FlightGear

CROSS-COUNTRY TUTORIAL

II

a VFR guide

DE PROFUNDIS

three point zero

FlightGear ▪ Cross-Country Tutorial II ▪ a V F R guide ▪ version 3.0

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Preface

This is a cross-country tutorial that aims to take the FlightGear Flight Simulator pilot a step closer to realism in all aspects of a VFR flight. It's designed for pilots who generally know how to operate aircraft in the FG environment, therefore having read the FlightGear Manual and the excellent tutorials it contains.

What is more in this tutorial is that it focuses a great deal in basic aviation knowledge, the necessary preflight preparations and provides useful information about airport operations, airspace and ATC communications.

Many countries have the policy of providing through the internet free access to their aeronautical information (charts, procedures etc). Data for this work has been collected from many sources but mostly from FAA (Federal Aviation Administration, USA's authority for aviation) publications such as the Aeronautical Information Manual (AIM) and the Pilot's Handbook of Aeronautical Knowledge (PHAK).

Although the standards for civil aviation worldwide, set by the UN's International Civil Aviation Organization (ICAO), are adopted by all UN member states, most countries make adjustments to meet their specific demands. So does USA and the European countries.

In some aspects, for example airspace classification, differences between USA (FAA standards) and Europe are more significant than others. This tutorial tries to fulfill its aim by adopting FAA standards, assuming that virtual pilots are equally benefited that way.

The reason for choosing USA procedures and locations is the long list of top quality aviation material, like those handbooks, available to everybody via the internet, for which we express our gratitude to the FAA.

Special Thanks to **chris_blues** !!

for being able and kind to provide the amazing in-game screenshots for the last chapter.

We hope to satisfy those who enjoy combining the fun of FlightGear
with expanding their knowledge about aviation.

The purpose of this tutorial is to be instructive only to virtual pilots and never to be used as a guide for real pilots!

Contents

Handy Tools **5**

Basic Concepts **6**

Course and Heading 6

Time Distance Speed 7

Atmosphere and Altitude 8

Fuel Consumption 9

Visual Flight Rules 10

Charts 10

A/FD and NOTAMs 11

Correcting for Wind 12

Airspace and Air Traffic Control 14

Flight Planning **17**

The Airports 18

Reno/Tahoe International - (RNO or KRNO) 18

Eastern Sierra Regional (BIH or KBIH) 20

Weather Check 21

Charting the Course 22

I - True Course and Distance 23

II – Elevation, Cruising Altitude, Airspeed 23

III - Wind triangle and Magnetic Heading 24

IV - Checkpoints 25

Filing a VFR Flight Plan 28

Flying! **30**

Parking Position 31

In the cockpit 32

The runway we'll be departing from 32

Startup and Taxi 33

Cleared for Takeoff 34

The Climb 35

En Route 37

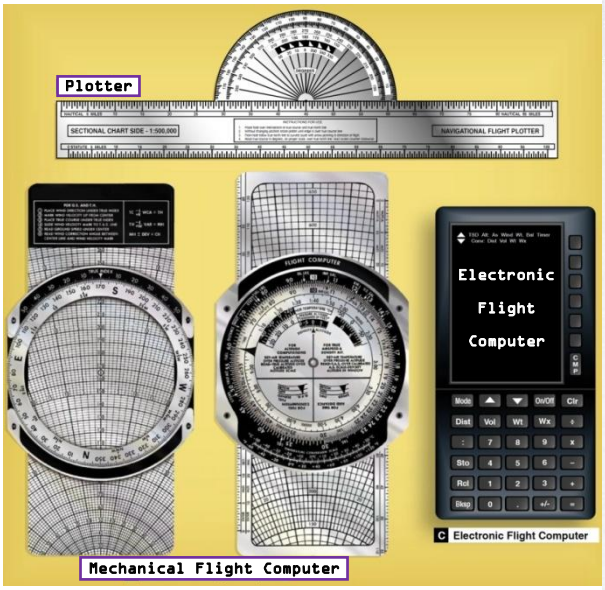
Downhill 41

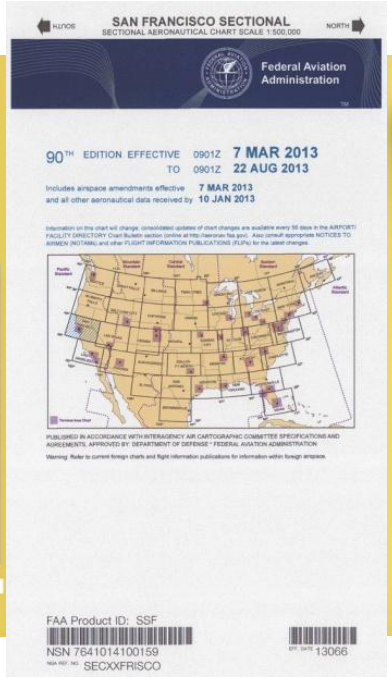
Downwind Base & Final 43

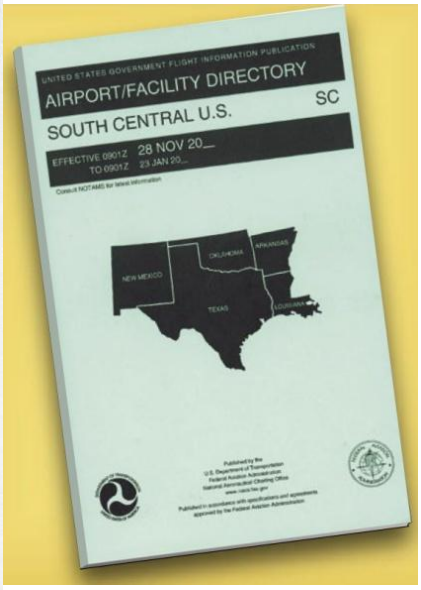
Touchdown 45

Appendix **48**

Handy Tools







Pen and Paper, a protractor (for measuring angles) and a ruler (for drawing /measuring lines) will come handy. It will also be useful to have a small calculator, the latest effective edition of Southwest U.S. Airport/Facility Directory (A/FD) and the latest edition of the San Francisco Sectional Aeronautical Chart (SAC) (!)

Unless you actually have these publications in your collection of aviation material, you can visit FAA website and download them for free (specific instructions coming up in the next chapter). Also, an easy way to access valid aeronautical information is skyvector.com, a great website for sim flight planning.

Picpick, an advanced version of the MS Paint tool, has a very nice protractor function so you can measure angles directly in your computer screen.

We will use four kinds of links in this document…

LINK		will lead you to…
blue underlined	(e.g. skyvector.com)	the internet
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orange not underlined	(e.g. click to go back…)	from the Appendix, back to the main part
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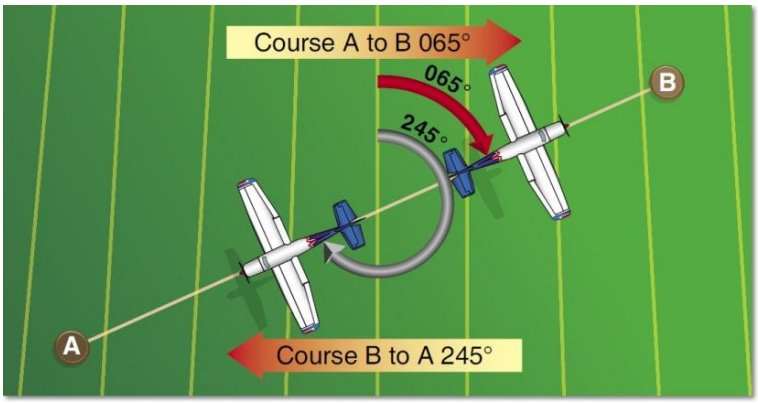
Basic Concepts

We will go through some basic information related to the kind of flight we want to accomplish.
The standard cliché is in effect: to expand ones knowledge and to serve as a reminder to the one who already knows. Either way, those interested in learning how things work, by constantly using the following data and formulae, eventually become very familiar with it.

Course and Heading

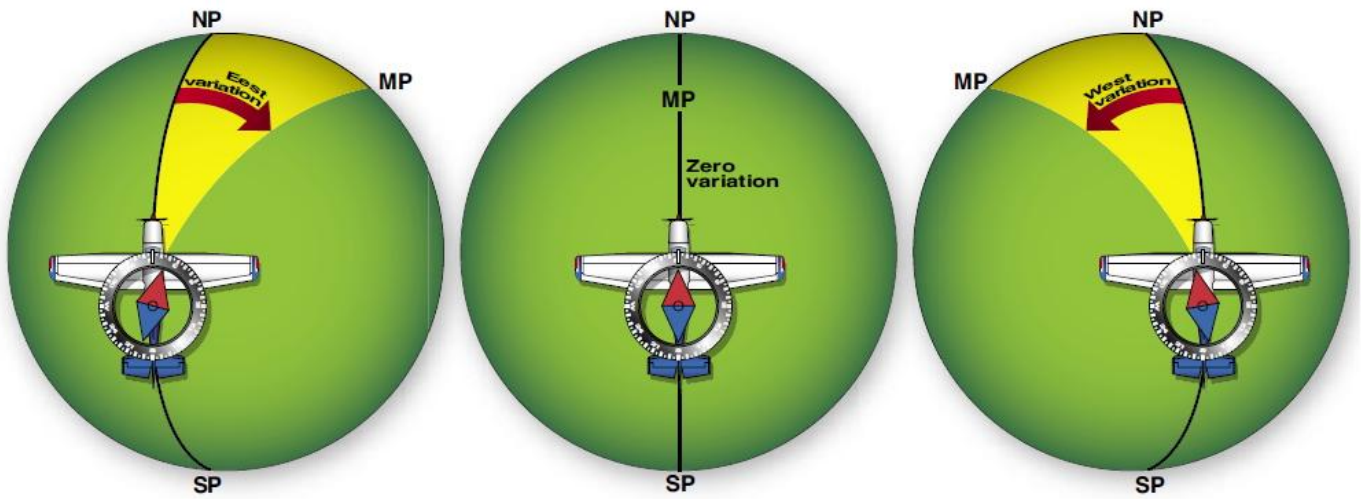
Draw a straight line in the chart from A to B and measure the clockwise angle it makes with the longitude line (meridian) - near the center of the AB. That is the **True Course (TC)**.
Those vertical longitude lines in the charts (meridians) all end up at the True North (TN) pole which actually is some 1,300 miles apart from the Magnetic North (MN) pole (that's where our compasses think north is).

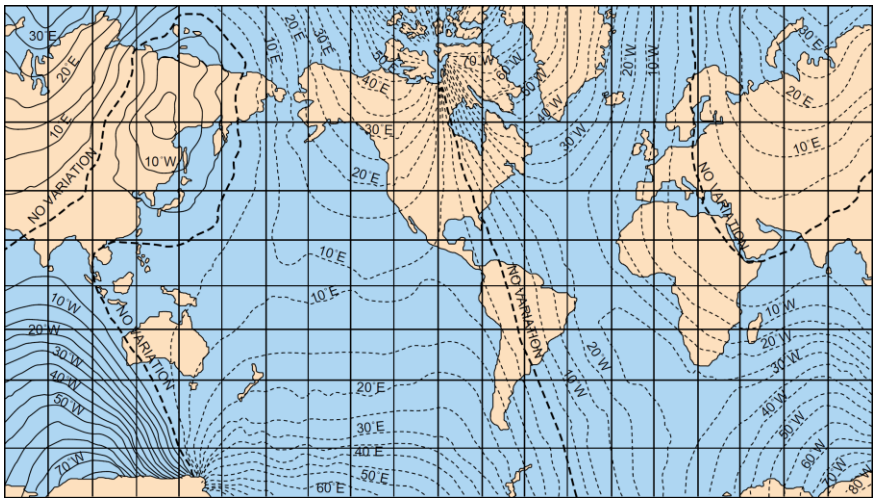


True Course alone isn't good enough if we want to get from A to B. Wind comes into play and carries our aircraft away in his direction, like all objects that don't physically connect to the ground. For this we need to correct true course by some angle, the Wind Correction Angle (WCA), to get the **True Heading (TH)** (there is a whole section coming up on how to correct for wind).

Remember: **TC ± WCA = TH**

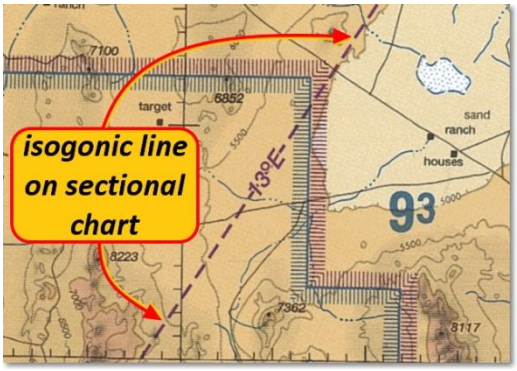
Magnetic Variation (MV) is the angle between true north and magnetic north. It is expressed as east variation or west variation depending upon whether magnetic north is to the east or west of true north.





Actually, the Earth is not uniformly magnetized. The needle points in the general direction of the magnetic pole, but it may vary in certain geographical localities by many degrees.

The exact amount of variation at thousands of selected locations in the world has been carefully determined.



The amount and the direction of variation, which change slightly from time to time, are shown on most aeronautical charts as broken magenta lines, called **isogonic lines**, which **connect points of equal magnetic variation**.

Because courses are measured in reference to geographical meridians which point toward true north, and these courses are maintained by reference to the compass which points in the general direction of magnetic north, the true direction must be converted into magnetic direction for the purpose of flight. This conversion is made by adding to or subtracting from True Heading, the variation which is indicated by the nearest isogonic line on the chart. It will be added to TH if West Variation or subtracted by the TH if East Variation (use the "west is best/east is least" mnemonic). This is the **Magnetic Heading (MH)**.

Remember: **TH ± MV = MH**

Finally, aircraft metal parts, radios, engines etc, affect the compass and we must correct for that too. This is called **Compass Deviation (CD)** and by correcting our Magnetic Heading for CD we get **Compass Heading (CH)**. Is this implemented in FlightGear? Looks like there are FG aircraft that have a plate for correcting CD (this picture is from the Seneca II). This said, we can just ignore this correction **(MH ± CD = CH)**, but it might be important to check here and see if your aircraft's Heading Indicator is properly aligned.

Time Distance Speed

Timing, when it comes to aviation, is reported worldwide in Coordinated Universal Time (UTC) which is also mentioned as Zulu (Z) time (this is about the same thing as Greenwich Mean Time - GMT). So when it's tea-time in Greenwich UK (isn't it 5am there?), it's also 1700UTC or 17Z all over the world!

One Nautical Mile (NM) equals 1.15 Statute Miles (SM). One NM equals 1.85 Kilometers (KM). One NM equals 6,076 feet. The Nautical Mile is not "randomly" defined. It actually equals to one sixtieth (1/60) of the distance between two parallels of latitude or one minute of arc of a degree of latitude! (There are 180 degrees of latitude from south to North Pole. The equator is mid-way).

Airspeed is the speed of the aircraft in relation to the mass of air surrounding it. Airspeed is usually measured in Knots (one Knot is one NM per Hour) or Miles per Hour (MPH). Our aircraft's Airspeed Indicator (ASI) displays our Indicated Airspeed (IAS).

True Air Speed (TAS) is IAS corrected for altitude and temperature. TAS is the speed which is used for flight planning and is used when filing a flight plan. A pilot can find TAS by two methods. The first and most accurate method is to use a flight computer. The second method, which is a rule of thumb, provides the approximate TAS:

Add 2 percent to the IAS for each 1,000 feet of altitude.

TAS=IAS + 0,02IAS x ALTITUDE (feet) / 1000

Groundspeed (GS) is the actual speed of the airplane over the ground. GS is TAS adjusted for wind. GS decreases with a headwind, and increases with a tailwind. To find the time (T) in flight, divide the distance (D) by the groundspeed (GS).

Remember: **T = D / GS**

The T=D/GS is an important and very useful equation. You should familiarize with every possible way it can be used (D = T x GS, GS = D / T).

Atmosphere and Altitude

The ATMOSPHERE is composed of 78 percent nitrogen, 21 percent oxygen, and 1 percent other gases. Most of the oxygen is contained below 35,000 feet altitude. Pilots are mainly concerned with the **pressure** and the **temperature** of the atmosphere. These two, along with humidity, affect the **density** of the air.

When the pressure rises, density rises too but when the temperature rises, density lowers.
Water vapor is lighter than air so when humidity rises, air gets less dense.

Standard Atmosphere

Altitude (ft)	Pressure (Hg)	Temperature (°C)	Temperature (°F)
0	29.92	15.0	59.0
1,000	28.86	13.0	55.4
2,000	27.82	11.0	51.9
3,000	26.82	9.1	48.3
4,000	25.84	7.1	44.7
5,000	24.89	5.1	41.2
6,000	23.98	3.1	37.6
7,000	23.09	1.1	34.0
8,000	22.22	-0.9	30.5
9,000	21.38	-2.8	26.9
10,000	20.57	-4.8	23.3
11,000	19.79	-6.8	19.8
12,000	19.02	-8.8	16.2
13,000	18.29	-10.8	12.6
14,000	17.57	-12.7	9.1
15,000	16.88	-14.7	5.5
16,000	16.21	-16.7	1.9
17,000	15.56	-18.7	-1.6
18,000	14.94	-20.7	-5.2
19,000	14.33	-22.6	-8.8
20,000	13.74	-24.6	-12.3

As the air becomes less dense, it reduces:

A **Power**... the engine takes in less air.

B **Thrust**...the propeller is less efficient in thin air.

C **Lift**...the thin air exerts less force on the airfoils.

In order to have a common reference for these ever changing atmospheric parameters, the **Standard Atmosphere** was developed which is a surface temperature of 59°F or 15°C and a surface pressure of 29.92 inches of mercury ("Hg), or 1,013.2 mb.

A **standard temperature lapse rate** is one in which the temperature decreases at the rate of approximately 3.5°F or 2°C per thousand feet up to 36,000 feet which is approximately -65 °F or -55 °C. Above this point, the temperature is considered constant up to 80,000 feet.

A **standard pressure lapse rate** is one in which pressure decreases at a rate of approximately 1 "Hg per 1,000 feet of altitude gain to 10,000 feet.

ICAO has established all these as a worldwide standard and it is often referred to as International Standard Atmosphere (ISA) or **ICAO Standard Atmosphere**.

Any temperature or pressure that differs from the standard lapse rates is considered **nonstandard temperature and pressure**.

ALTITUDE is the vertical distance above some point or level used as a reference.
Pilots are mainly concerned with **five types of altitudes**:

1. Indicated altitude—read directly from the altimeter when it is set to the current altimeter setting.

2. True altitude—the vertical distance of the aircraft above sea level—**the actual altitude**.

It is often expressed as feet above mean sea level (MSL).
Airport, terrain, and obstacle elevations on aeronautical charts are true altitudes.

