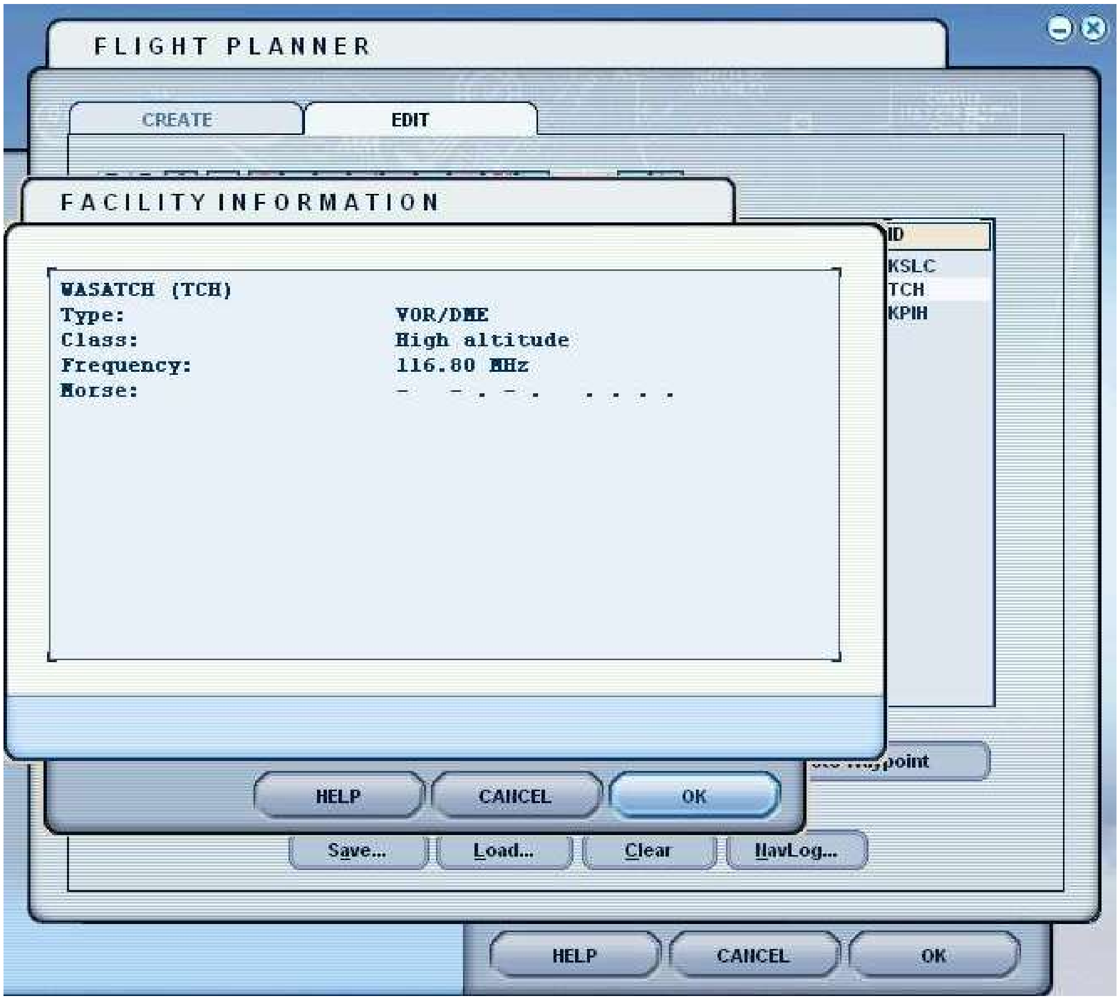


Zooming in on the Navigational Aid

You can also zoom in on the selected waypoint and find more information about it, such as the Morse code signal used to identify the Wasatch (TCH) VOR. You can listen to this code to verify that you have the proper VOR tuned into your radio and that the VOR is working.

This is also a great way to check out terrain features – obviously the Great Salt Lake is easy to spot, but where on that big lake are you? Take a look at the terrain features around the waypoint to help give you visual clues to help you know where you are at all times. We call this situational awareness.

Go ahead and click on the blue TCH VOR to bring up the information page associated with it.



Facility Information

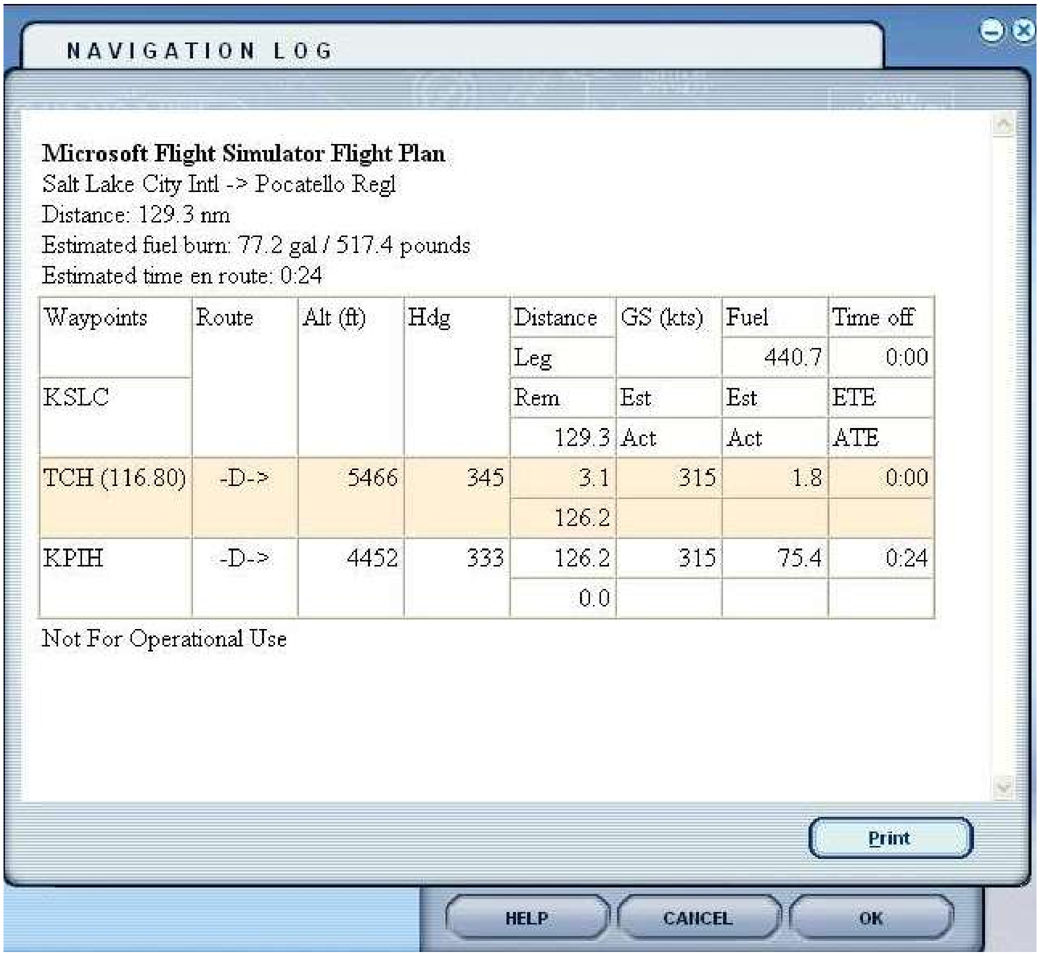
Here you can see that we are able to pull up information about the facility. This can be useful when trying to determine the type of VOR, the range of the navigational aid, the radio frequency, and the Morse code identifier.