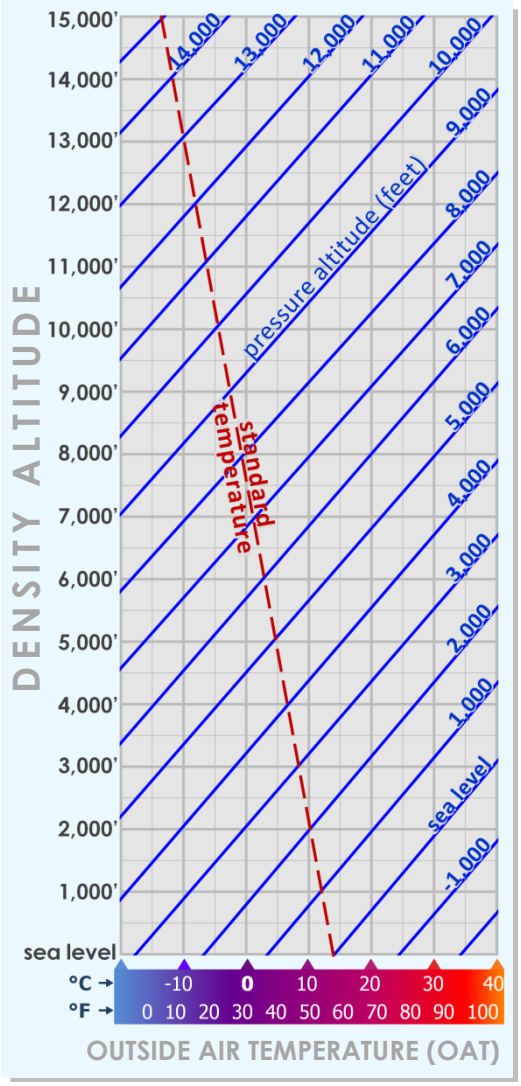
3. Absolute altitude—the vertical distance above the terrain, or above ground level (AGL).

4. Pressure altitude—the altitude indicated when the altimeter setting window (barometric scale) is adjusted to **29.92"Hg**.

This is the altitude above the standard datum plane, which is a theoretical plane where air pressure (corrected to 15 °C) equals 29.92" Hg. Pressure altitude is used to compute density altitude, true altitude, true airspeed (TAS), and other performance data.

5. Density altitude—pressure altitude corrected for variations from standard temperature. When conditions are standard, pressure altitude and density altitude are the same.

This graph is used for calculating density altitude (when the temperature and the pressure altitude are known). There is an example of how to use it in the Appendix.



The density of the air, as we said, affects aircraft and engine performance:

High density **altitude** means **thinner** air**.**
Low density **altitude** means **thicker** air**.**

Regardless of the **actual altitude** at which the aircraft is operating, it will perform as though it were operating at an altitude equal to the existing **density altitude**.

Fuel Consumption

Is measured hourly in various units, usually in Gallons per Hour (GPH) or Pounds per Hour (PPH). To determine the amount of fuel we need Distance and Groundspeed to get Time (remember?). Then we multiply Time (in hours) with GPH or PPH to find out how much we are going to burn.

The trick is getting to know your aircrafts GPH or PPH. It's in the manual. Or you can just fill her up from the Equipment > Fuel and Payload tab, anytime, but that would be highly unrealistic. Let alone that flying with the tanks filled to the maximum is not economic at all.

So do some flying with your aircraft and measure how much the fuel consumption is when cruising. Add an extra hour or two of fuel when planning the trip. Simple as that!

Visual Flight Rules

VFR Navigation involves combining Pilotage, Dead Reckoning and VFR Radio Navigation.

Pilotage is navigation by reference to landmarks or checkpoints. The checkpoints selected should be prominent features common to the area of the flight.
Dead reckoning is navigation solely by means of computations based on time, airspeed, distance, and direction.
VFR Radio Navigation involves using the aircraft's navigational radio receivers and supplements navigation by visual reference to the ground, providing an effective safeguard against disorientation.

Visibility / distance from clouds minimums have been set, depending on the airspace classification. When these minimums are met, we have Visual Meteorological Conditions (VMC) and VFR flights can be accomplished. We'll get back to this on the Weather section of the Flight Planning chapter.

An important task a VFR pilot is required to perform is vigilant scanning outside the window for other aircraft. There are certain techniques for this "see and avoid" scanning. We do not need to say more about this as there is no real danger in virtual mid-air collisions.
It's good to have in mind that VFR demands pilot attention is 2/3 of the time outside of the cockpit window and 1/3 inside…!

These aspects on Navigating VFR (and more!), are analyzed
in the flight planning chapter of the tutorial.

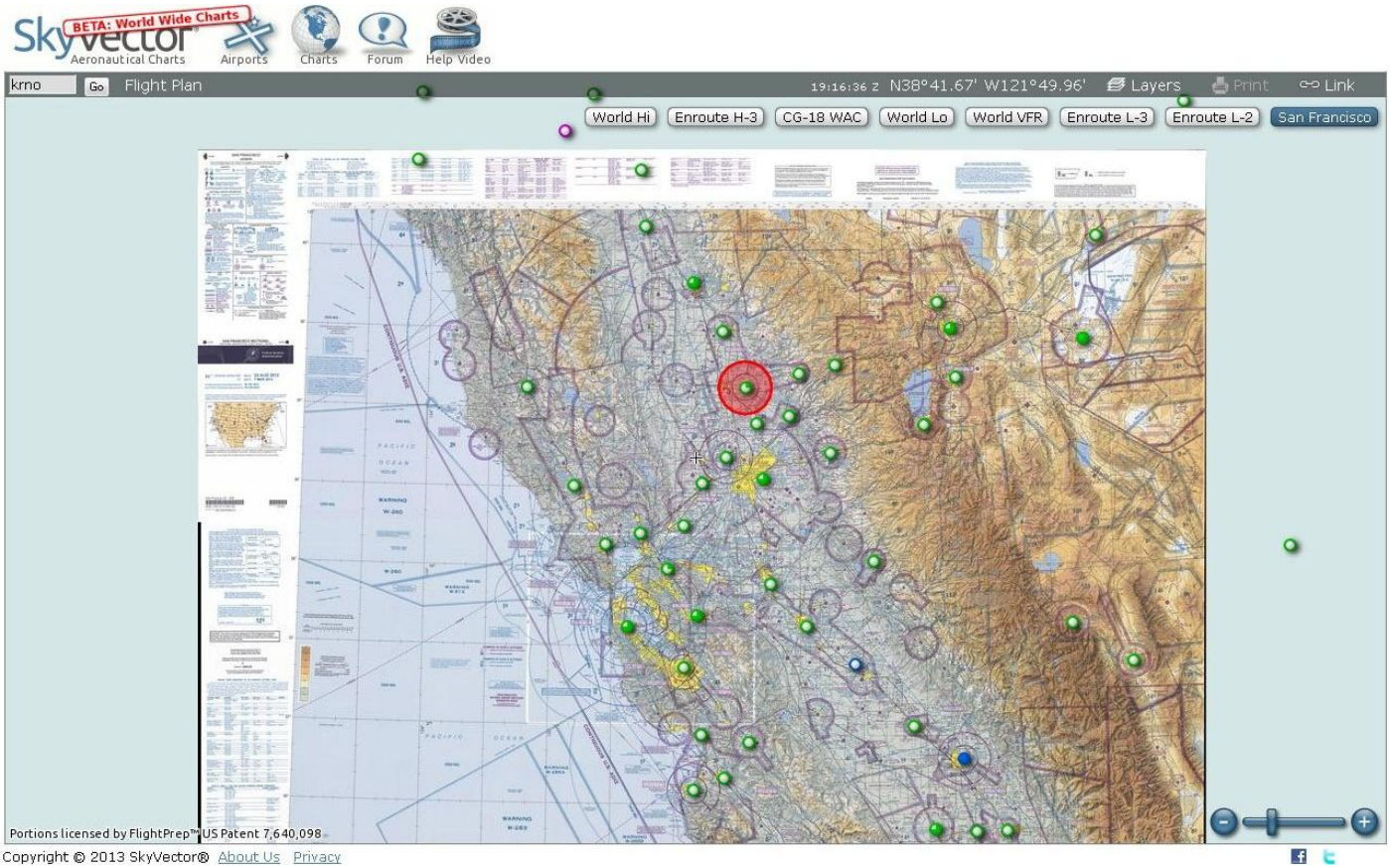
Charts

We live in the era of fancy glass cockpits and GPS receivers available not only for modern airliners but also for General Aviation (GA) aircraft. But still, the backbone of navigation relies on understanding those - complicated and crammed with information - aeronautical charts.
Although advanced avionics, make our lives much easier and greatly enhance ''**situational awareness**'', there are good reasons why we shouldn't **over-rely** on them for navigating (what if they fail in-flight or the database is not current/updated??). The appropriate and up-to-date charts for the route of each flight must always be onboard regardless of cockpit equipment.

Nowadays, the printed charts in the cockpits are being replaced by their digital versions, stored in tablet mobile computers!

It's great that some of that sophistication is simulated in the FlightGear aircraft cockpits and I think we will get more of this with time. Besides that, we have the grey in-game map, the GPS menu and the Autopilot Settings>Route Manager (not available in every aircraft), that can also be considered as automation.

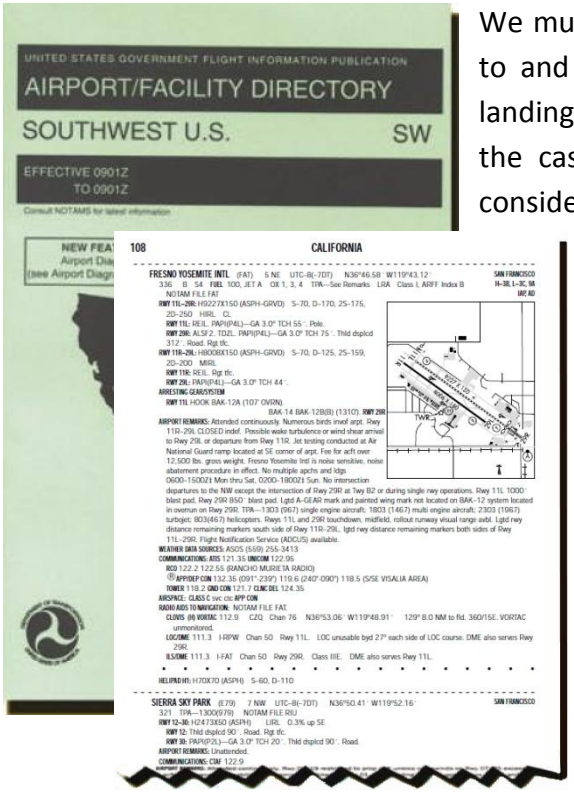
Although we may not have official sectional charts in our virtual cockpit, we have SkyVector® bookmarked in our browser! We visit their home-page, input KSFO in the top-left box, click GO (map focuses on San Francisco airport), look for the tab labeled "San Francisco" in the top-right and click it, zoom out with the bottom-right slider or mouse wheel until we have the sectional chart in view. That's it!



You can also download the Sectional Chart! Visit [FAA's page of sectional charts]() and scroll down for the San Francisco one.

The amount of data contained in these charts is mind-blowing when you first come across them. There is additional info and facts about charts in [this]() and [that]() FAA page.

A/FD and NOTAMs

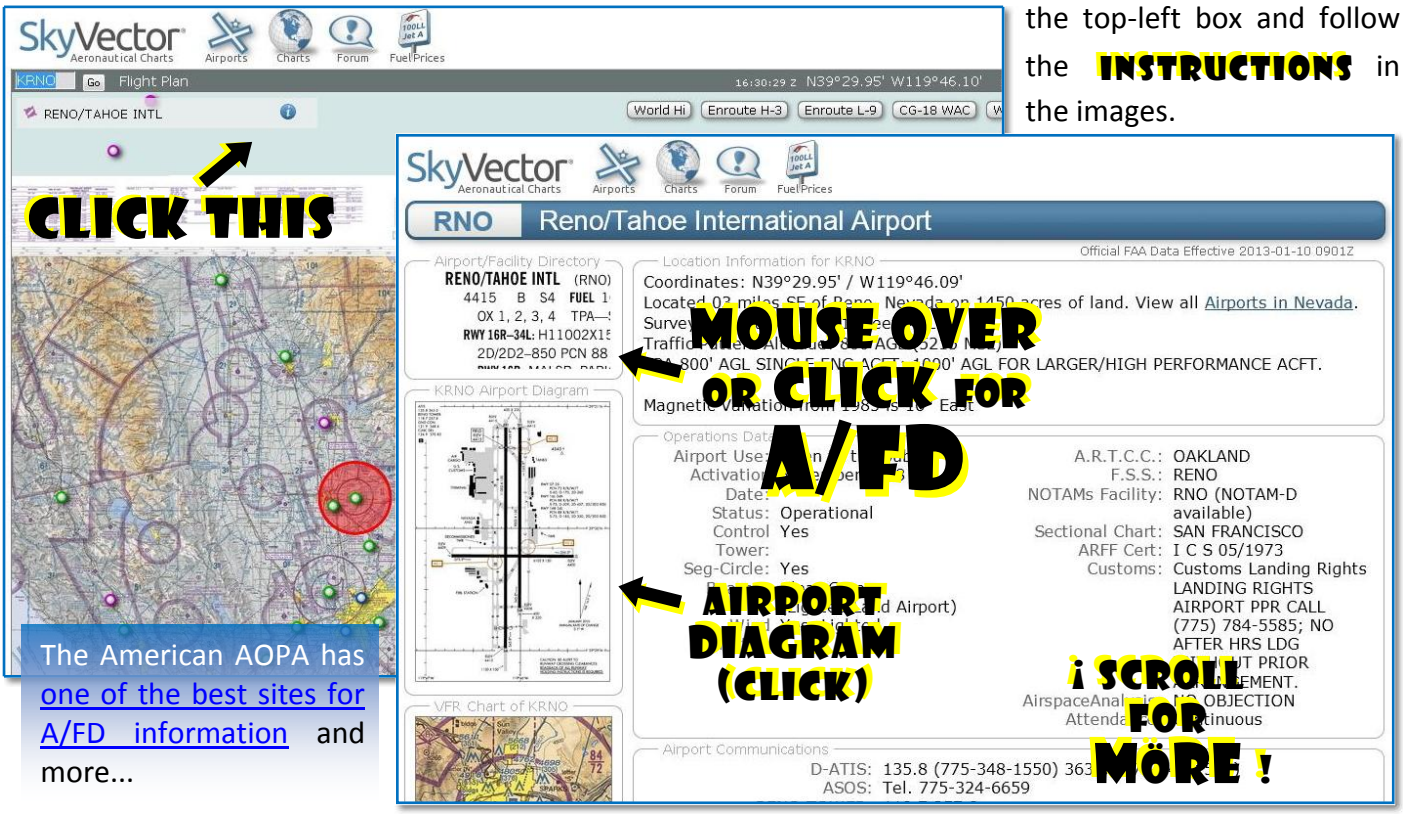


We must study all available information about the airports we will fly to and from. In some cases pilots must familiarize with alternative landing airports and include them in their flight plan too. This is not the case for our simple VFR cross-country; one landing airport to consider is fine.

The data we want is included in the Airport /Facility Directory (A/FD). Issued every 56 days, it contains all airport information such as location, elevation, runway and lighting facilities, available services, availability of aeronautical advisory station frequency (UNICOM), types of fuel available (use to decide on refueling stops), communication facilities and frequencies, traffic information, remarks, and other significant information.

The Notices to Airmen (NOTAMs), issued every 28 days, should be checked for additional information on hazardous conditions or changes that have been made since issuance of the A/FD.

A/FDs and NOTAMs are available in printed form or can be downloaded from their original source - FAA.gov. You can also access them in aviation portals. Open SkyVector®, dial in the code for the airport in the top-left box and follow the **INSTRUCTIONS** in the images.



The American AOPA has one of the best sites for A/FD information and more...

Correcting for Wind

The basis for dead reckoning is the wind triangle, a graphic explanation of the effect of wind upon flight. Groundspeed (GS), heading, and time for any flight can be determined by using the wind triangle.

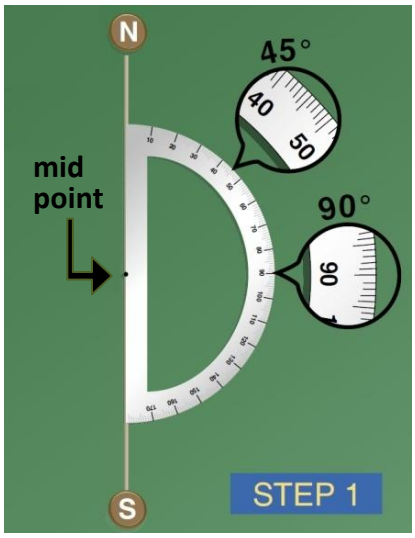
The Pilot's Handbook of Aeronautical Knowledge (PHAK) gives us the following example on how to draw a wind triangle:

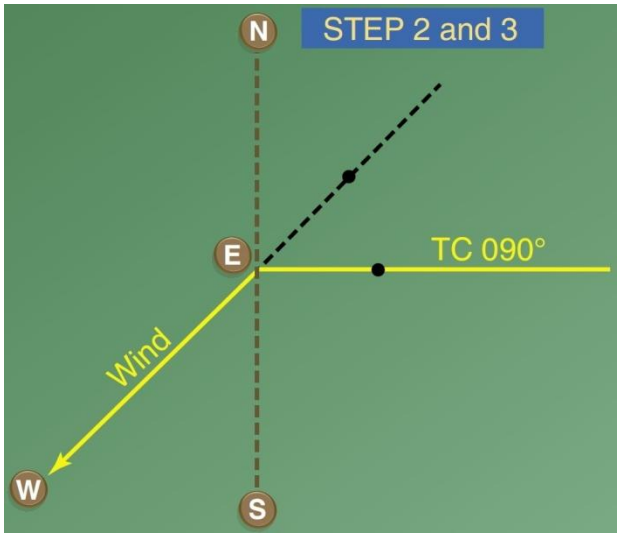
Suppose a flight is to be flown from E to P. Draw a line on the aeronautical chart connecting these two points; measure its direction with a protractor, or plotter, in reference to a meridian. This is the true course, which in this example is assumed to be 090° (east). From the NWS, it is learned that the wind at the altitude of the intended flight is 40 knots from the northeast (045°). Since the NWS reports the wind speed in knots, if the true airspeed of the aircraft is 120 knots, there is no need to convert speeds from knots to mph or vice versa.

Now, on a plain sheet of paper draw a vertical line representing north to south.

Step 1:

Place the protractor with the base resting on the vertical line and the curved edge facing east. At the center point of the base, make a dot labeled "E" (point of departure), and at the curved edge, make a dot at 90° (indicating the direction of the true course) and another at 45° (indicating wind direction).