The Morse code is a feature that is most useful. Write down the code and then check it when flying. This is the Morse Code for Wasatch (TCH) VOR and yes, you *really* use this when flying!

Notice the type is VOR/DME – this means that the VOR also has a DME (Distance Measuring Equipment) that gives mileage to the VOR - this is given in slant range.

The class of the VOR is High Altitude, meaning it has a range in FS2004 of 194 NM.

When you are done looking at this, click **Cancel** or **OK** to return to the map.



Microsoft Flight Simulator Flight Plan
Salt Lake City Intl -> Pocatello Regl
Distance: 129.3 nm
Estimated fuel burn: 77.2 gal / 517.4 pounds
Estimated time en route: 0:24

Waypoints	Route	Alt (ft)	Hdg	Distance	GS (kts)	Fuel	Time off
				Leg		440.7	0:00
KSLC				Rem	Est	Est	ETE
				129.3	Act	Act	ATE
TCH (116.80)	-D->	5466	345	3.1	315	1.8	0:00
				126.2			
KPIH	-D->	4452	333	126.2	315	75.4	0:24
				0.0			

Not For Operational Use

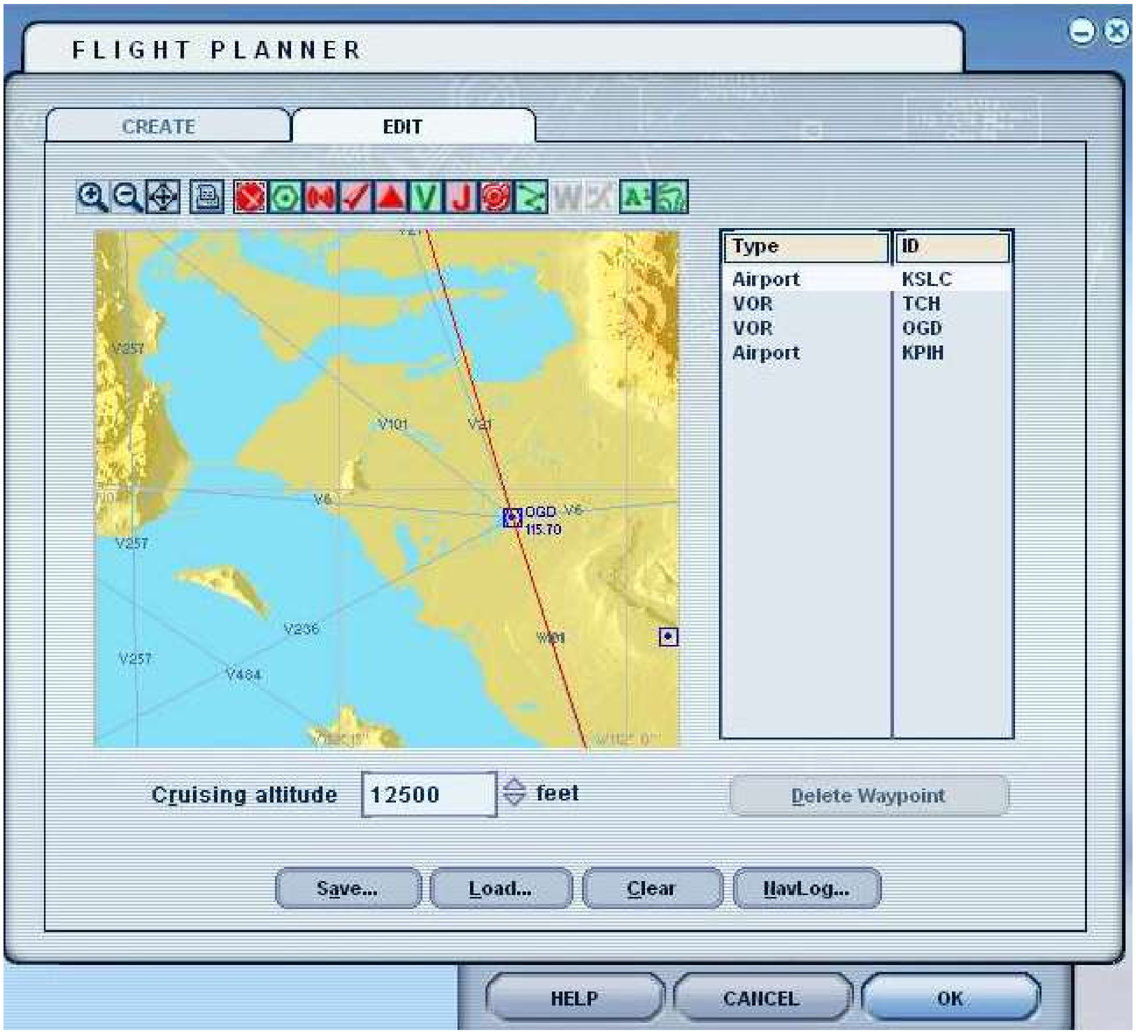
Navigation Log after adding the first waypoint

Click on the Navigation Log to see how the information has changed since you added the waypoint.

The pertinent information is the VOR name, frequency, heading and distance. This information is TCH, 116.80, 345° and 3 NM (rounding off is sufficient here) – it is important to know the distance because we don't want to use a VOR that is out of range.

When you takeoff from KSLC, you should expect to fly close to the runway heading (341 degrees) if departing to the north and if departing from the south, you will expect to turn to a heading of 280, then head directly to the Wasatch (TCH) VOR, which is approximately heading 345°. You have the frequency and the name, so if you know Morse code you can listen on your NAV radio when you tune it to 116.80 to verify it is Wasatch (TCH) VOR.

You can see that we are just 126 NM from KPIH. The total trip distance has increased but this is not really important until the flight route is finished.



Adding the 2nd waypoint

To add the next waypoint, follow the route line towards KPIH – in this case follow the airway V21 (Victor Airway number 21) till you hit the next VOR. The next VOR on the route is the Ogden VOR (OGD115.70). It is common for pilots and ATC to leave off the last zero in the frequency. This will be the next waypoint.

You add the 2nd waypoint just like the first one – select the route line and drag it to the next waypoint and if need be, choosing it in the list box if one pops up. The waypoint is added to the spot between the last waypoint and the next one. In the top right hand side of the flight planner, you can see that the Ogden (OGD) VOR has been added.

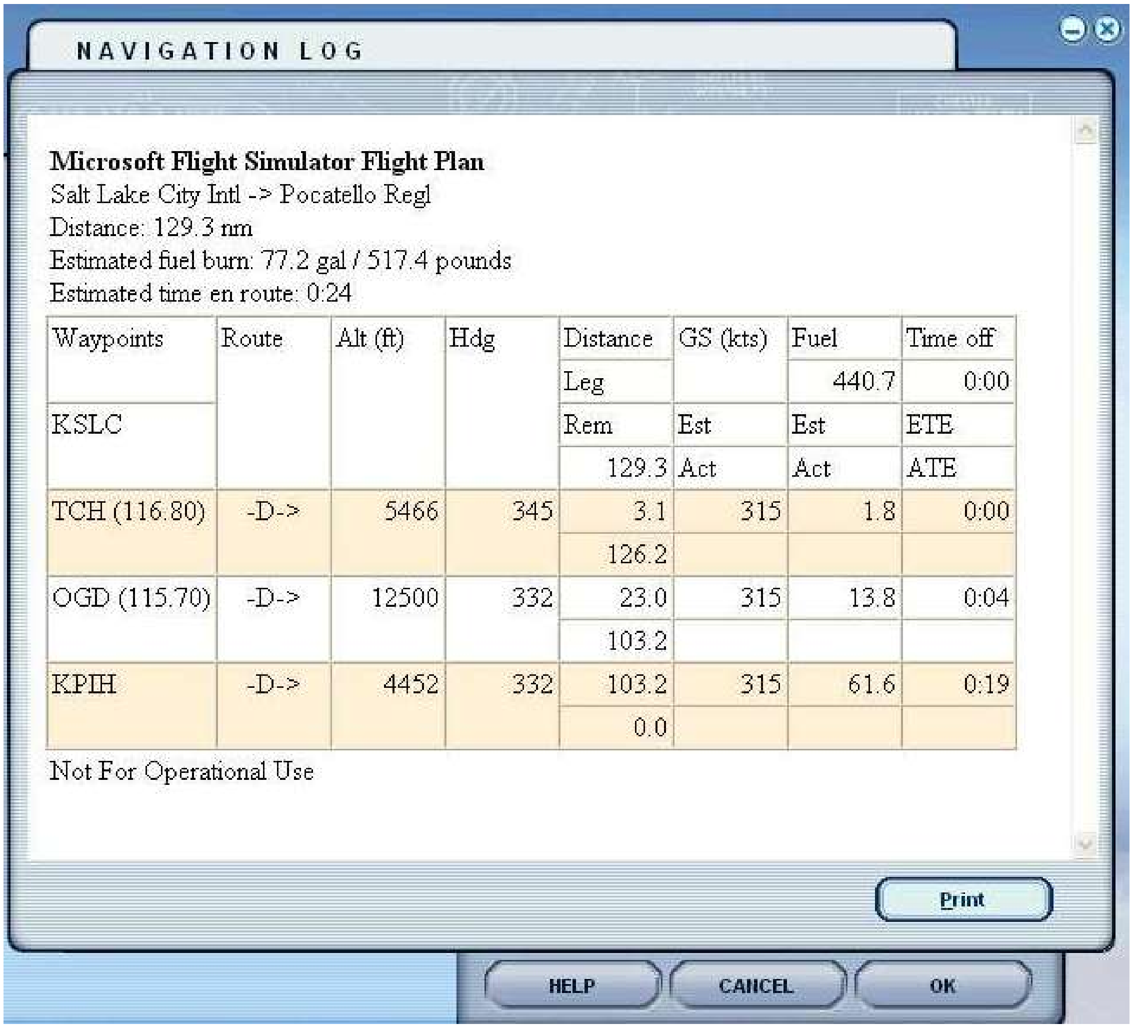
Situational Awareness

Now that you have added the 2nd waypoint, turn on the airport icon again to have the airfields show up on the map. It is a good idea to note the nearby airports to you when you are flying, so in case of an emergency, you are not scrambling to find a place to land.

By knowing that there will be two controlled airports off to your right near the Ogden VOR will help you verify you position during the VFR flight. These airports can act as position checkpoints for your route, reassuring you that you are on the right path and haven't gotten lost.

If you make a mistake and need to delete a waypoint, simply highlight the waypoint in the flight plan to the right, and then click on "Delete Waypoint". Note that there are now 2 waypoints in the flight plan to the right of the screen.

Click on Navigation Log to see the information on the newly added waypoint and what it has done to the flight plan.



Microsoft Flight Simulator Flight Plan
Salt Lake City Intl -> Pocatello Regl
Distance: 129.3 nm
Estimated fuel burn: 77.2 gal / 517.4 pounds
Estimated time en route: 0:24

Waypoints	Route	Alt (ft)	Hdg	Distance	GS (kts)	Fuel	Time off
				Leg		440.7	0:00
KSLC				Rem	Est	Est	ETE
				129.3	Act	Act	ATE
TCH (116.80)	-D->	5466	345	3.1	315	1.8	0:00
				126.2			
OGD (115.70)	-D->	12500	332	23.0	315	13.8	0:04
				103.2			
KPIH	-D->	4452	332	103.2	315	61.6	0:19
				0.0			

Not For Operational Use

Navigation Log after 2nd waypoint is added

You can see that you now have the 2nd waypoint along with the name, frequency, approximate heading to the waypoint and the number of nautical miles to the waypoint.

That information would be Ogden VOR (OGD 115.70), heading of 332 degrees and a leg distance of 23 NM from the Wasatch VOR (TCH 116.80). This is along the Victor 21 Airway. You will cover navigating with Victor (V) Airways in more detail when you cover flight planning using real world low altitude en-route navigation charts. For the purposes of basic flight planning techniques however, the route between the Wasatch VOR (TCH 116.80) and Ogden VOR (OGD 115.70) is on the V21 airway.

Now that you have an idea of how to add waypoint, it is time to try some on your own – next move further down the route line and add in the Malad City (MLD 117.40) VOR and Pocatello (PIH 112.60) VOR.