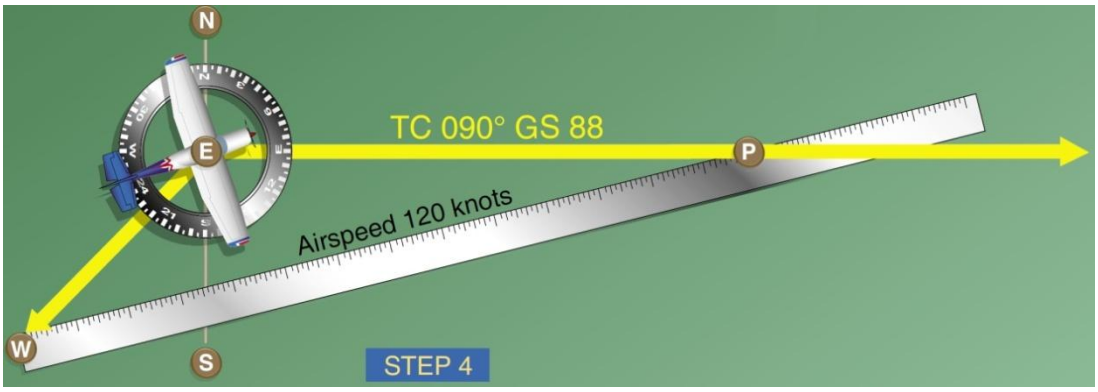




Step 2:
With the ruler, draw the true course line from E, extending it somewhat beyond the dot by 90°, and labeling it "TC 090°."

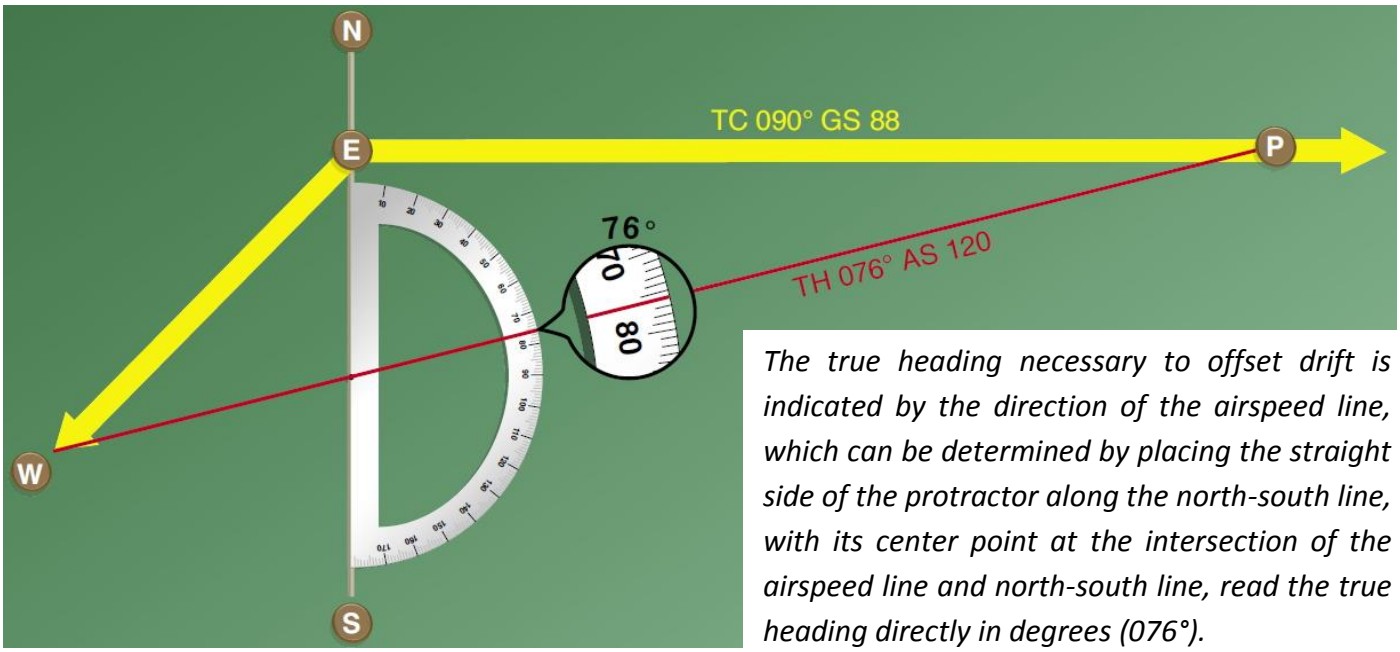
Step 3:
Next, align the ruler with E and the dot at 45°, and draw the wind arrow from E, not toward 045°, but downwind in the direction the wind is blowing, making it 40 units long, to correspond with the wind velocity of 40 knots. Identify this line as the wind line by placing the letter "W" at the end to show the wind direction.

Step 4:
Finally, measure 120 units on the ruler to represent the airspeed, making a dot on the ruler at this point. The units used may be of any convenient scale or value (such as ¼ inch = 10 knots), but once selected, the same scale must be used for each of the linear movements involved.



Then place the ruler so that the end is on the arrowhead (W) and the 120-knot dot intercepts the true course line. Draw the line and label it "AS 120." The point "P" placed at the intersection represents the position of the aircraft at the end of 1 hour. The diagram is now complete.

The distance flown in 1 hour (GS) is measured as the numbers of units on the true course line (88 NMPH, or 88 knots).



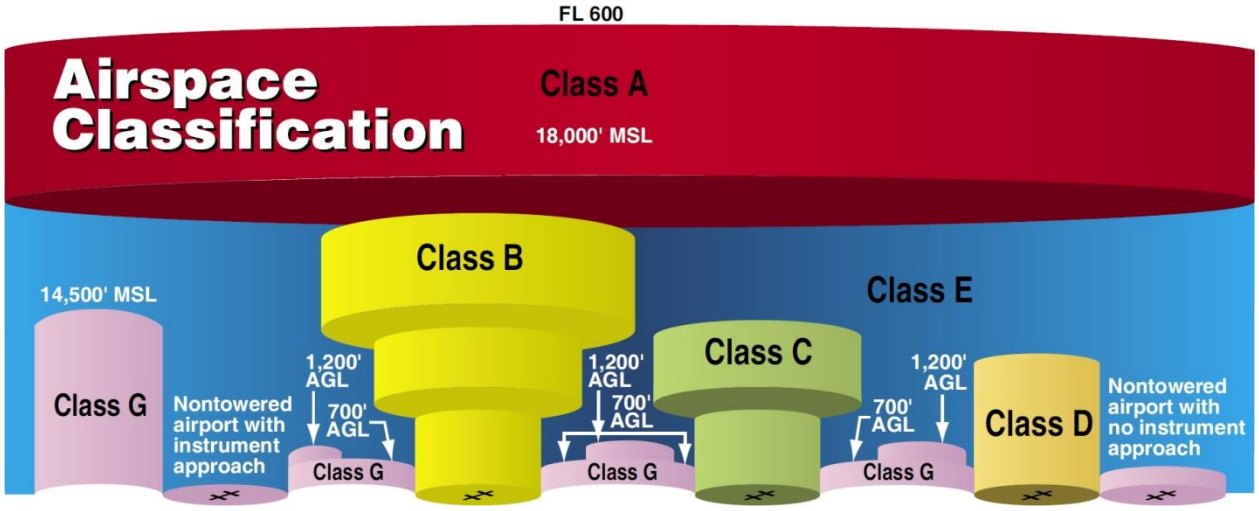
The true heading necessary to offset drift is indicated by the direction of the airspeed line, which can be determined by placing the straight side of the protractor along the north-south line, with its center point at the intersection of the airspeed line and north-south line, read the true heading directly in degrees (076°).

Practice drawing wind triangles, using different course/wind scenarios and master the skill. The experienced pilot becomes so familiar with the fundamental principles that estimates can be made which are adequate for visual flight without actually drawing the diagrams.

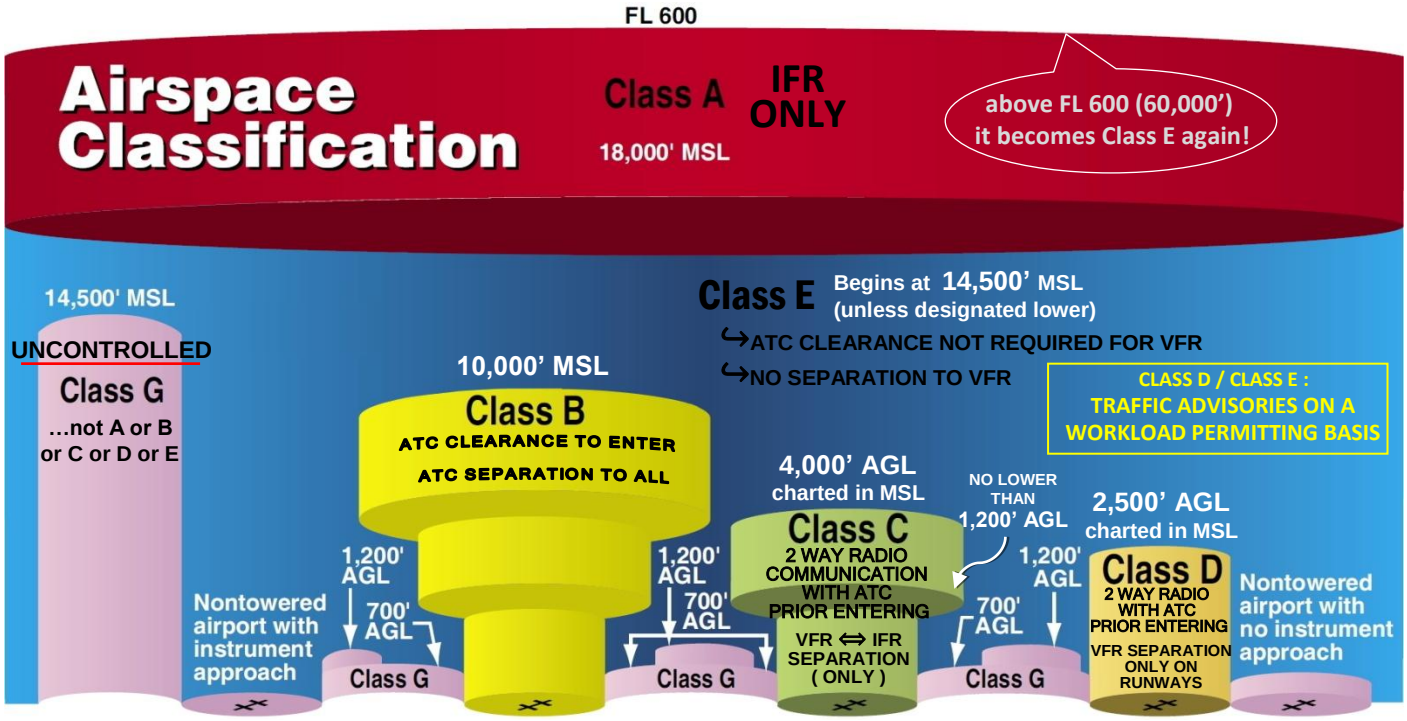
Either consciously or unconsciously,
every good pilot thinks of the flight in terms of wind triangle.

Airspace and Air Traffic Control

The following FAA image that describes airspace classification…



…has been tweaked and loaded with information to get the next image…



…not only in an attempt to shorten this chapter, but also because I thought it was a nice idea.

Don't panic! Read the charts and learn more every time.

As you come across lines that look like dividing airspace class, **consult the chart's legend** - at the top-left for sectionals - and get to know what airspace you are looking at.

There is never enough to be said about the regulations for airspace. Some basics are:

- ✯ *ALFA* - It's everywhere above 18,000 feet so it's not charted. IFR means you are an *instrument rated pilot* or they don't let you in…
- ✯ *BRAVO* - Upside-Down Wedding Cakes. Around major international airports, like KSFO. You will need to consult additional charts (TAC, FLY) for flying around Class Bravo airspace.
- ✯ *CHARLIE* - Other busy airports, like the one we will be…oh wait! not yet, not yet…
- ✯ *DELTA* - Less busy airports but busy enough to have a control tower (although this tower might be closed at night).
- ✶ *ECHO* - Imho the most interesting part is to make it to FL 600 (60,000 feet MSL) and fly VFR again!
- ✯ *GOLF* - I still don't get it why it exists but since it does… make sure no one gets hurt and enjoy free flying!

And there is more! *SPECIAL USE AIRSPACE* among others includes *Prohibited* (the White House), *Restricted…*(invisible hazards…!), *Warning…*(close to borders), *Military Opps***…**(MOAs), *Alert…* and *Controlled Firing…Areas*. You will also come across them in the sectionals.

When we are talking about airspace classification, we are also talking about AIR TRAFFIC CONTROL (ATC) - the guys looking after the safely and orderly execution of flying.

The amount of ATC service available for each class of controlled airspace ranges from near zero (class G) to maximum (class A, B).

For VFR flights, ATC is kept to the most necessary information and advice, especially out of class B and C airspace where no radar monitoring is involved.

You will not hear controllers giving **vectors** to aircraft under VFR, unless they consider it **important for safety** or **on pilot request**.

Instead **Traffic Advisories** are frequent in VFR e.g.:

"Traffic, 10 o'clock, 5 miles east bound, Cessna 172, 3,000 feet"

The pilot then replies *"Traffic in sight"* or *"Looking for the traffic"* (if not yet in sight).

Nevertheless, it's always his/hers responsibility to **see and avoid** other aircraft.

A TRANSPONDER is the equipment on-board an aircraft that gives air traffic control more precise information about the aircraft's lateral and vertical position.

There are many types of transponders. In each type there are various functions or "modes". One of these is automatic altitude reporting / Mode-C. When operating in Mode-C, the transponder reports your altitude directly to the ATC radar-scope.

The reason why we are discussing transponders in the Airspace and ATC chapter is that aircraft are required to be equipped with Mode-C capable transponders to operate:

- within 30NM from a Class B airport below 10,000' MSL
- within Class C airspace, up to 10,000' MSL
- within 10NM of certain Class D airports
- at or above 10,000' MSL excluding airspace below 2,500' AGL (that's tricky!)

Quote from the previous versions of this tutorial (v1.0 until v2.0):

> Even though there are some FlightGear aircraft that have transponder units fully modeled in their cockpits, these report altitude to no one.
> :(
> Therefore, ATC in the FG multiplayer environment do not issue instructions regarding these things.
>
> That might as well change some day, so we better be prepared.

Well…those days are gone!!
With FlightGear version 2.12.0 came the Transponder unit functionality in our favorite flight-sim. And if we come across an air traffic controller who uses OpenRadar - the best ATC platform for FG - we might be given a "squawk" code.
That means we must dial a four digit number in our aircraft's transponder. Depending on what we fly, we can do that by turning knobs and dials (like in the PA24-250) or just open the Equipment > Radio Settings box (F12) and input those 4 numbers in the last field of the Radio menu.

More on ATC and radio communications coming up in the next sections.

CHARACTER	*Pronunciation*	Morse Code	CHARACTER	*Pronunciation*	Morse Code	CHARACTER	*Pronunciation*	Morse Code
ALFA	*AL-FAH*	· —	NOVEMBER	*NO-VEM-BER*	— ·	1 ONE	*WUN*	· 4—
BRAVO	*BRAH-VOH*	— · · ·	OSCAR	*OSS-CAH*	— — —	2 TWO	*TOO*	· · 3—
CHARLIE	*CHAR-LEE or SHAR-LEE*	— · — ·	PAPA	*PAH-PAH*	· — — ·	3 THREE	*TREE*	· · · —
DELTA	*DELL-TAH*	— · ·	QUEBEQ	*KEH-BECK*	— — ·	4 FOUR	*FOW-ER*	· · · ·
ECHO	*ECK-OH*	·	ROMEO	*ROW-ME-OH*	· — ·	5 FIVE	*FIFE*	· · · · ·
FOXTROT	*FOKS-TROT*	· · — ·	SIERRA	*SEE-AIR-RAH*	· · ·	6 SIX	*SIX*	— · · ·
GOLF	*GOLF*	— — ·	TANGO	*TANG-GO*	—	7 SEVEN	*SEV-EN*	— — · ·
HOTEL	*HOH-TEL*	· · · ·	UNIFORM	*YOU-NEE-FORM OO-NEE-FORM*	· · —	8 EIGHT	*AIT*	3— · ·
INDIA	*IN-DEE-AH*	· ·	VICTOR	*VIK-TAH*	· · · —	9 NINE	*NIN-ER*	4— ·
JULIETT	*JEW-LEE-ETT*	· — —	WISKEY	*WISS-KEY*	· — —	0 ZERO	*ZEE-RO*	5—
KILO	*KEY-LOH*	— · —	X-RAY	*ECKS-RAY*	— · · —			
LIMA	*LEE-MAH*	· — · ·	YANKEE	*YANG-KEY*	— · —			
MIKE	*MIKE*	— —	ZULU	*ZOO-LOO*	— — · ·			

Different airspace rules apply to different countries (click here).
We will stay with the USA set of rules (FAA standards) as in all sections of this guide.

Flight Planning

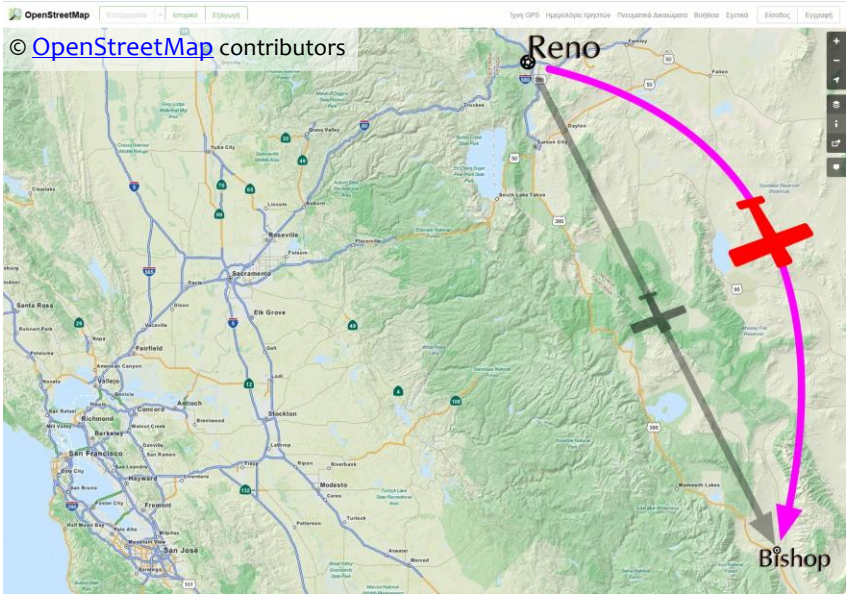
...at last!