All waypoints added

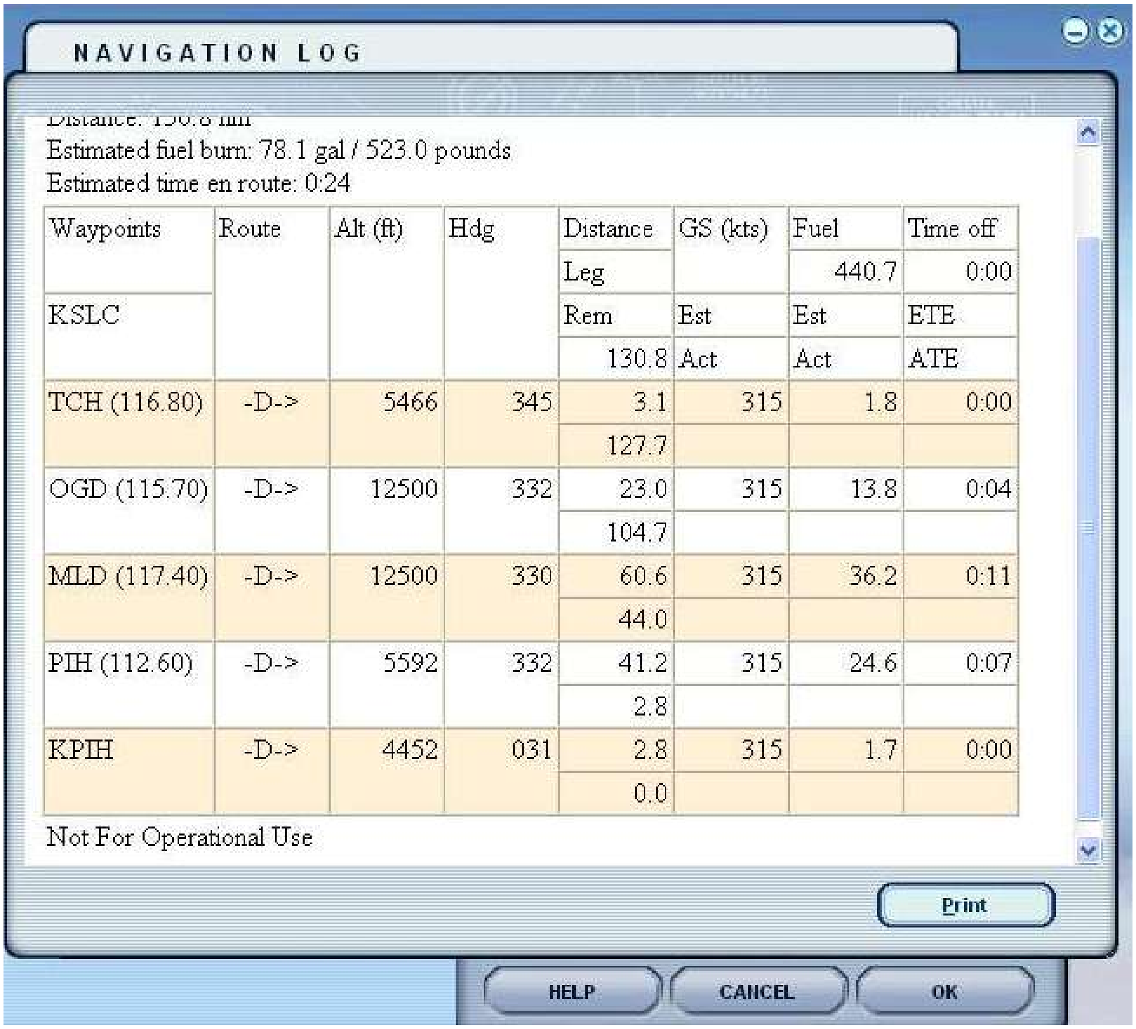
Add all the waypoints to the flight plan, as shown in the list in the top right corner:

KSLC TCH OGD MLD PIH KPIH

This route follows the V21 airway and because of this it can be written in your flight plan as:

KSLC TCH V21 PIH KPIH

Victor (V) airways and flight plans will be covered separately, but if you are flying a Victor (V) airway, you note the entry point onto the airway and the exit point off of the airway – in this case, you would enter it at the Wasatch (TCH 116.80) VOR and leave it at the Pocatello (PIH 112.60) VOR. You do not need to put all of the VORs in the middle in your flight plan. However, you need to know what each waypoint is and how to get there when you are flying.



Distance: 130.8 nm
Estimated fuel burn: 78.1 gal / 523.0 pounds
Estimated time en route: 0:24

Waypoints	Route	Alt (ft)	Hdg	Distance	GS (kts)	Fuel	Time off
				Leg		440.7	0:00
KSLC				Rem	Est	Est	ETE
				130.8	Act	Act	ATE
TCH (116.80)	-D->	5466	345	3.1	315	1.8	0:00
				127.7			
OGD (115.70)	-D->	12500	332	23.0	315	13.8	0:04
				104.7			
MLD (117.40)	-D->	12500	330	60.6	315	36.2	0:11
				44.0			
PIH (112.60)	-D->	5592	332	41.2	315	24.6	0:07
				2.8			
KPIH	-D->	4452	031	2.8	315	1.7	0:00
				0.0			