A lovely day for a flight,

especially around the magnificent Sierra Nevada Mountains, in the western part of the USA!

Departure airport for today is **Reno/Tahoe International (KRNO)** at Reno, Nevada.

After an hour or so of VFR cross-country flying southeasterly, we will be landing in **Eastern Sierra Regional** airport **(KBIH)** at Bishop, California.



To download the SCENERY file containing the area and airports:
Go to the FG scenery download map and look for the **w120n30** tile, in the western USA. To be sure you are looking at the correct one, mouse over it and look at the bottom-left of the window for the link name. Click the one ending with "…/w120n30.tgz". Follow the wiki instructions to install it.
Additionally, if you are on-line when flying, there is always the TerraSync utility that automatically downloads the newest version of the needed FlightGear scenery.

Next we are going to need an AIRCRAFT.
Any prop good to cruise between 13,000-15,000feet MSL (above sea level) at an indicated airspeed of 100-120 knots, will do. Suggested ones are listed below:

- **Skymaster**
- **Comanche**
- **DC-3**
- **Seneca II**
- **A6M2**

The last two are included in the basic FG installation package.

Our good o' c172p, we are so familiar with, doesn't seem to be good enough for this one ☹ so we better pick your next best in terms of familiarity that fits those performance demands.

Suitable airplanes for this flight are mainly equipped with constant-speed propellers. These have adjustable blade angle (pitch) for better performance (there is an extra lever for that, next to the throttle).

It might be too much for such a guide to say more about this or any other technicality for controlling an aircraft. In any case, it's all contained in publications like the FAA's Airplane Flying Handbook.

The Airports

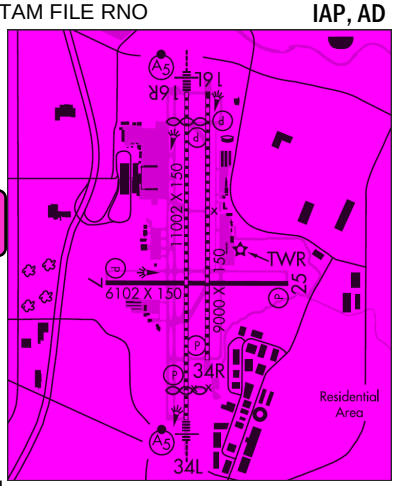
Reno/Tahoe International - (RNO or KRNO)

We consult the A/FD to get information about our departure airport (**INSTRUCTIONS** on how to find it in page 11). In this one, the most essential data for our flight is highlighted:

NEVADA **291**

RENO/TAHOE INTL (RNO) (KRNO) 3 SEUTC–8(–7DT) N39°29.95´ W119°46.09 **SAN FRANCISCO**
4415 B S4 **FUEL** 100LL, JET A1+ **H-3B, L-9A**
OX 1, 2, 3, 4 TPA—See Remarks LRA Class I, ARFF Index C NOTAM FILE RNO **IAP, AD**

RWY 16R-34L: H11002X150 (CONC–GRVD) S–75, D–185, 2D–350, 2D/2D2–850 PCN 88 R/B/W/T HIRL CL
RWY 16R: MALSR. PAPI(P4L)—GA 3.06° TCH 77´. Thld dsplcd 999´.
RWY 34L: MALSR. PAPI(P4L)—GA 3.54° TCH 72´. Thld dsplcd 990´. Ground.
RWY 16L-34R: H9000X150 (CONC–GRVD) S–75, D–209, 2D–407, 2D/2D2–850 PCN 88 R/B/W/T HIRL CL
RWY 16L: REIL. PAPI(P4L)—GA 3.0° TCH 75´.
RWY 34R: REIL. PAPI(P4L)—GA 3.0° TCH 75´.
RWY 07-25: H6102X150 (CONC–GRVD) S–60, D–170, 2D–260 PCN 72 R/B/W/T MIRL
RWY 07: REIL. PAPI(P4L)—GA 3.2° TCH 48´. Pole.
RWY 25: REIL. PAPI(P4L)—GA 3.0° TCH 45´. Tree.



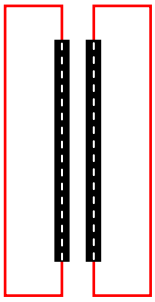
RUNWAY DECLARED DISTANCE INFORMATION
RWY 07: TORA–6102 TODA–6102 ASDA–5854 LDA–5854
RWY 25: TORA–6102 TODA–6102 ASDA–6102 LDA–6102

AIRPORT REMARKS: Attended continuously. CAUTION: Intensive glider activity invof arpt and surrounding areas up to 18.000´. Waterfowl all quadrants all seasons. Concentrated NW of Rwy 16R and E of Rwy16L.Twy M clsd to air carrier acft. Twy J east of rwy 16L–34R clsd to air carrier acft. Twy A between N Twy B and Twy D closed to acft with wingspan greater than 149´. Twy C between Twy L and Twy D clsd to air carrier acft. Twy C between Twy L and Twy D restricted to acft 60,000 pounds or less. TPA—5215(800) single engine, 5415(1000) larger/high performance acft. Noise sensitive area all quadrants. All commercial acft ctc ground ctl for advisories prior to push back on the terminal ramp. Pilots of turbojet acft use recommended noise abatement procedures, avbl on req. Pilots of non–turbojet acft use best abatement procedures and settings. Avoid as much as feasible flying over populated areas. Pure jet touch and go low apch and practice instrument approaches are prohibited; acft over 12500 lbs require prior written approval for training flights; for further information ctc arpt ops 1–877–736–6359. 24 hours PPR for transient acft parking with wingspans greater than 75´. LRA PPR call 775–784–5585, no after hours ldg without prior arrangement. Glider/soaring ops 30–50 miles S of arpt during VFR Wx and mountain wave wind conditions 1900Z‡ to SS. Rwy 25 PAPI not to be used byd 2 NM due to rapidly rising mountainous terrain. Rwy 34L and Rwy 34R PAPI not to be used beyond 6 NM due to high terrain. For MIRL Rwy 07–25 0600–1330Z‡, HIRL Rwy 16L–34R and centerline lgts 0800–1330Z‡ ctc twr. Touchdown rwy visual range and rwy visibility value Rwy 16R. Flight Notification Service (ADCUS) avbl. NOTE: See Special Notices — Glider/Soaring Activities around the Reno –Tahoe Intl, Arpt, Continuous Power Facilities.

AIRPORT MANAGER: 775-328-6400
WEATHER DATA SOURCES: ASOS (775) 324–6659
COMMUNICATIONS: D-ATIS 135.8 775–348–1550 **UNICOM** 122.95
RCO 122.2 122.5 (RENO RADIO)
®**NORCAL APP/DEP CON** 126.3 (220°–035°) 119.2 (036°–219°)
TOWER 118.7 **GND CON** 121.9 **CLNC DEL** 124.9
AIRSPACE: CLASS C svc ctc **APP CON** svc renother times ahoe intl. ?
CLASS C svc continuous ctc **APP CON**
RADIO AIDS TO NAVIGATION: NOTAM FILE RNO.
MUSTANG (H) VORTACW 117.9 FMG Chan 126 N39°31.88´ W119°39.36´ 234° 5.5 NM to fld. 5949/16E.
VORTAC unusable:
200°–230° byd 30 NM blo 13,000´
ILS/DME 110.9 I–RNO Chan 46 Rwy 16R. Class ID. Localizer backcourse unusable byd 20° left of course.
ILS/DME 109.9 I–AGY Chan 36 Rwy 34L. Class IE. LOC front course unusable inside DUYEP (3.6 NM) above 8,500´ MSL; at threshold above 6,400´ MSL

1=Airport elevation

2=Traffic Pattern Altitude (TPA)
Note that for two parallel runways the direction of turns is always the same so to get the following pattern design:



Also for RWY 07-25 its left turns, since it doesn't say RP.

3=Sectional chart containing the airport

4=Airport Diagram
To get a more detailed diagram click the one on the airport page (check page 11).

5=Important stuff
Everything in the A/FD is important, but some things are more important.

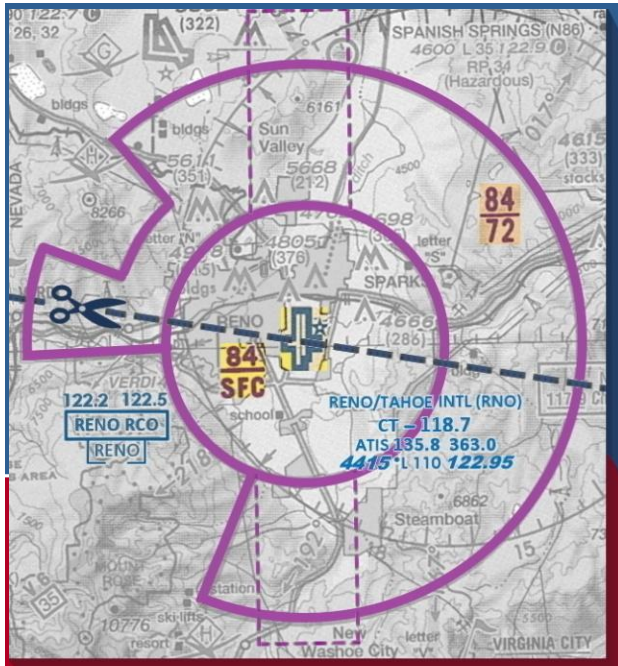
6=Facilities. To whom are we going to be talking with?

There is never enough to be said about proper radio communication techniques; we would need another guide just for that. Among the things we see here:

- ® means the facility is radar equipped.
- Class C service and rules is continuous (some class C airports become D or E for some hours of the day).

All this data is going to be further explained as we progress with flight-planning, when we get there and finally get airborne in this tutorial.

Remember this airspace image? ⇩



⇦ ZOOM IN TO THIS IMAGE

Class C (solid circles):

→ 5 NM radius core surface area (84/SFC=from surface up to 8,400' MSL)

→ 10 NM radius shelf area (84/72=from 7,200' to 8,400' MSL)

Some parts of the shelf area are missing as you can see. There is no Class C service in those parts, probably because of the mountains underneath. There is also an outer area, extending 20 NM from the airport which is not charted but it is also covered with Class C radar service.

Class E extensions (broken boxes north and south):

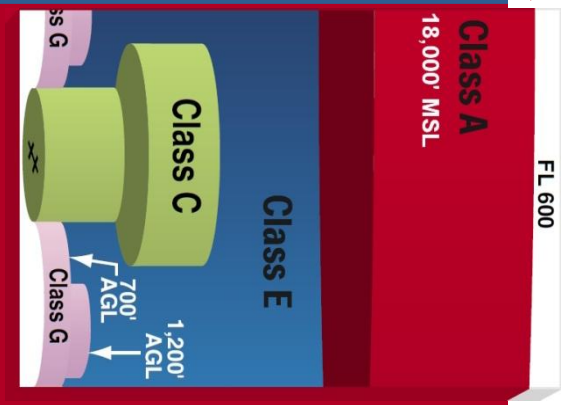
While normally Class E surrounding airports begins at 700' or 1,200' AGL, in these boxes it begins from surface.

Key info about the airport and the Flight Service Station (FSS) we will be talking with, after exiting Class C, has been highlighted.

You will see the profile view of the airspace at the broken blue line if you zoom back out.

All dimensions are accurately scaled.

The airspace colors match with those in the FAA image ⇨

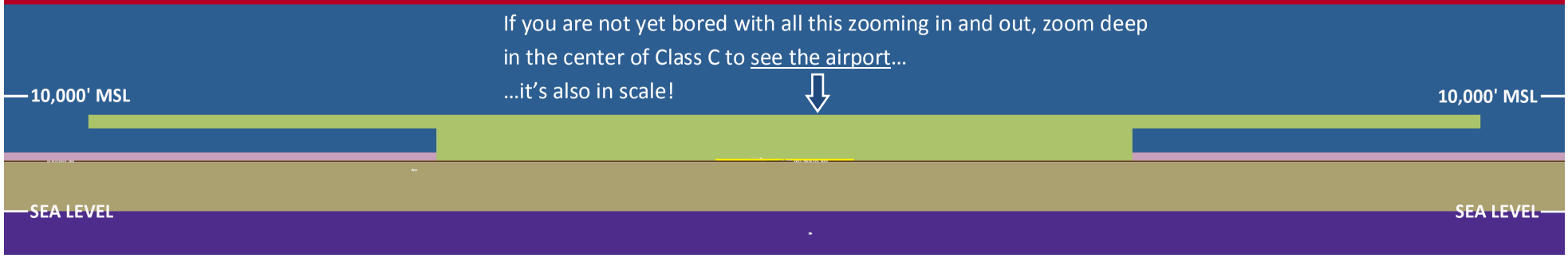


You need to zoom back in to clearly see the underlying Class G (pink).

Now **rotate the view clockwise...!**

If you are not yet bored with all this zooming in and out, zoom deep in the center of Class C to see the airport...

...it's also in scale! ⇩

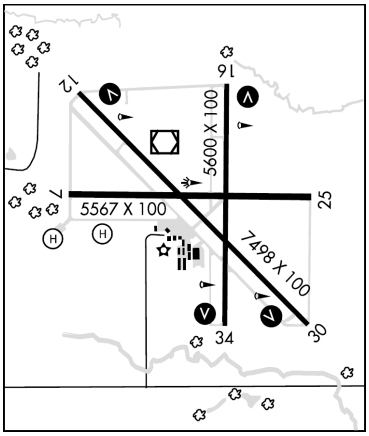


Eastern Sierra Regional (BIH or KBIH)

84 **CALIFORNIA**

BISHOP SAN FRANCISCO H-3C, L-9A IAP

EASTERN SIERRA RGNL (BIH)(KBIH) 2 E UTC–8(–7DT) N37°22.39´ W118°21.82´
4124 B S4 **FUEL** 100LL, JET A OX 2 TPA—5124(1000) NOTAM FILE BIH
RWY 12-30: H7498X100 (ASPH–PFC) S–70, D–110, 2S–139, 2D–200, C5–685 HIRL 0.3% up NW
RWY 12: VASI(V2L)—GA 3.0° TCH 48´. Trees.
RWY 30: VASI(V2L)—GA 3.5° TCH 52´. Tree.
RWY 16-34: H5600X100 (ASPH–PFC) S–100, D–140, 2S–175, 2D–240 HIRL
RWY 16: VASI(V2L)—GA 3.0° TCH 39´. Trees.
RWY 34: VASI(V2L)—GA 3.0° TCH 42´.
RWY 07-25: H5567X100 (ASPH) S–40, D–56, 2D–98 MIRL0.4% up W
RWY 07: Trees.
AIRPORT REMARKS: Attended Mon–Fri 1530–0200Z‡, Sat–Sun 1500–0100Z‡. Hang glider activity invof arpt. Due to high apch minimums pilots may need an IFR alternate even though weather is forecast to be higher than 2000´–3. No intersection departures, helicopter tfc apch arpt from the W boundary. VASI Rwy 16, VASI Rwy 30 and VASI Rwy 34 unusable byd 1 NM.
ACTIVATE MIRL Rwy 07–25,HIRL Rwys 12–30 and 16–34, VASI Rwys 12, 30, 16 and 34—CTAF.
AIRPORT MANAGER: (760) 872-2971
WEATHER DATA SOURCES: ASOS 119.025 (760) 872–2658.
COMMUNICATIONS: CTAF/UNICOM 123.0
RCO 122.6 (RIVERSIDE RADIO)
OAKLAND CENTER APP/DEP CON 125.75
RADIO AIDS TO NAVIGATION: NOTAM FILE BIH.
BISHOP (T) VORW/DME 109.6 BIH Chan 33 N37°22.62´ W118°21.99´ at fld. 4117/15E. VOR/DME unusable: 360°–105° byd 18 NM
LDA/DME 109.1 I–BIH Chan 28 Rwy 16.
LOC/DME unusable byd 14.5 NM blo 8,600´.

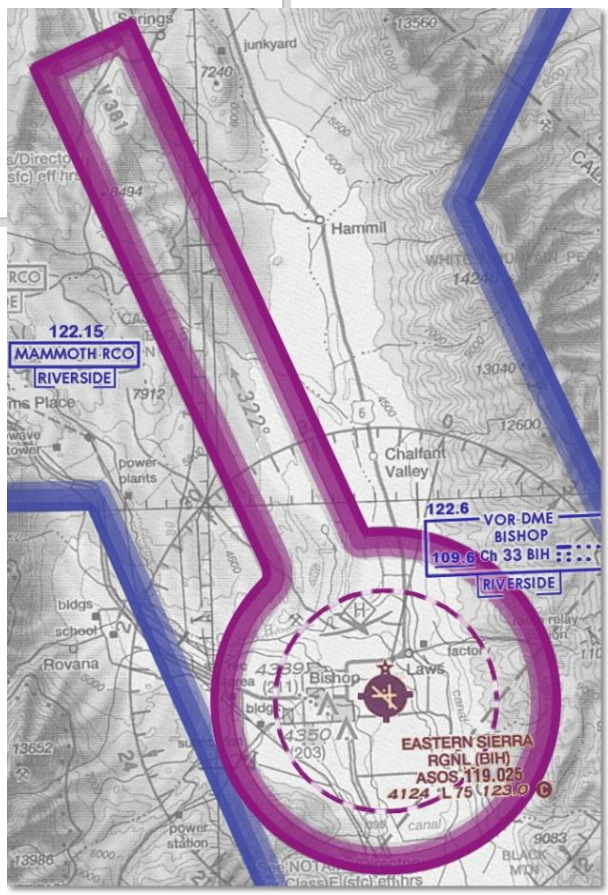


We are looking at this airport's A/FD for the same items with those previously highlighted.

Most important is that our landing airport **doesn't have a control tower at all**.

Also, it's not attended at night but we are going to be there before sunset and find someone to explain us what "attended" means.

The image to the right has some important features highlighted.



There are fow-er kinds of **Class E airspace** here:

- ♥ The 4NM radius broken circle surrounding the airport is Class E beginning from the surface.
- ♣ The keyhole shaped thick magenta line marks the lateral limits of Class E airspace with 700' floor.
- ♦ Beyond that, it is Class E with 1,200' floor.
- ♠ Finally, at the bottom-left and top-right corners, beyond the thick blue lines, Class E begins above 14,500' MSL.

As always, wherever Echo begins at a certain height above ground, Class G uncontrolled airspace lies beneath.

For the approach and landing, Riverside FSS and the Common Traffic Advisory Frequency (CTAF), are going to be our radio communication friends.

Bishop VOR-DME being inside the airport is a welcome "safeguard against disorientation". Since it's the Terminal kind of a VOR station (that's what the (T) means in the AF/D description), we expect its signal to be received at a range of 25 NM from the station and as high as 12,000' AGL.

The legend in the top left of the sectional, contains explanations for the encoding of the airport info box and the symbols used (that star on top of the airport symbol circle has to mean something, right?).

That is more than enough about the airports for now. Before we go on,
don't forget to check the NOTAM files RNO and BIH too…

Weather Check

We need weather forecasts to:

- ✓ see if we are good to fly VFR (VFR Minimums are met)
- ✓ calculate the wind effect for the course of flight
- ✓ evaluate aircraft performance in the given weather conditions

The most realistic thing to do is to use the "Live Data" weather setting in FG, to simulate real weather conditions in the area (you'll need to be on-line while flying).

★ Check the table to see if you are in Visual Meteorological Conditions (VMC) so that a VFR flight can be accomplished

We'll be flying Class Charlie, Echo and Golf airspace so the most restrictive visibility and cloud conditions must be met.

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	1,000 feet above 500 feet below 2,000 feet horizontal
Class D			3 statute miles	1,000 feet above 500 feet below 2,000 feet horizontal
Class E	At or above 10,000 feet MSL		5 statute miles	1,000 feet above 1,000 feet below 1 statute mile horizontal
Class E	Less than10,000 feet MSL		3 statute miles	1,000 feet above 500 feet below 2,000 feet horizontal
Class G	1,200 feet or less above the surface (regardless of MSL altitude)	Day*	1 statute mile	Clear of clouds
Class G	1,200 feet or less above the surface (regardless of MSL altitude)	Night*	3 statute miles	1,000 feet above 500 feet below 2,000 feet horizontal
Class G	More than 1,200 feet above the surface but less than 10,000 feet MSL	Day	1 statute mile	1,000 feet above 500 feet below 2,000 feet horizontal
Class G	More than 1,200 feet above the surface but less than 10,000 feet MSL	Night	3 statute miles	1,000 feet above 500 feet below 2,000 feet horizontal
Class G	More than 1,200 feet above the surface and at or above 10,000 feet MSL		5 statute miles	1,000 feet above 1,000 feet below 1 statute mile horizontal

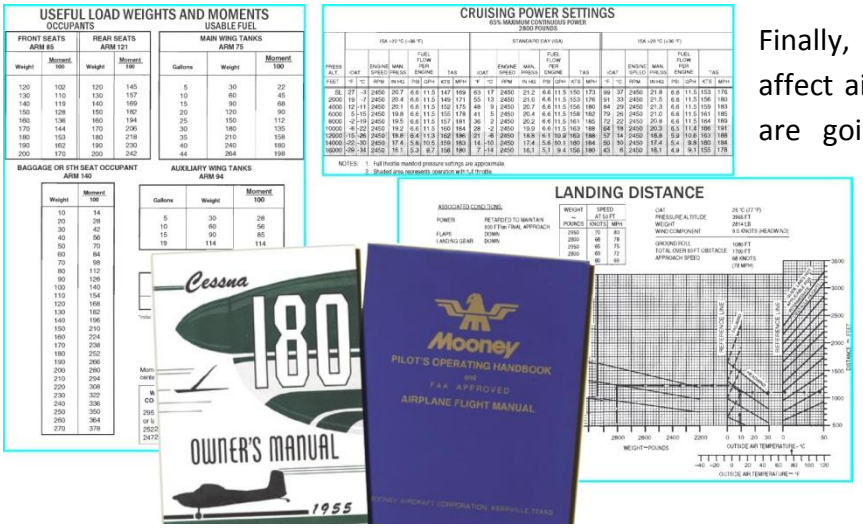
***except as provided in section 91.155(b)**

There are various weather reports and forecasts like METARs, TAFs, PIREPs, FDs (Winds Aloft) etc. Pilots get weather briefings from weather service outlets via telephone, radio and computer, before they fly and while en-route. Weather can rapidly change or be quite different than forecasted. Ending up **flying in Instrument Meteorological Conditions (IMC) is too bad for a pilot flying VFR.**

Mouse over those colored dots in SkyVector and see if you can understand METARs, TAFs and how they affect your flight. You can always press Environment>Weather inside FG and get a detailed description of the weather conditions reported in the METAR.

Next is calculating the wind direction and speed at the cruising altitude we will travel.

Pay attention to the fact that METARs indicate surface winds and that winds change with altitude. We do not need to have the Winds Aloft forecast as you would in a real flight as FG seems to have a standard way of altering winds at higher levels of the atmosphere. You can check Environment>Weather inside FG to get your winds in the altitude you will be flying in the top-right portion of the weather settings window.



Finally, weather and atmospheric conditions affect aircraft performance. To evaluate this we are going to need our aircraft's AFM / POH (Airplane Flight Manual / Pilot's Operating Handbook).

If you happen to posses the AFM/POH for your aircraft of choice you can make pre-flight calculations, especially those regarding the weather.

If you don't have it, just improvise...

For this tutorial, surface winds are forecasted to be blowing from 60 degrees at a speed of 7knots. Winds Aloft at our cruising altitude (between 10000 and 18000 feet MSL (above sea level) will be from 90 degrees at 10 knots. Visibility at 12 statute miles and a few clouds at a height of 20000 feet AGL (above the ground) are expected. The temperature will be around 20°C.

We can set these lovely Visual Meteorological Conditions (VMC) by changing the FG's METAR Source field to "Manual Input" then go to the METAR Data box and change the values as seen below:

The in-game weather menu has a new style since FG version 2.10 but basically we are looking for the same things as described above (the 2.8 and earlier style for FG weather is pictured in the left half of this d parts of the while already ullshit).

We inputted surface winds from 60 degrees at 7 knots to get the result of 90 deg at 10 knots between 10000 and 18000 feet!

CAUTION! METAR displays wind direction in True Headings while in FG, ATIS and ATC broadcast wind in Magnetic Headings. In our case you will hear the Reno ATIS guy say "…wind 045@7…" (060° TH – 14° MV = 046° MH rounded to the nearest 5 degrees in the ATIS broadcast). But we are not there yet…

Charting the Course

- Instructions for this step are described as we would do with the <u>printed</u> sectional chart in hand.
- You can apply them using the SkyVector (or the downloaded from FAA's website) sectional.
- Use Picpick to verify/measure angles in your pc screen.
- Or place a real protractor and ruler on your screen. I do it all the time (and will probably need a new screen soon).
- It's always good to keep notes in paper.

➲ 1 NM equals to 1/60th of one degree latitude. The bars in the meridian lines represent NM (*see next page top right image*).

It is always better to plan as much as we can before entering the cockpit. It is what we'll do now except for the departure / climb and the arrival/descent, because….

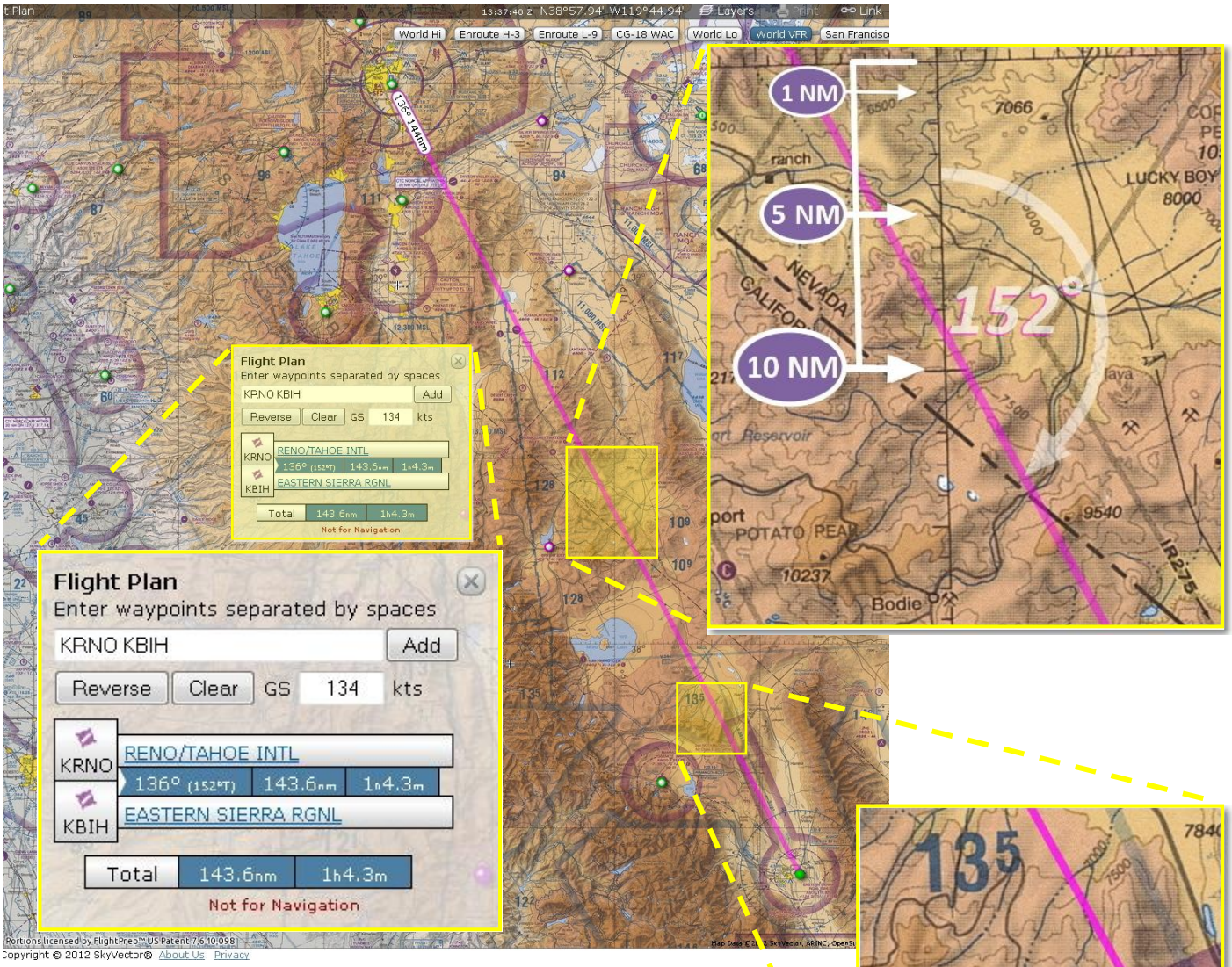
DEPARTURE - We don't know the runways that will be available for takeoff in Reno.

ARRIVAL - With the forecasted winds in mind, we can already tell which would be the most favorable runway for landing at KBIH. This is a non-towered airport so we are free to use any landing runway we prefer.

✱ For presentation reasons, it is considered more suitable that the planning we've made for the descent is described in the last chapter of this tutorial.

I - True Course and Distance

We will fly **direct from KRNO to KBIH**. Use a ruler to draw a straight line in the sectional chart connecting the middle points of the two airports. This is our course line. With a protractor, measure the right/clockwise angle our course line forms with the line of longitude (meridian) closest to the center of the line. This is the **True Course** angle and we find it **152º**. Then measure the length of the line and by applying the correct calculations for the chart's scale (1:500000 for sectionals) get the real distance. It's **143.6 Nautical Miles**.



II – Elevation, Cruising Altitude, Airspeed

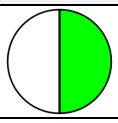
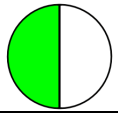
A closer look on the sectional enables us to determine the highest (ground) elevation on our flight-path. Our course line, as we can see, passes over some mountains, the highest of which are a couple of 9,500' MSL peaks about halfway between the two airports.

But let's give ourselves some room and see our flight-path as a corridor rather as a line. Our corridor extends 5 NM from each side of the line we drawn and feels quite comfortable (map scale=1:500000 / real 5 NM = 1.85cm or 0.73inch in the chart).

This corridor we established contains even higher elevation, the highest of which is **11,200'** near the last quarter of the flight-path, northeast of KMMH airport. That is the highest elevation our flight will have to fly over. We can choose our cruising altitude to be anything above 1000' from the highest elevation. But there are some rules…

The next table shows appropriate VFR cruising altitudes, also known as the "***semicircle rule***":

VFr above 18,000' ??

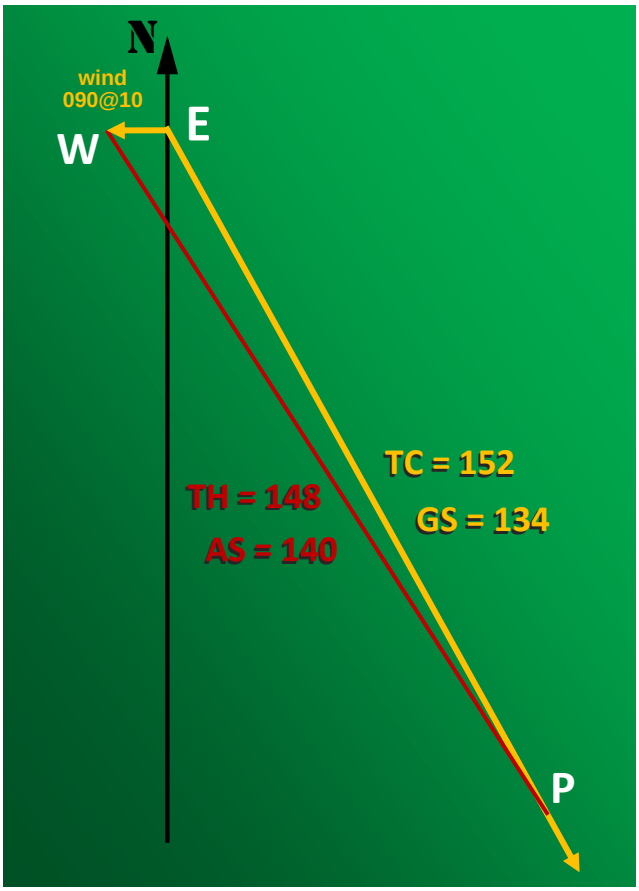
VFR Cruising Altitudes & Flight Levels		
If your Magnetic Course (ground track) is:	**And you are more than 3,000 feet above the surface but below 18,000 feet MSL, fly:**	**And you are above 18,000 feet MSL to FL 290, fly:**
0° to 179° 	**Odd** thousands MSL, **plus 500** feet (3,500; 5,500; 7,500 etc)	**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)

We must decide ours having in mind highest elevation and the Magnetic Course (MC) we'll fly. Our MC will be 152-14=138° (MC = TC ± MV). After some thinking, we choose a **cruising altitude of 13,500 feet**.

By referring to the AFM/POH, although we might not have one, we estimate **True Air Speed ≈140 knots** at our cruising altitude (that would be our GS if no wind was blowing).

III - Wind triangle and Magnetic Heading

We now have all we need (true course, distance, true airspeed, winds) to work on our wind triangle (example in pages 11-12), which should look like this:



So, we'll get from KRNO to KBIH by flying
True Heading 148°
and we will travel
134 NM in one hour.

We must convert true to magnetic heading.

For this we need to look in the sectional and find the **isogonic line** closest to the middle of our KRNO-KBIH line.

That is the broken magenta line - labeled ***14°E*** - representing the Magnetic Variation (MV) for the area we will fly (pictured here →).

We subtract MV from TH ("east is least") to get our **Magnetic Heading (MH) of 134 degrees**. So both GS and MH will be 134 =]

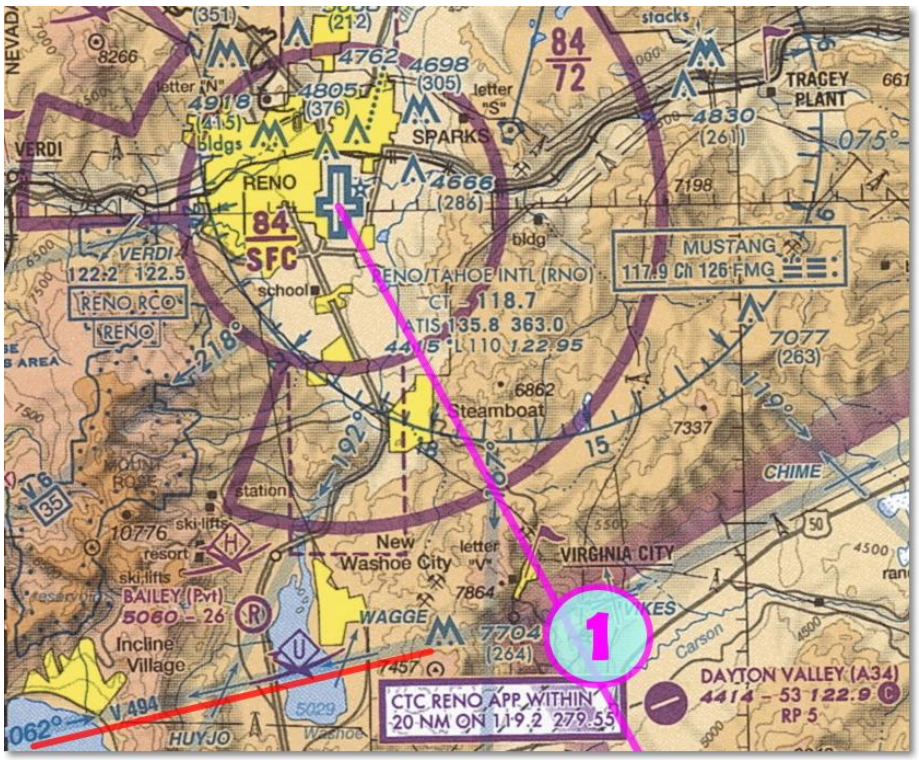
Looks like Compass Deviation (CD) is not important in FlightGear. So MH equals Compass Heading (CH) and we are good to go unless them FG developers decide to make things harder in the future (then CH=MH±CD might be useful).

IV - Checkpoints

Let's have a closer look in our course line at the sectional four some **prominent terrain features and landmarks** to pick as Checkpoints (CPs). At the same time, we **create a flight log**, by keeping note of the **distance** (chart scale=1:500,000 ⇒ 1 inch (2.53cm) = 8 SM or 6.86 NM) and the **time** (T = D / GS ⇒ T (mins) = 60 x NM / 134) from one checkpoint to the next.

We can roughly **add 5 minutes** to our flight log **for the climb** of approximately 9,000 feet from airport elevation (4,415') to cruising altitude (13,500').

CP #1



Because this one comes when we'll be finishing with the departure and climb, and because it is the first one, we will define CP#1 with extra detail. We want to be sure we get there to make a good start for our trip.

Furthermore, cockpit workload during the climb is increased. We definitely don't want to get confused at that time.

After exiting the lateral limits of Class C, at that point we will also be crossing the (charted) Radial 167 of Mustang Vortac (117.9 FMG), we will:

- ☑ Fly over the town of Virginia City (the little flag means it's a VFR Checkpoint for controlling VFR traffic),
- ☑ Fly across Carson River…
- ☑ Fly several miles east of Washoe Lake (will it be visible??)…
- ☑ Fly just west of Dayton Valley airport (A34).

All these 4 features/landmarks compose checkpoint number one.