Not For Operational Use

Navigation Log complete

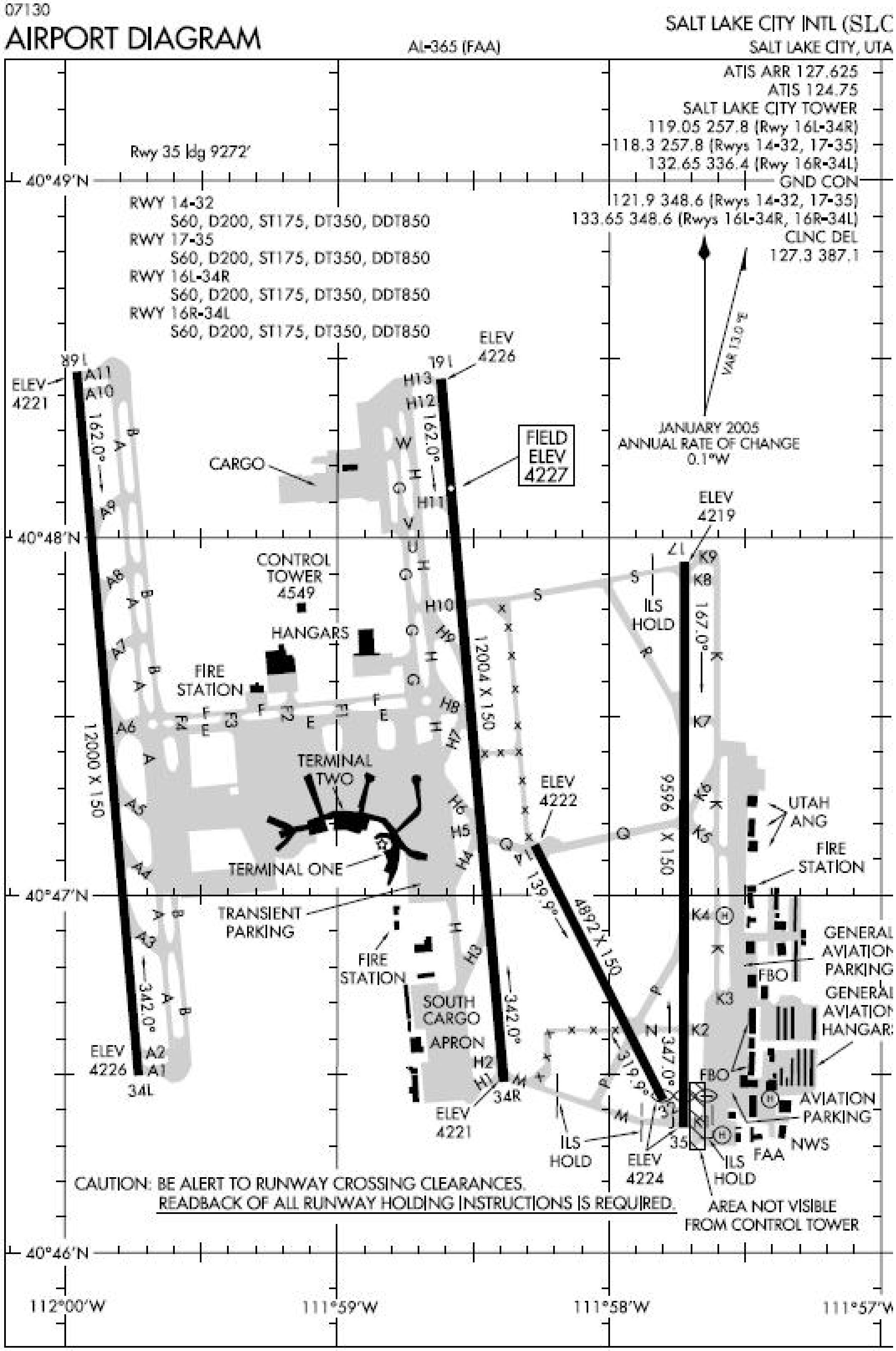
Click on the Navigation Log. This brings up your flight plan. Print this information so you can reference it during your flight. Here is the breakdown:

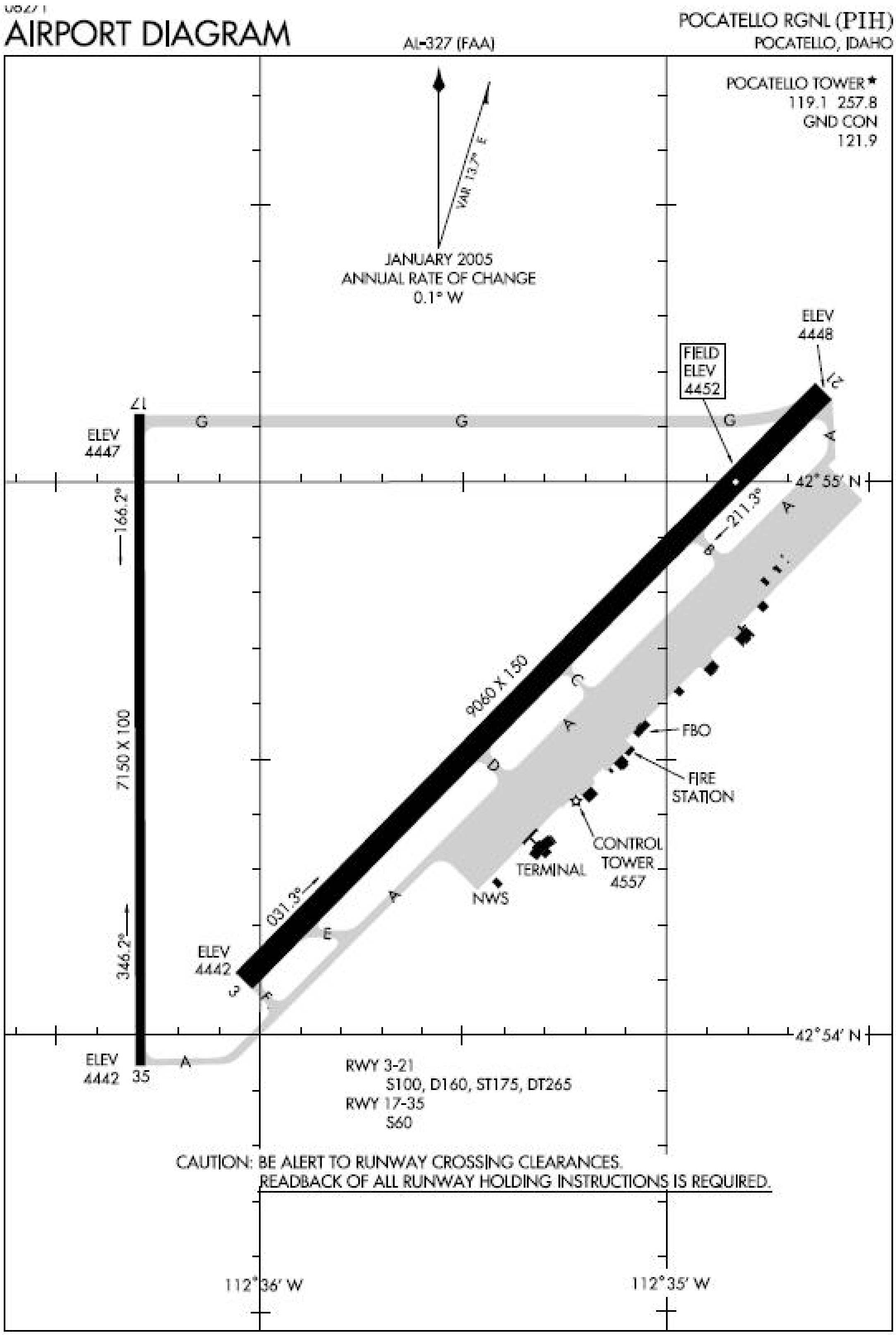
Name of Navigation Aid, Freq, estimated heading and distance in NM

Salt Lake City Airport	KSLC	N/A	N/A	0 NM
Wasatch VOR	TCH	116.8	345°	3 NM
Ogden VOR	OGD	115.7	332°	23 NM
Malad City VOR	MLD	117.4	330°	61 NM
Pocatello VOR	PIH	112.6	332°	41 NM
Pocatello Airport	KPIH	N/A	031°	3 NM

You now have your route of flight, VORs, headings and airports. Verify that each VOR has the range to make the trip. Remember, **Low** altitude VORs have a range of only 60 NM in FS2004 and **High** altitude VORs have a range of 194 NM.

Here are the airport diagrams for the Salt Lake City and Pocatello airports.