To assist us in perfectly knowing we've got there, a nice coincidence is that we will also be crossing Radial 062 of Squaw Valley VOR-DME (113.2 SWR). It didn't make it to the image but you can see that (charted) radial underlined in the bottom left.

The boundary of Class E with floor 700'-which now becomes Class E with floor 1200'- is at CP#1 too.

We keep in mind that close to Virginia City the elevation is 7,864' but we should be well above that, well before getting there.

Let's make some use of the "*time equals distance divided by speed*" equation before we move on.

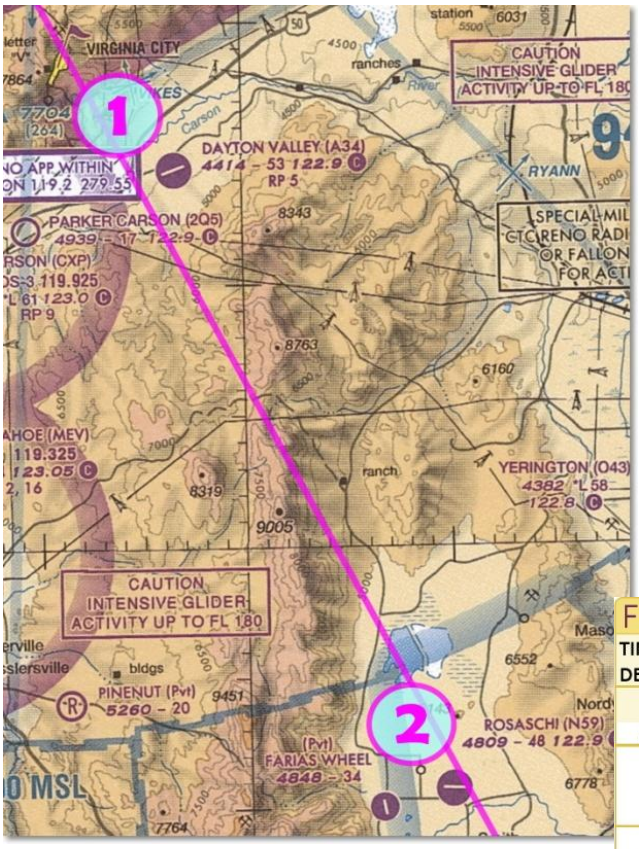
FLIGHT LOG

TIME OF DEPARTURE:	REMARKS	DISTANCE	ELAPSED TIME
POINT OF DEPARTURE KRNO	GS=134 MH=134	POINT TO POINT / CUMULATIVE	ESTIMATED / ACTUAL
CP#1	virginia city VFR CP - carson river - A34 SWR R-062	15 nm / 15 nm	7 mins +5

With a ruler and by applying chart scale (or by using SkyVector's "Flight Plan" application), we measure CP#1's distance from the airport to be around 15 NM. Divide this with the GS of 134 knots and multiply it 60 times to get time in minutes. We'll need 6.72 minutes to get there.

Let's round this to 7 minutes and add the 5 minutes for the climb.

CP #2



These "CAUTION GLIDER ACTIVITY" boxes make me feel a bit nervous!

As soon as we clear those 9000' mountains, we'll fly over a 5000' plateau, beginning with a small lake, half dried. Less than 5 NM ahead, right below our path is the Rosaschi (N59) air-park and the private Farias Wheel, a couple of miles to the west.

Our second checkpoint is made up of the lake and the two small airports.

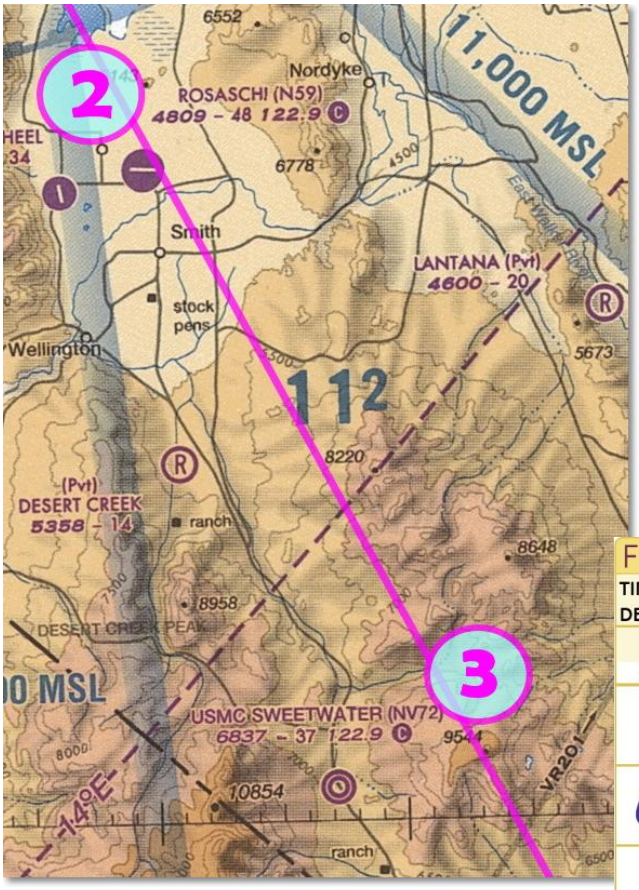
It is about 27 NM away from the first checkpoint so we will need 12 minutes to get from CP#1 to CP#2.

Notice the transparent thick blue line marking the end of 1,200' floor Class E and the beginning of floor 14,500' Class E. It means that after the lake we will enter Class G uncontrolled airspace!

FLIGHT LOG

TIME OF DEPARTURE:	REMARKS	DISTANCE	ELAPSED TIME
POINT OF DEPARTURE KRNO	GS=134 MH=134	POINT TO POINT / CUMULATIVE	ESTIMATED / ACTUAL
CP#1	virginia city VFR CP - carson river - A34 SWR R-062	15 nm / 15 nm	7 mins +5
CP#2	half-dry lake + 4-5nm=N59 ↳ entering class G	27 nm / 42 nm	12 mins (24)

CP #3



Ideal terrain for fast low flying FG war birds. We better watch out!

Terrain is rising again as we cross the 14°E isogonic. The peak of these mountains at 9544' and the military Sweetwater airport (NV72), 3 NM to the west, mark the **checkpoint number 3**, which is 23 NM away from the previous one (that's almost 10 minutes).

Generally this is quite featureless terrain.

One thing we should notice here is the VR201 Military Training Route (MTR) in the bottom right of this image. Before we fly in the vicinity of the MTR, we must have been specifically briefed and instructed by the FSS about the status there.

FLIGHT LOG

TIME OF DEPARTURE:	REMARKS	DISTANCE	ELAPSED TIME
POINT OF DEPARTURE KRNO	GS=134 MH=134	POINT TO POINT / CUMULATIVE	ESTIMATED / ACTUAL
CP#1	virginia city VFR CP - carson river - A34 SWR R-062	15 nm / 15 nm	7 mins +5
CP#2	half-dry lake + 4-5nm=N59 ↳ entering class G	27 nm / 42 nm	12 mins (24)
#3	9544' peak - east of NV72 sos! VR201 MTR	23 nm / 65nm	10 mins (34)

CPs #4 and #5

As we are approaching the border of California, watch out for the three white spots pointed by the arrows. They must be salt deposits or dry lakes or something.

We choose them for **checkpoint #4** because in these desert mountains it's hard to find more prominent terrain features.

Also, we will be flying very close to another MTR so we better turn all our lights on…!

About 6 NM (3 mins) after number four we are back in Class E airspace. Another plateau and the magnificent Mono Lake lay below to the west. Although it's a big lake we might or might not see her, depending on the prevailing visibility.

Terrain raises once more below our flight-path and we are at **number five** when west of those white spots and facing that highest elevation point we discussed earlier, down south.

We are closing in at our destination. The Bishop VOR's signal should be received somewhere after passing #5.

and remember… the planning we've made for the descent is described in the last chapter of this tutorial ✱

Let's do some measuring and timing and update the log…

FLIGHT LOG

TIME OF DEPARTURE:	REMARKS	DISTANCE	ELAPSED TIME
POINT OF DEPARTURE KRNO	GS=134 MH=134	POINT TO POINT / CUMULATIVE	ESTIMATED / ACTUAL
CP#1	virginia city VFR CP - carson river - A34 SWR R-062	15 nm / 15 nm	7 mins +5
CP#2	half-dry lake + 4-5nm=N59 ↳ entering class G	27 nm / 42 nm	12 mins (24)
#3	9544' peak - east of NV72 sos! VR201 MTR	23 nm / 65nm	10 mins (34)
#4 mono lake west	3 white spots: 2 small west, 1 big east sos! IR275 MTR class E again	18 nm / 83nm	8 mins (42)
#5	white spots east- 11200' mtn ahead. BIH v-o-r	25 nm / 108nm	11 mins (53)
DESTINATION KBIH	5nm after CP#5→ descend! TPA=5124'	33 nm / 141nm	15 mins (68)

Final thoughts about checkpoints

Obviously, there will be times when the terrain features we planned to use as checkpoints will not be implemented in the FlightGear virtual landscape. The ground features selected for this tutorial have all been cross-checked to exist in the basic FG terrain. Feel free to choose whatever CP you think is best to assist you as visual reference to the ground while you will be flying. At the same time, consider CPs as brackets which your "flight-corridor" should stay inside. This tutorial's CPs are good for that too.

Someone might notice that we ended up shortening the trip, from the 143.6 NM we initially measured and it actually is, to 141 NM in our flight-log. It happened not only because I was rather hasty in measuring and applying scale, but also because the selected CPs don't have an exact center or reference point to use for measuring. They are rather vague. Anyway, it feels like this 1.8% difference is totally insignificant for this kind of flight.

A lot of personal taste is involved in the composing and filling of the flight-log. Keep in mind that it has to serve us out there when trying to **aviate, navigate and communicate**.

Having in mind all that has been said about flight-planning so far…

- it becomes clearer why ATC do not issue vectors to VFR aircraft so often. A simple ATC altitude, heading or speed change instruction to VFR aircraft, is enough to cancel much of the pre-flight planning made by the pilot. Then she/he would have to plan the rest of the flight all over again in the cockpit.
- GPS can do a lot, among which drawing us a nice magenta line "direct to" our destination in our panel's Multi Functional Display (MFD). Following that line makes things much simpler but skipping pre flight planning is never a good idea, especially in the wilderness we'll fly.

Filing a VFR Flight Plan

It is not required by regulations for VFR flights; however, filing a VFR Flight Plan is a good operating practice, since it can be used in search and rescue in the event of an emergency.
In real aviation, flight plans can be filed in the air by radio or by contacting the nearest flight service station (FSS) just before departing. They provide aeronautical and meteorological briefings while accepting flight plans.

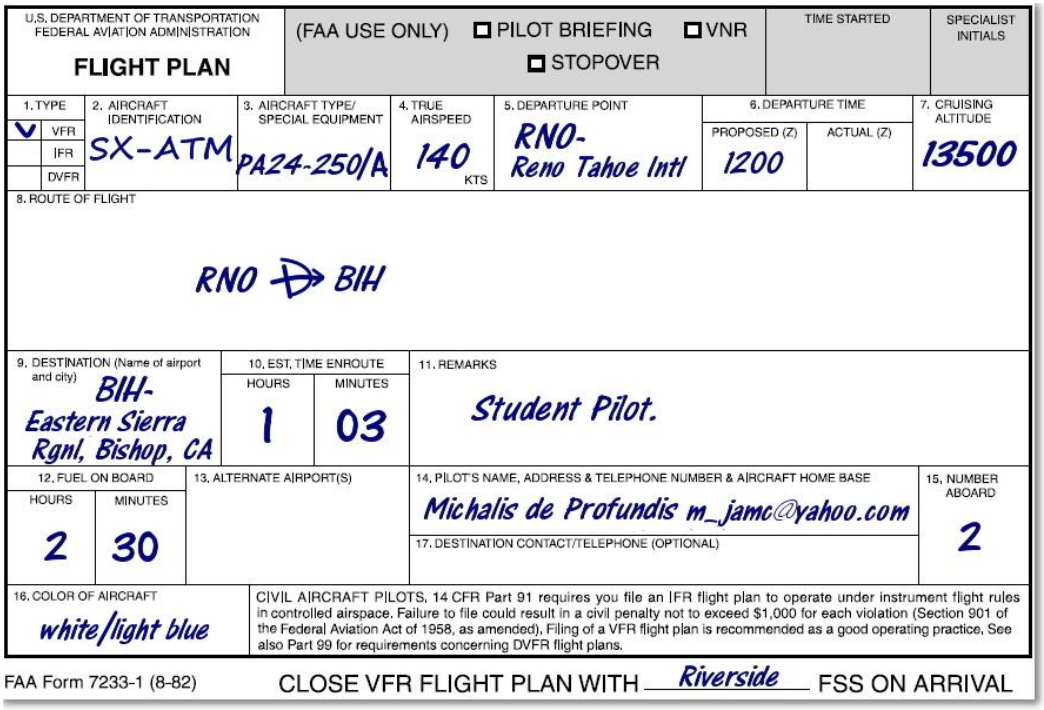
For us flight simmers, submitting a flight plan depends on whether there is someone to receive it, therefore if we can expect ATC service in a multiplayer environment.

Check the FG Multiplayer Forum posts. There are several event organizers in the FlightGear community which will happily receive your flight-plan. Most virtual airlines also provide you with a form to file a flight plan. Things get much more serious when you want to fly online in the VATSIM or IVAO multiplayer environments, although they too should not oblige you for filing a VFR flight plan.

Most of these virtual organizations have their custom flight plan form for you to fill. They want to know in advance about your flight so that they are better prepared to provide you with the corresponding ATC services.

These **basic characteristics of your flight** are: the type of flight (VFR, SVFR or IFR), call sign, aircraft type, departure and destination airports, time of departure, time en-route, cruising altitude and route of flight.

Here is an FAA flight plan form, filled with the appropriate information about our flight.



U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

FLIGHT PLAN

(FAA USE ONLY) ☐ PILOT BRIEFING ☐ VNR ☐ STOPOVER | TIME STARTED | SPECIALIST INITIALS

1. TYPE	2. AIRCRAFT IDENTIFICATION	3. AIRCRAFT TYPE/ SPECIAL EQUIPMENT	4. TRUE AIRSPEED	5. DEPARTURE POINT	6. DEPARTURE TIME PROPOSED (Z)	ACTUAL (Z)	7. CRUISING ALTITUDE
✓ VFR / IFR / DVFR	SX-ATM	PA24-250/A	140 KTS	RNO- Reno Tahoe Intl	1200		13500

8. ROUTE OF FLIGHT: RNO → BIH

9. DESTINATION (Name of airport and city)	10. EST. TIME ENROUTE HOURS	MINUTES	11. REMARKS
BIH- Eastern Sierra Rgnl, Bishop, CA	1	03	Student Pilot.

12. FUEL ON BOARD HOURS	MINUTES	13. ALTERNATE AIRPORT(S)	14. PILOT'S NAME, ADDRESS & TELEPHONE NUMBER & AIRCRAFT HOME BASE	15. NUMBER ABOARD
2	30		Michalis de Profundis m_jamc@yahoo.com 17. DESTINATION CONTACT/TELEPHONE (OPTIONAL)	2

16. COLOR OF AIRCRAFT: white/light blue

CIVIL AIRCRAFT PILOTS, 14 CFR Part 91 requires you file an IFR flight plan to operate under instrument flight rules in controlled airspace. Failure to file could result in a civil penalty not to exceed $1,000 for each violation (Section 901 of the Federal Aviation Act of 1958, as amended). Filing of a VFR flight plan is recommended as a good operating practice. See also Part 99 for requirements concerning DVFR flight plans.

FAA Form 7233-1 (8-82) CLOSE VFR FLIGHT PLAN WITH Riverside FSS ON ARRIVAL

★ Pick the right suffix for the special equipment your aircraft carries and place it in box three - after the aircraft type and slash - by consulting this table

Suffix	Equipment Capability
	NO DME
/X	No transponder
/T	Transponder with no Mode C
/U	Transponder with Mode C
	DME
/D	No transponder
/B	Transponder with no Mode C
/A	Transponder with Mode C
	TACAN ONLY
/M	No transponder
/N	Transponder with no Mode C
/P	Transponder with Mode C

Suffix	Equipment Capability
	AREA NAVIGATION (RNAV)
/Y	VOR/DME, or INS with no transponder
/C	VOR/DME, or INS, transponder with no Mode C
/I	VOR/DME, or INS, transponder with Mode C
	ADVANCED RNAV
/E	Flight Management System (FMS) with DME/DME and IRU position updating
/F	FMS with DME/DME position updating
/G	Global Navigation Satellite System (GNSS), including GPS or WAAS, with en route and terminal capability.
/R	Required Navigational Performance (RNP).
	REDUCED VERTICAL SEPARATION MINIMUM-RVSM
/J	/E with RVSM
/K	/F with RVSM
/L	/G with RVSM
/Q	/R with RVSM
/W	RVSM

We picked "…/A" for that although "…/I" might also be correct (anyway they still don't care for transponders in FGear…)

Other suffixes to be included in a flight plan that would be useful for the FG and other multiplayer environments are:

- … **/T** means "I can communicate with ATC only by **text** messaging"
- … **/V** means "I am able to communicate with ATC by **voice**, because I'm using applications like FGCOM, TeamSpeak, Mumble etc"
- … **/R** means "I will **receive** oral ATC instructions via the above applications but I don't have a working microphone to reply or readback so I will do that by text"
- … **/E** means "I am kind of **inexperienced** in these things and I would like ATC to be kind of extra instructive and tolerant to me"

Make sure to install and learn how to use every available voice communication program like the ones mentioned above. It's really simple and it's always better than having to read and type text messages. Moreover, when many pilots must be serviced by ATC at the same time, naturally the ones with voice capability have better chances for adequate communication.

The last one (…/E) has almost the same meaning with the comment in the remarks box of the above flight plan form (student pilot). If that is the case, it is wise to let the people who will be dealing with you, know. They, in principal, are always willing to help you practice and improve your skills as long as you prove eager to cooperate and learn.

This is the quickest way to shorten the time until no one expects you to use the …/E suffix.

Flying !

We finally made it!
All our effort for accurately planning our trip in every detail has been completed. Our nice airplane is there in the apron waiting for its skillful commander to safely pilot it in the skies (and then back in the ground, preferably in one piece).

It is written in the first paragraph of this guide but will be written once more:

Before reading this tutorial, you should have already acquired the know-how of flying with FlightGear by reading the Manual contained in the basic FG installation package. Most of the information contained in that manual is not considered necessary to be further analyzed in this tutorial.

So, if this is the case, what is the need for a **Flying!** chapter in this tutorial, after all??

Yes, you already know how to start the engine(s), get the ATIS and set the altimeter, taxi to the runway and decently get airborne, properly navigate with or without using the autopilot, track and follow VOR radials, NDB bearings and ILS glide-paths, understand what a Traffic Pattern is and know how to use it for executing a normal approach and landing.