Your flight route will bring you to the Pocatello (PIH 112.60) VOR which will set you up for either a straight in landing runway 3 or if winds dictate, a left hand pattern for runway 21.

Flight Planning Basics

This section will cover flight planning except for the flight route. The flight route will be covered next. Flight planning is the single most critical component of a flight. There are many factors to take into consideration such as:

- Flight Number
- Fuel
- Flight route
- NOTAMS
- Restricted airspace
- Charts
- Weather conditions
- Weight and balance
- ATC
- Length and time of flight
- Aircraft and its systems
- Flight number and related information

Flight number and related information – the Flight Academy has designated flight numbers for training flights that you must use to receive flight credit for your flights while training.

Salt Lake City Flight Academy	European Flight Academy
DVA Flight 9951 leg 1: KSLC-KTVY	DVA Flight 9952 leg 1:
DVA Flight 9951 leg 2: KSLC-KOGD	DVA Flight 9952 leg 2:
DVA Flight 9951 leg 3: KSLC-KPVU	DVA Flight 9952 leg 3:
DVA Flight 9951 leg 4: KSLC-KLGU	DVA Flight 9952 leg 4:
DVA Flight 9951 leg 5: KSLC-KPIH	DVA Flight 9952 leg 5:
DVA Flight 9951 leg 6: KSLC-KTWF	

Using GMT

You want to use GMT time on every flight. If you cross time zones, GMT will keep you straight. Here is an example:

If you depart KMCO for KSLC at 0800 hours local time and arrive in KSLC at 1030 hours – how long did the flight take? Well, to get the answer you have to know what time zone KMCO and KSLC are in.

The easy way to do this is use GMT time. You depart KMCO at 1300 hours GMT and arrive 4.5 hours later at 1730 hours. Then you can figure out the local time zone. However, you can see that GMT is consistent no matter what time zone you fly in.

Orlando International is in the Eastern Time zone, which is 5 hours behind Greenwich Mean Time (GMT) – To come up with the GMT, add 5 hours. Salt Lake City is in the Mountain Time zone – which is 7 hours behind GMT. During Daylight Savings time, areas affected will be 1 less hour behind GMT.

It should also be noted that GMT is on a 24 hour clock cycle. Therefore the PM times are listed as hours after 1200 hrs. For example: 1700 hours is 5 PM, and 2100 hours is 9PM.

Fuel – This is aircraft system specific and since you will be flying the EMB-120ER, refer to the EMB-120ER AOM for your fuel planning needs.

Flight Route

This is covered separately because it is a big topic on its own, but generally you will want to fly as straight a line as possible from departure to destination, taking into consideration restricted airspace, weather (bad weather, winds), traffic and radio navigation aids. For VFR flights you will not be dealing with a SID or STAR. Filing VFR flight plans will remove such a restriction, however depending on the airspace, you may be required to fly a specific VFR departure.

NOTAMS

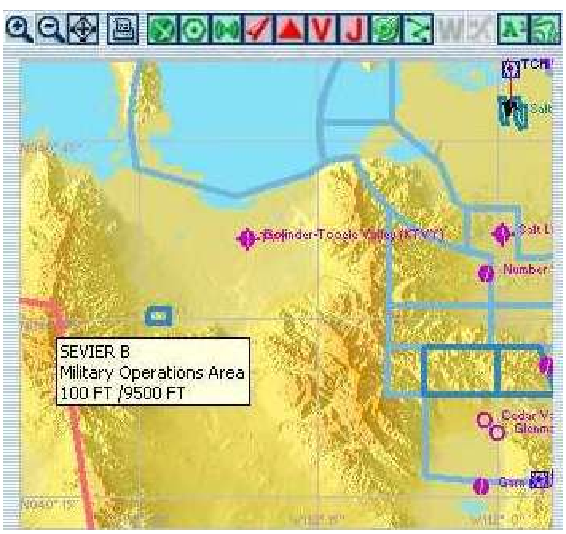
Notice to Airmen – this is a list that you need to check – from your departure to destination airport and every place along the route. There may be some important flight restrictions or other information you would need to know about for your flight. Real world NOTAMS can be accessed here: https://www.notams.faa.gov/

Cruising Altitude

VFR flights eastbound are at odd thousands of feet + 500 feet. Legal cruising altitudes are 3,500, 5,500, 7,500, 9,500, 11,500, 13,500, 15,500 and 17,500 feet.

VFR flights westbound are at even thousands of feet +500 feet. Legal cruising altitudes are 4,500, 6,500, 8,500, 10,500, 12,500, 14,500 and 16,500 feet.

Checking the airspace



Hold the mouse pointer over the airspace border where the red route line is and we see that it is named SEVIER Band it is a Military Operations Area (MOA). The restriction is from 100 feet to 9500 feet.

Right on top of the SEVIER B MOA is the SEVIER D MOA, which is from 9500 feet to 17999 feet.

MOAs

These are military operation areas. Your charts will indicate at what times these area's are hot, and ATC will tell you the same if you ask. Even if getting the times from a chart, it would be wise to ask ATC if any military activity is occurring or likely to occur if you are transitioning the MOA.

Altitude blocks are frequently used as well and the flight may take you under (VFR) or over (IFR) the block altitude in use. Flight planning through an MOA is not impossible and more often than not, quite possible and can save you some flight time.

For purposes of teaching aspects of navigation, we will assume here that the MOAs are hot and therefore we are going to avoid their airspace. If you want to assume they are not active, feel free to do so.

Restricted Airspace

If you are flying near or into restricted airspace, you must check the airspace restrictions. Sometimes the restrictions are altitude requirements – for example the airspace may be restricted to 5,000 feet and we would be able to fly over the airspace at an altitude of higher than 5,000 feet. The airspace may not being used during the time you would be traveling through it. Flying through restricted airspace such as a military operating area could mean getting run over by a military airplane or be caught in the crossfire of some military exercise. You need to investigate closer before trying to fly through this type of airspace.

Charts

Real world flight planning would involve getting VFR sectionals and/or low altitude IFR en-route charts of the area you will be flying in. You can go to your local airport's FBO (Fixed Base Operator) and purchase them. A trip to your local FBO to buy charts is definitely fun and you might meet someone there who is willing to take you flying!

You can get the charts online you will use for VFR flying are the airport diagrams. It's really a good idea to download them and print them out. Many of you have seen links providing free charts. Delta Virtual offers charts in our Pilot Center under the Approach Charts link. These charts are created by the **National Aeronautical Charting Office** – their Acronym is NACO and you can access them also at: http://www.naco.faa.gov/index.asp?xml=naco/online/d_tpp - just choose the date range – they are always kept current – suppose you want to find charts for Salt Lake City, the hub of the Flight Academy. You would simply click on the state of Utah and then type in SLC to bring up the Salt Lake City charts.

Route charts are available at: http://skyvector.com/

You can download the files to your hard drive and refer to them on your PC or print them out.

Weather

There are many resources for checking the weather. You cannot fly into or out of a airport under IFR conditions if you are flying VFR.

For Flight Academy training purposes, you will include in your flight plan that you are "flying in clear VFR weather for Flight Training purposes" and the controllers at KSLC will allow you to fly in their airspace.

You want to re-check the basics of the weather as it is explained in the theory section. You can look at maps to show weather conditions, but there are two very good online items you want to check out; the METAR Report and the TAF Forecast, both of which are put out by NOAA.

You need to check on the current local conditions and the forecasted conditions at the departure, arrival and alternate location. Forecasts should be checked for the time that you would be in the weather system. Using a "Winds Aloft" report is also a good idea and you can find a link for it in the Winds section of this course.

Weight and Balance

Since you have not changed the weight of your EMB-120ER as listed in the AOM, you should be within the weight and balance center of gravity limitations. Flight Sim 2004 doesn't do a very good job of modeling weight and balance. In the real world, if you make a mistake here, you could have serious problems.

ATC

Most Flight Academy training flights will be flown online using VATSIM ATC. Flights that are flown offline will have your instructor acting as ATC.

Length and duration of flight

Will the trip be within the range of the aircraft? How many nautical miles is the trip, and factored in with the expected groundspeed of the aircraft, how long will it take to get there? You do not figure the actual range of your aircraft by the miles it can fly, but rather by the length of the trip multiplied by the ground speed at a specific fuel flow rate. The equipment specifications may say the airplane can fly X amount of miles but as the pilot in command, you are responsible for verifying your flight and fuel planning to ensure you can safely complete the flight.

Time to physically fly the flight

The other big question is – if flying online, do you have the physical time to complete this flight uninterrupted? You should factor extra time for start up, clearance, startup, pushback and taxi. Flight planning itself can take anywhere from 15 minutes to over an hour depending on how thorough and how familiar with the process you are. Take your time. Remember, trouble comes when you try to rush something. If you don't have time to do the flight, pick a shorter duration flight or fly another time. Turn off your IM, ACARS Chat, etc when making a flight.

Aircraft and its systems – You should be familiar with the aircraft you will be flying. Know your systems – how to change radios, lights, where the gear, flaps, spoilers and other systems are located and how they work.

Putting it all together

Now you will put the entire flight plan – route, fuel, weather, etc, together.

Official Flight Information

The flight is officially **DVA Flight # 9951 leg 5**

Flight # Leg#	Departure Airport	Departure Time	Arrival Airport	Arrival Time	Alternate
DVA 9951 Leg 5	KSLC	1215 hrs EST 1915 hrs GMT	KPIH	1315 hrs EST 2015 hrs GMT	KIDA

You are to use simulated weather, as the flight you fly will probably have different weather

- This will be a daytime VFR Flight.
- Cruising altitude is 14,500 feet.
- Real world weather can be used (so long as the flight can be flown VFR)
- This flight will be flown online and we will use VATSIM METAR information for ATIS.

- ATC Radio Frequencies for KSLC, KPIH and KIDA will be available on the airport diagrams but since this is flown on VATSIM, use the frequencies that appear on line.
- Aircraft will be the EMB-120ER.
- KSLC winds 020/8
- KPIH winds 050/11
- KIDA winds 040/6
- Aircraft performance will be as published in the EMB-120ER AOM
- Scheduled time from departure to gate arrival is 1 hour.
- Flight route is: **KSLC TCH V21 PIH KPIH** and is 131 NM.

FLIGHT PLAN

1. Type		2. Aircraft Ident	3. Aircraft / Special Equipment	4. True Airspeed	5. Departure Point	6. Departure Time		7. Cruising Altitude
X	**VFR**	**N285AS**	**EMB-120ER**	**305**	**KSLC**	Proposed	Actual	**14,500**
	IFR							
	DVFR							

8. Route of Flight
TCH V21 PIH KPIH

9. Destination	10. Est. Time Enroute		11. Remarks
KPIH	Hours	Minutes	VFR Training Flight
Pocatello ID	**01**	**00**	Delta Flight Academy

12. Fuel on Board		13. Alternate Airport	14. Pilot Name, Address, Telephone Number & Aircraft Home BAse	15. Number Aboard
Hours	Minutes		Joe Pilot- Delta 2253	**2**
3	**00**		17. Destination Contact	
			208.234.2141 Delta Ops	

16. Color of Aircraft	
Red/White/Blue	:

Now we need to fill in the hard numbers for the flight.

- Length of trip
- Cruise profile
- Climb profile
- Top of Descent
- Descent profile

Do you know how to come up with all these numbers, or why you need them?

- Length of trip – You need to know how long the entire flight is.
- Cruise profile – You need to know what altitude to fly at. Look at the heading, terrain and winds aloft as factors for finding a favorable altitude. What speed to cruise at? How long will it take you to fly the flight? This is crucial for figuring out fuel planning.
- Climb profile – You want to determine how long it will take you to reach your cruising altitude. In the real world this is important but for flight training purposes, we will not break down each minute of the climb phase of flight as this is not necessary for basic flight planning.
- Top of Descent – (TOD) This is where you begin the descent from cruise altitude down to a predetermined lower altitude in preparation for your approach and landing at your destination airport.

- Descent profile – Before you can determine your TOD, you have to know when and where you need to be in regards to vertical flight planning. Do you need to lose 5,000 feet or perhaps 25,000 feet? It makes a difference.

The flight cycle begins with the flight planning. To get started, layout your flight route like this:

Name	Freq	Heading	Distance	Comments
TCH	116.8	345	3 NM	Entry onto the V21 Airway
OGD	115.7	332	23 NM	V21 Airway
MLD	117.4	330	61 NM	V21 Airway
PIH	112.6	332	41 NM	Exit from the V21 Airway
KPIH	N/A	031	3 NM	Distance to the airport
Total	N/A	N/A	131 NM	

To figure out the fuel, time and speeds you will need to do some math. This is also covered in the Flight Encyclopedia on the Delta Virtual Airlines website.

To properly plan fuel, you need to know how long you will burn the fuel. Since you will be flying at 14,500 ft @ 250 KIAS using 400 PPH, you can start to solve some problems.

Computing True Airspeed (KTAS)

First, you need the True Airspeed and you get this by using the 2% rule. Here is the formula:

(KIAS x .02) x (.001 of the altitude) + KIAS = KTAS

Example: 250 KIAS x .02 = 5, then 5 x 14.5 (for 14,500 ft) = 72.5 knots extra speed – round up to 73 knots. Then 73 knots + 250 KIAS = 323 KTAS

Computing Groundspeed

The groundspeed is simply the true airspeed (KTAS) adjusted for winds aloft. To compute this, you will need either an E6B or a flight calculator. Fortunately, you can do this with online flight calculators. Simply insert the heading, the wind speed and direction and your true airspeed. The flight calculator will tell you what your adjusted wind correction angle is along with your ground speed.