To answer the question above, in this chapter we will get deeper in the actual flying procedures involved in our thoroughly planned flight, focusing on proper communication with the various ATC facilities.

We would need another guide, with many more pages than this one, just to describe proper radio-communication techniques and ATC clearances in all their detail. So we will stay with a nice demonstration of the dialogs that would take place, as if all ATC positions that would affect a real Reno direct Bishop VFR flight were manned.

That line was here in the previous versions of the tutorial → =]

We will only skip any transponder (or "squawk") ATC instructions. Maybe, another version of this guide will include squawks when they begin to be used in FG communications.

All the planning for our flight was based in weather forecasted to be as described in page 21. So we will stick to the same weather scenario for this chapter. As soon as FG finishes loading, the first thing to do is set the weather conditions (if you are using other than the "Fair Weather" or "Live Data" settings). It takes a while until the program adjusts to the new settings.

The marvelous Piper 24-250 Comanche is the airplane for this tutorial. As we said, it can be any airplane you prefer which you think is good for this flight.

One last thing and we are ready to explore what the FlightGear simulation has to offer.
MOUNTAIN FLYING is tricky in reality. Some information about it has been included in the Appendix, having in mind that someday - hopefully - the conditions that affect flying around mountainous terrain will be simulated in FG!

Parking Position

We don't want to start on the runways, especially if we have multiplayer mode enabled and in order to keep on the good side of them controllers.

Even on single player, the realistic thing to do is to start in a parking position.
Taxiing is another aviator skill with another set of rules attached to it.

Many popular airports have one or more startup positions.

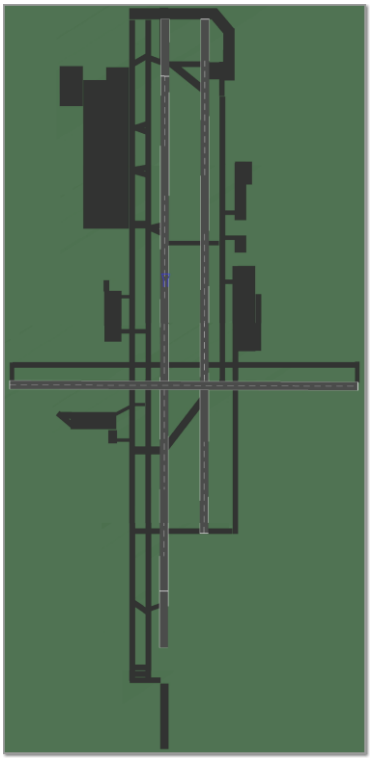
Until tonight that these lines are being written, KRNO is not one of them (neither is very popular, I guess, although it has a terminal building modeled plus animated jetways).

We still don't want to start on a runway so we go to the last page of the *FG-Wizard* and click the "Advanced…" button, just above "RUN". A new window pops up and we click on "Initial Position" in the left column. Type **–119.764333** in the Longitude and **39.500000** in the Latitude field. Click "OK". Run FG and you will find your aircraft in this neat parking spot.

When you want to start at an apron, for those airports, like KRNO, that do not have preset parking/startup positions, use google maps. Find the location of the airport and zoooom in, until you can clearly see taxiways aprons and buildings, preferably in the "satellite view" mode.

The small diagram below shows exactly how runways, taxiways and aprons are modeled in FG.

Airport layouts are available under "Location" > "Select Airport" > "Airfield Chart" in FG-run, since the 2.10 release.



Then, right click on the exact location you want to start and select "What is here?".
The coordinates you got in the search-field at the top-left can be used as described in the right part of this page, to start exactly where you want!

ATTENTION: Unless you go back to the Initial Position window and erase the Lat/Lon values you once inputted, FG will always start in those coordinates and not at the airport you picked in the previous page!

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In the cockpit

Preflight inspection of the aircraft completed. We walked around, with "Helicopter View", to check the overall condition of various parts, select livery and explore the modeling detail of our aircraft. I just love that openable baggage door!

Now back in "Cockpit View".

Time to perform our **checklists** and get things going, right?

Yes, many FG aircraft now come with checklists. Otherwise, we may use pilot instinct to come up with our imaginary ones. Have in mind that from pre-startup to after-shutdown, there is a checklist for everything.

Also have in mind that they will not be mentioned again in this tutorial.

Have all systems turned on but wait before turning the key to start the engine(s).

Before making initial contact with ATC and request startup, it's good to have the latest Automatic Terminal Information Service (ATIS) obtained. COM1 on 135.8 to receive the following information:

Reno Tahoe International information Sierra. one one zero zero zulu. Weather: two zero thousand few. Visibility: one two miles. Temperature: two zero Celsius. Dew point: eight Celsius. Wind: zero fouer fife at seven. Altimeter: two niner niner fife. ILS runway one six left approach in use. Landing runway one six right and left. Advise you have Sierra.

That is probably more than the usual ATIS in FG because, as for the rest of this chapter, ATC is assumed to be fully staffed so someone out there has prepared a correct and detailed broadcast for us. It is essential that we keep note of this info as we hear it.

Now we know something we couldn't have known when planning the trip and that is…

The runway we'll be departing from

It will be either 16L or 16R, as we heard in the ATIS (the departure runway will only be given if different from the landing runway). That is all we need to know to make a quick plan for our departure and climb. Since we filed a VFR flight plan we will probably not be given any instructions or vectors by ATC, other than the take-off clearance. Except if we request some and we will do that at any time we get disorientated.

So, we plan to depart on a runway heading of 166° (magnetic) and keep this course to climb straight out of the traffic pattern. True Airspeed will be 90 to 100 knots for the climb. To correct for the wind we'll fly a MH of 160° for this leg of the climb. (shouldn't we draw another wind triangle for this correction?)

Then, at 5 NM out, we turn about 50° to the left (we used a protractor to measure this angle), and fly 110° MH for 6 NM to the point where radial 167 of Mustang VOR crosses the lateral boundary of the Class C shelf area. Then we'll join our initially charted course of flight, thus turn right 134°. Assuming we'll be climbing at a constant airspeed, we can use timing to define the turning point for the second leg.

Pilotage is not recommended for this part because much of what we see in the map isn't implemented in the FG scenery (these yellow towns are not there at all).

At what rate should we be climbing?
We have to be higher than 7,864' MSL by the end of the second leg of the climb. As we see in the chart, that is the highest elevation in proximity of our flight path, a couple of miles to the south of the point we will be exiting Class C. Add 1,000 feet for safety and comfort and round it up to 9,000' to get a target minimum altitude to be climbing when we will be there.

Thus we need to get from 4,415' to 9,000' in about 11 NM or roughly a **minimum climb rate of 420 feet per NM**. If we know the TAS we will be climbing (as we should), we can convert this to feet per minute (fpm), which is displayed in the Vertical Speed Indicator (VSI) in the cockpit.

Startup and Taxi

Reno Clearance Delivery, *good day,* Comanche + full call sign, *at the general aviation parking, V-F-R direct Eastern Sierra Regional with information Sierra.*

We tuned COM1 to 124.9 MHZ and made initial contact with the RNO tower (local control) at their Clearance Delivery frequency. After some seconds we receive their response, which goes something like this:

Full call sign, *Reno Delivery, good-morning, you are cleared to Bishop, maintain V-F-R, expect runway One Six Left, contact Ground One Two One point Niner for startup and taxi, have a nice flight.*

They omitted the info contained in the ATIS since we said we know that. They will include ATIS related pieces of info in the clearances, only in case of a significant change to that info. Our fingers are already touching the ignition key as we **read back the clearance**…

Cleared to Bishop, expecting runway One Six Left,
will contact Ground, full call sign, *bye bye!*

…then switch COM1 to 121.9 - pause, listen, make sure the frequency is clear (always do that before transmitting) - and push the talk button:

Reno Ground, good morning, Comanche + full call sign, *at the general aviation parking, V-F-R to Bishop, information Sierra received, request startup.*

Call sign, *Reno Ground, good morning sir,*
startup engine and advice when ready to taxi.

*Starting-up "…**vROOOOMmmm**…" will inform when ready to taxi, call sign.*

That was not an explosion. It was the first roar of the engine :b (no more sound effects).
This controller used an abbreviated call sign for us (the first and the last two or three characters of our full call sign). So, from now on, we can also use this cut down call sign when talking to this controller, without risking misunderstandings.

Now is the time to make sure we are all set for the departure:

- All instruments seem to work fine, the engine runs smooth and the lights are on.
- 118.7 for Tower is set on standby at COM1 (careful: on standby, not on the active frequency).
- 119.2 for NORCAL Departure Control, on COM2 standby (we expect the tower will hand us off to them at some point after the departure).
- 117.9 for FMG VOR on NAV1 with radial 167 selected on the corresponding OBS.
  (we found these frequencies in the RNO page of the A/FD)
- 113.2 for SWR VOR on NAV2 and 062 on the NAV2 OBS (remember why?).

After all this messing with the dials and knobs on the radio stack, we make sure 121.9 is still the active frequency. They are still waiting to give us the "go" message…

Reno Ground, call sign, *at the G-A parking, ready to taxi.*

Call sign, *runway One Six Left, intersection departure Delta, taxi via Charlie, hold short at Delta and contact tower.*

Runway One Six Left via Charlie, will hold at Delta and contact the tower, thank you, call sign.

Wow! We are in for an **Intersection Takeoff**!

That means we are not required to taxi all the way down to the beginning of the runway (the runway threshold).

It also means we will have less runway for our takeoff roll, but plenty enough for this aircraft and weather.

We can decline such an ATC instruction if, for any reason, we do not want to use less than the full length of the runway or we feel that we are given a shorter takeoff roll than we wanted ("*Unable intersection Delta, requesting full runway distance,* call sign").

Via Charlie we taxi northbound to enter the runway at the intersection of taxiway **D** and runway 16L as specified by ATC. Actually we must **STOP** at that intersection and call the tower **BEFORE** entering the runway.

We will switch to the tower frequency when the airplane has stopped behind those lines marking the holding position.

Cleared for Takeoff

Reno Tower, Comanche + full call sign, *holding short of runway One Six Left at Delta*.

Call sign, Reno Tower, *a straight exit from pattern is advised, runway One Six Left cleared for takeoff.*

Straight exit from the pattern, cleared for takeoff, call sign.

It's in every ATC communications guide:
Do not take off unless you receive the "**cleared for takeoff**" clearance.

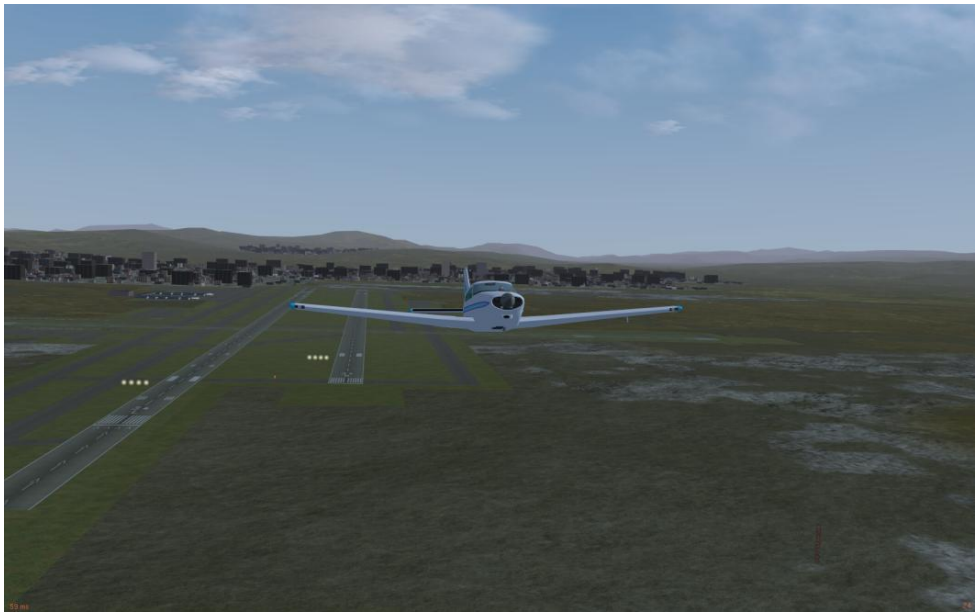
After climbing to Traffic Pattern Altitude (=5,215' for single engine aircraft at RNO) and also after crossing the runway end, we would have had **two options for departing the Traffic Pattern**.
One would be climbing left turn 45° and the other to continue climbing straight ahead. The tower would like us to exit straight ahead. We have planned this.

If we hadn't, there would be no time for pen, paper and protractor, as we would be expected to take off without delay. In that case we could have asked for a different clearance, one that we would be better prepared to safely execute. (*"We prefer the straight exit from pattern, if available,* call sign*,")*

Another option would be to ask a controller for assistance by guiding us with vectors to a point that we would be able to continue on our own. (*"We would like vectors to Virginia City V-F-R checkpoint,* call sign*")*

Back to our scenario… release the brakes and steer it to a nice alignment with the runway, reset the timer…full throttle…V1…Rotate!

The Climb



Optimally, we'll be climbing at 90 to 100 knots True Airspeed in the Comanche (it's displayed in miles per hour (mph) in its Airspeed Indicator).

That is 1.583 NM per minute.

We'll get to the turning point for the second leg - 5 NM out - after 3.2 minutes (5÷1.583). Multiply our target minimum climb rate of 420 feet per NM by 1.583 to get 665 feet per minute.

Piece of cake for the Comanche that will easily be climbing at around 800 fpm in this density altitude of about 6,000'.

About two and a half minutes on the timer and we get a call from the tower:

Call sign, *One One Niner point Two for Departure, bon voyage!*

Departure at One One Niner point two, call sign, *ciao!*

Norcal Departure, *hello,* Comanche + full call sign, *Three miles south of Reno/Tahoe, climbing through Six thousand Fouer hundred, V-F-R direct Eastern Sierra Regional.*

We describe our position so they can quickly confirm our position on their radar.

Call sign, *good day,* Norcal Departure, *proceed southeast VFR.*

We will request VFR flight following (traffic advisories). That means we want their instructions / help to separate us from other traffic they might have in their radar-scope.

Roger, southeast VFR for call sign. *We'd like to have flight following, if that is possible.*

Call sign, *squawk 0-4-2-7.*

Squawk zeero fouer too seven, call sign.

Call sign, *radar contact, four southeast of Reno International, altimeter 2996, maintain VFR.*

Too niner niner six, VFR, thanks, call sign.

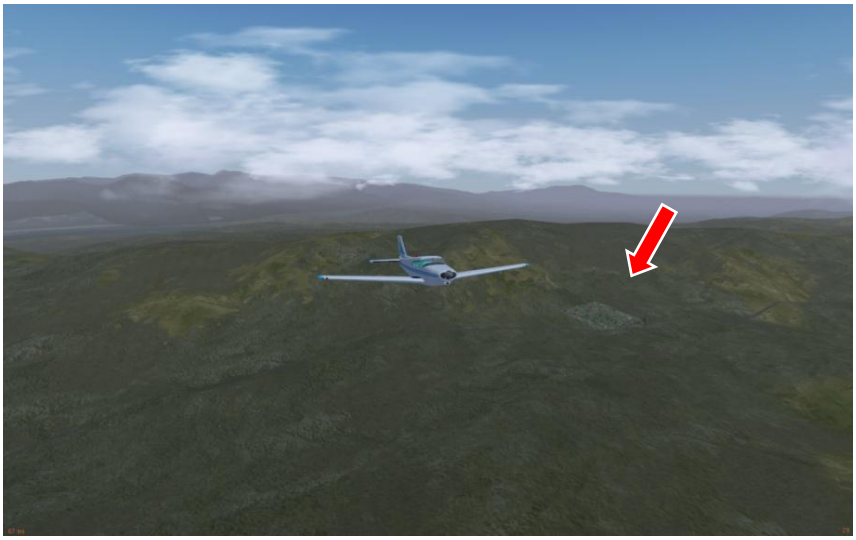
Three and a half minutes already on our timer so we better begin our climbing left turn to 110° MH for the second leg of this part of the climb. After another three or four minute, the needle on our NAV1 OBS should be centered. That is the signal we've been waiting to make the right turn to 134° and join the magenta line that will lead us straight to our destination airport.

From now on we need to frequently check out our flight log.

Now we have almost reached 10,000'. Virginia City should be somewhere down below…

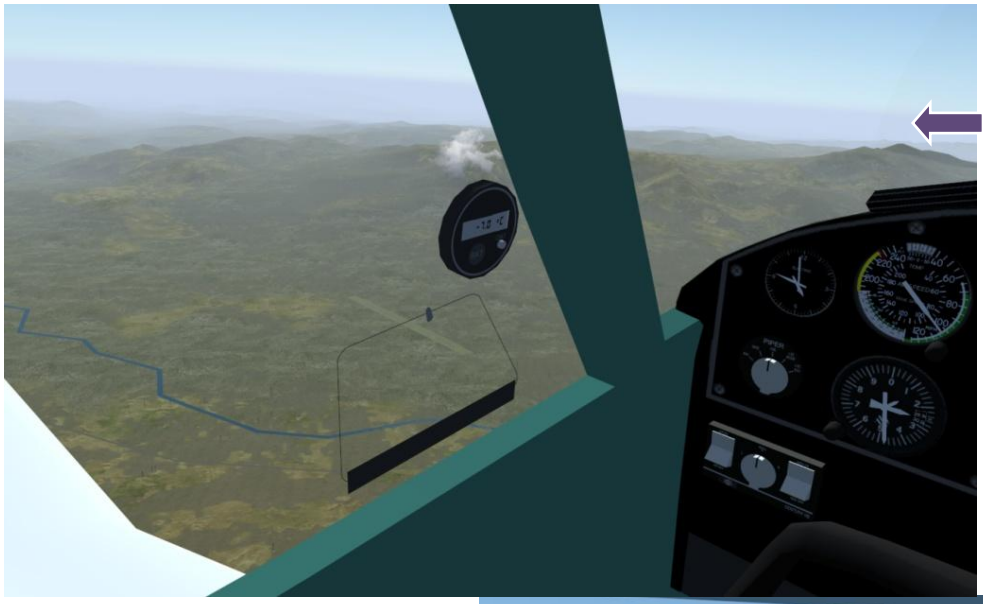
You cannot miss it, right?

It's good we used enough features to be sure we reached the first checkpoint. One of these is radial 062 of SWR VOR. As soon as we cross it, we will reset the timer in order to keep the timing we have calculated for the rest of the flight, as noted in our flight log.