For example, if you were flying heading 090 and the winds aloft were 270 @ 50, you would have a 50 knot tailwind. The 323 KTAS would result in a 373 knot ground speed. Flying with winds of 090 @ 050 would result in 273 knots groundspeed with a 50 knot headwind.

For the purpose of this flight plan, we will say our groundspeed is the same as the true airspeed – or no winds aloft and clear weather.

Computing the Nautical Miles per minute

Next take your 323 KTAS and divide it by 60 (minutes) to come up with how many NM you will fly in 1 minute. (323 ÷ 60 = 5.38). Round this number to the nearest tenth, or 5.4 NM per minute.

Computing the flight time

Now that you know the distance you are traveling per minute at cruise altitude, divide the flight distance of 131 NM by the NM per minute of 5.4. (131 ÷ 5.4 = 24.2) – rounded down to 24 minutes.

The next step is to add 10 minutes to the flight time. Always add 10 minutes to this number to offset the climb and descent. This makes your flight time 34 minutes.

Divide 34 minutes by 60 to get the flight hours (34 ÷ 60 = .56) flight hours, which is rounded up to .6 flight hours.

You will have to add fuel for a .6 flight hour flight. You will also have to add fuel for other factors and this is covered in the EMB-120ER AOM under fuel planning. Your instructor will go over fuel planning with you in detail in the flight planning lesson to ensure you fully understand.

The Descent

Your descent will be at 220 KIAS @ 1500 fpm with the power at flight idle. You want to get to the PIH VOR at 6000 feet at the same time.

You will have to descend 8,500 feet (14,500 – 6000 = 8,500 ft). 8,500 ft divided by 1,500 fpm is about 5 minutes and 30 seconds.

For basic TOD planning purposes, use a factor of 3 NM per every 1000 feet needed to descend. Therefore plan 3 NM x 8.5 ft = 25.5 NM for the descent. Add in up to 5NM total for slowing down the airplane at TOD, crossing @ 10,000 ft and slowing to approach speed. You should begin your descent at 30.5 NM out from the PIH VOR in order cross it at 6,000 ft to be at the right altitude to make the approach into runway 3 or to enter a left downwind for runway 21.

The Alternate Airport – by the numbers

To fly to your alternate, Idaho Falls (KIDA), you need to fly to the IDA VOR, which from the PIH VOR is 47 NM away. You should always create a 2nd flight plan from the arrival airport to the alternate airport and have the navigation information ready. Plan the alternate airport at the same fuel rate as the cruise rate. This was 5.4 NM per minute.

(47 NM ÷ 5.4 NM) = 8.7 minutes. Round it up to 9 minutes, then divide by 60, equals .15 flight hours. Round it up to .2 flight hours to the alternate airport.

Putting It All Together – by the numbers

Here are some numbers:

- Length of trip – 131 NM
- Cruise profile – 14,500 feet at 323 knots groundspeed
- TOD – 30.5 NM from PIH VOR
- Descent profile - - 1500 FPM at 210 KIAS, taking 30.5 NM from 14,500 to 6,000’ at PIH
- Flight time – .6 flight hours
- Alternate – 47 NM - .2 flight hours
- Fuel planning IAW EMB-120ER AOM

We can now figure out the fuel needed for the trip. We will make a chart

Phase	**PPH**	**Flight Hrs**	**Fuel per Eng**
Unusable Fuel	N/A	N/A	24.4 lbs (static)
Ground Ops	200 PPH	.5	100
Flight	400	.6	240
Reserves	400	.75	300
Alternate	400	.2	80
Hold	N/A for VFR flight	N/A for VFR flight	N/A for VFR flight
Total	N/A	2.05 hrs of fuel	744.4 lbs of fuel

You can see that the chart includes the PPH (pounds per hour), Flight Hours and Fuel per engine – this is important to understand. If you have 2 engines, you double the fuel listed here – if you have 4 engines, you multiply by 4, etc.

At this point in your training, your instructor will also be teaching you how to navigate using NDB, VOR and DME. You will have an idea of what is going on when you get into the cockpit. Please keep in mind that all of these techniques may seem confusing at first, but in a one-on-one voice session with your instructor in the airplane, it will be a lot easier to understand.

Phonetic Alphabet

When you communicate with ATC, or listen to an ATIS, you will routinely substitute letters with Phonetic words. You should memorize this phonetic alphabet. Never say "DELTA 2253 is 15 miles north of the VXV VOR". You should say "DELTA 2253 (twenty two fifty three) is 15 miles north of the Victor X-Ray Victor VOR"

A	Alpha
B	Bravo
C	Charlie
D	Delta
E	Echo
F	Foxtrot
G	Golf
H	Hotel
I	India
J	Juliet
K	Kilo
L	Lima
M	Mike
N	November
O	Oscar
P	Papa
Q	Quebec
R	Romeo
S	Sierra
T	Tango
U	Uniform
V	Victor
W	Whiskey
X	X-Ray
Y	Yankee
Z	Zulu

Delta Virtual Airlines Flight Academy Embraer EMB-120ER Checklist

The EMB-120ER checklist is located in the aircraft operations manual (AOM). Download this manual and aircraft check list. Go to the Delta Virtual Airlines website @ http://www.deltava.org/ and log in. Then go to the Pilot Center, scroll down to the Document library and download the EMB-120ER Operating Manual.

Learn the cockpit - The Embraer 120ER

In the Embraer 120ER AOM there is an explanation of the cockpit layout. Learn the cockpit layout by heart, so you can go to controls, switches, radios, etc with your eyes closed.

Recommended References:

- **[FAA - Home]** **website**
- **FAA Aviation Manuals**

  http://www.faa.gov/regulations_policies/handbooks_manuals/aviation/
- **Pilots Handbook of Aeronautical Knowledge**

  http://www.faa.gov/library/manuals/aviation/pilot_handbook/
- **Aeronautical Information Manual (AIM)**

  http://www.faa.gov/airports_airtraffic/air_traffic/publications/ATpubs/AIM/
- **NACO Aeronautical Charts**

  Free Online Products
- **METAR/TAF, Winds Aloft**

  http://weather.noaa.gov/weather/coded.html
- **Aviation Supplies & Academics (ASA)-Books, Calculators, Pilot Supplies**

  http://www.asa2fly.com/
- **Aircraft Owners & Pilots Association (AOPA)**

  http://www.aopa.org/
- **On Line Charts from Sky Vector-VFR, Terminal, Airports**

  http://skyvector.com/
- **EMB 120ER Aircraft Operations Manual (AOM)**

  Delta Virtual Airlines

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