So, we are getting close to checkpoint #1, approaching our cruising altitude of 13,500 feet MSL. That brings us to the next phase of the flight…

En Route

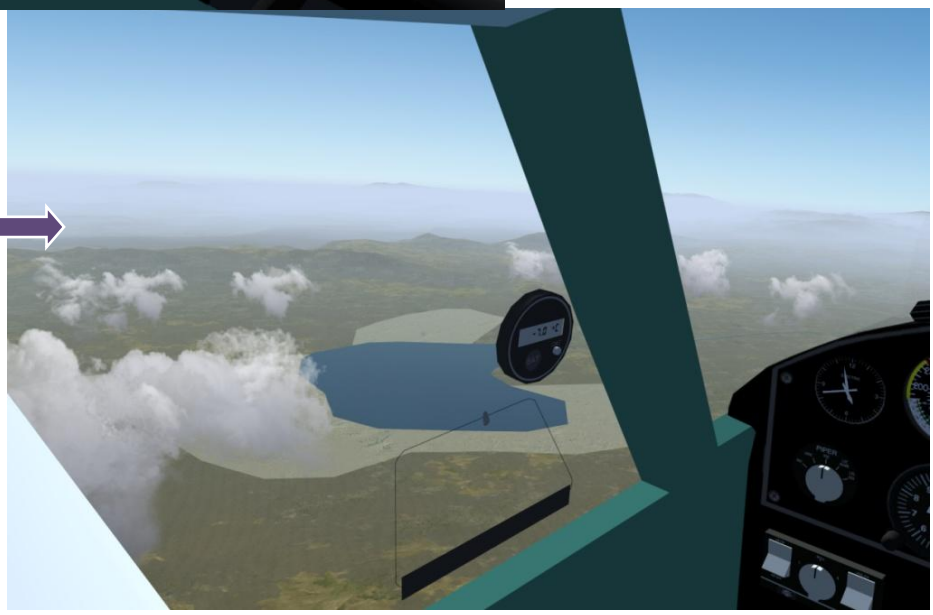


Overflying A34 (Dayton Valley), one of the CP#1 landmarks.

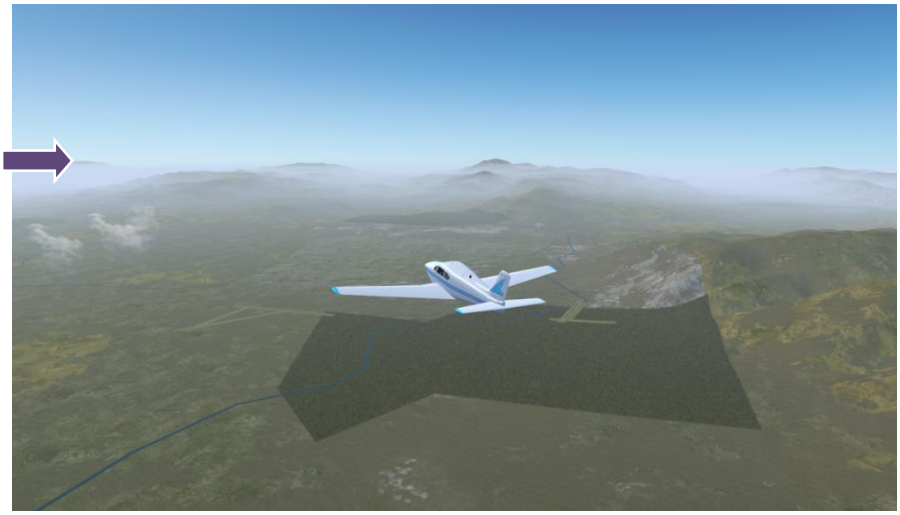
That nice thermometer on the window displays the Outside Air Temperature (OAT).

That is the small lake of CP#2. We are west of it, instead of overflying it, as we should...

…let's correct this by turning left.



N59 (Rosaschi) and the private Farias Wheel to the west, are also CP#2 landmarks.



As we enter Class G (uncontrolled) airspace, we hear from departure control for the last time...

Call sign, *flight following terminated, squawk V-F-R, frequency change approved, enjoy your flight, bye!*

Squawk V-F-R, call sign, *adios.*

That means we dial 1200 (for USA, it would be 7000 for most other countries) in our transponder.
Now we can tune COM1 to 122.2 for the Flight Service Station (FSS) in the area we are flying. They will be our next ATC companion, this time one without a radar scope.

Reno Radio, *good afternoon,* Comanche + full call sign, *on One Two Two point Two.*

Our initial contact with the FSS is kept short, just like asking for their attention. We included the frequency we are tuned in - since they transmit in many different frequencies in many locations.

Comanche + full call sign, Reno Radio, *good afternoon.*

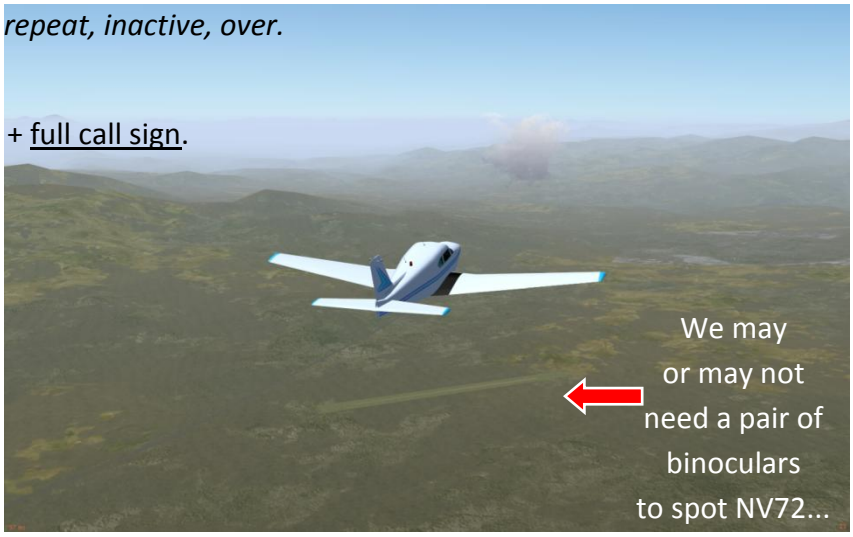
Reno Radio, Comanche + full call sign *is 42 miles southeast of Reno International over Dayton Valley airstrip, level at One Three thousand Fife Hundred, requesting military training route status, over.*

The word "over" is used so that they know they heard our full transmission.

Comanche + full call sign, *be alert for unknown traffic in Class Golf, military routes are inactive, I repeat, inactive, over.*

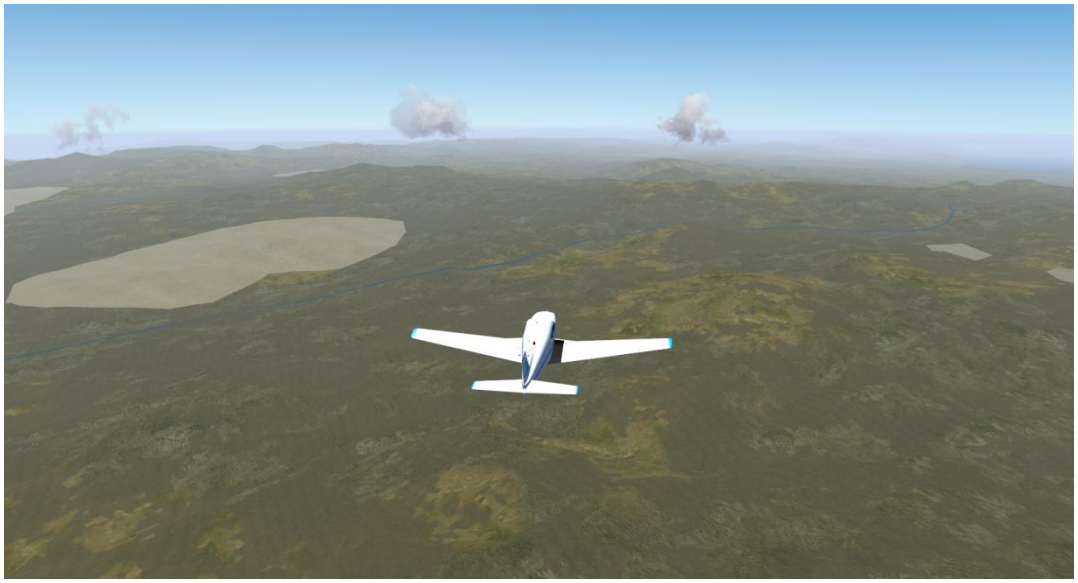
Roger, thank you, Comanche + full call sign.

Time flies when you fly… we are already at CP#3.
Given that the last reset of the timer was at the first checkpoint, we should be looking for Sweetwater (NV72) and the 9,544' peak at about 22 minutes on the timer.



That must be CP#4's largest of the three white spots down east.

It took us 8 minutes to get there from the last checkpoint.



It has been a while since the last communication we had with Reno Radio.

Let's give them a goodbye call.

According to the sectional, we should monitor Riverside FSS from now on.

Reno Radio, Comanche + full call sign, *switching to Riverside Radio, thank you.*

Call sign, *you're welcome, enjoy the rest of your flight.*

122.15 for the "Mammoth" Radio Communication Outlet (RCO) of Riverside FSS.

Riverside Radio, Comanche + full call sign, *on Mammoth One Two Two point One Fife.*

Call sign, *Riverside Radio, go ahead.*

Riverside Radio, call sign, is t*en nautical miles northeast of Mono Lake, level at One Three thousand Fife Hundred, V-F-R direct Eastern Sierra Regional airport, any traffic around here?*

Call sign, *no traffic is reported in your area.*

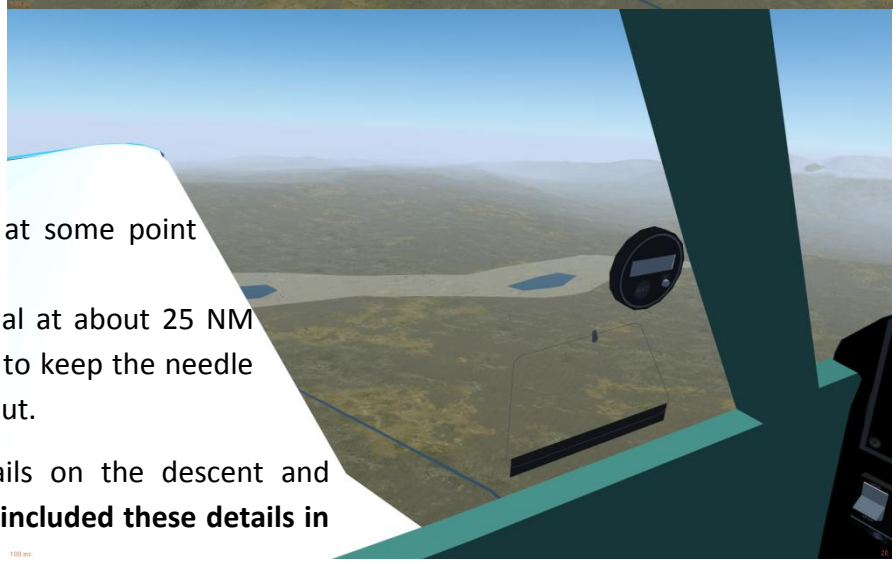
Copy that, call sign.

Mono Lake barely visible to our west in the distance…

We should be approaching CP#5.

We may use all VFR navigation techniques to verify our position:

- Pilotage - These must be the white spots we see east of our course in the sectional. Also that 11,200' peak is beginning to take shape at our 2 o'clock.
- Dead Reckoning - The timer says we are 11 minutes past the fourth checkpoint.
- VFR Radio Navigation - Tune a NAV receiver to 109.6 for Bishop VOR and set its OBS to our magnetic course of 138 degrees.

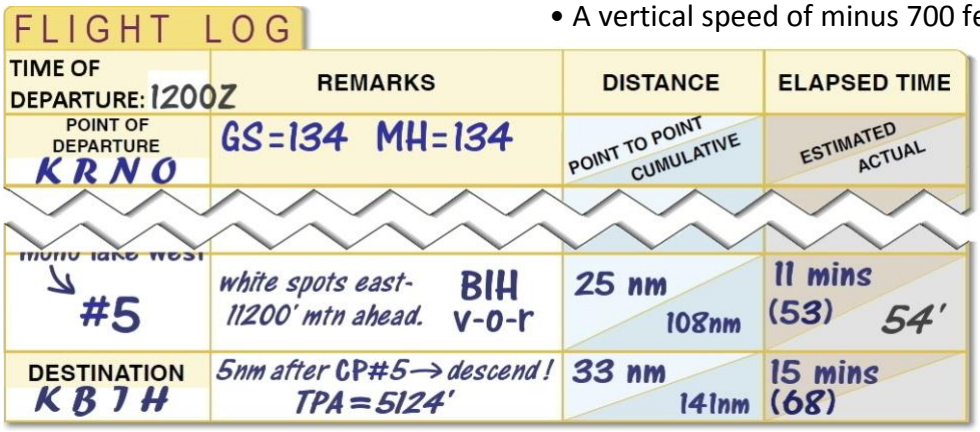


The descent to Bishop should begin at some point after the fifth checkpoint.
We must be receiving the VOR's signal at about 25 NM from the airport. Then we'll just have to keep the needle centered and an eye at the DME readout.

The next part begins with the details on the descent and approach. **Normally, we should have included these details in the flight planning.**

Downhill

So far so good and everything has gone as planned. When at the fifth checkpoint, we reset the timer once more and review our plan for the descent:



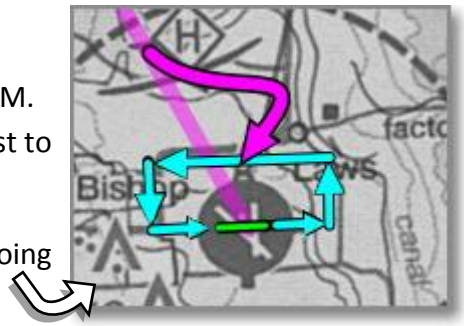
FLIGHT LOG

TIME OF DEPARTURE: 1200Z	REMARKS	DISTANCE	ELAPSED TIME
POINT OF DEPARTURE KRNO	GS=134 MH=134	POINT TO POINT / CUMULATIVE	ESTIMATED / ACTUAL
mono lake west #5	white spots east- 11200' mtn ahead. BIH v-o-r	25 nm / 108nm	11 mins (53) / 54'
DESTINATION KBIH	5nm after CP#5 → descend! TPA=5124'	33 nm / 141nm	15 mins (68)

- A vertical speed of minus 700 feet per minute has been chosen.
- We will get from the cruising altitude of 13,500 feet to Traffic Pattern Altitude (TPA) of 5,124 feet. That is 8,376 feet.
- So we need 11.97 minutes (8,376÷700) for this.

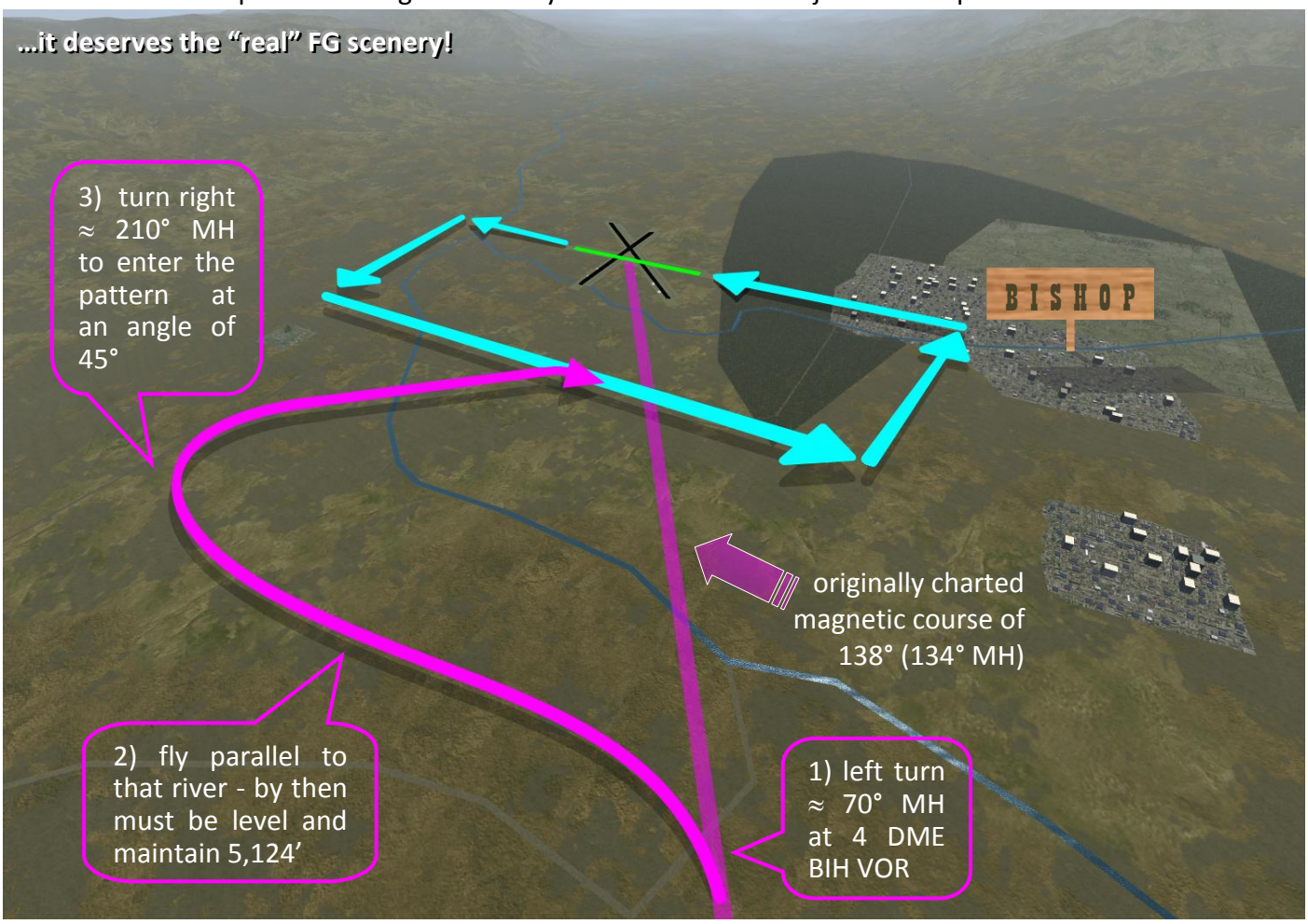
Make that 12 minutes.

- CP#5 is about 33 NM from the airport.
- By checking the chart, we decide it is safe to begin the descent 5 NM after CP#5 or 2.2 minutes (GS=134 knots).
- We want to be at TPA 4 NM before the airport.
- All that means the distance available for the descent will be about 24 NM.
- Since we want to cover 24 NM in 12 minutes (GS = D / T) we must adjust to about 120 knots groundspeed, while descending.



We zoomed in the chart and used colored arrows for the route we are going to fly those last 4 NM, to enter the traffic pattern.

But this last crucial part of our flight definitely deserves more than just a small piece of chart…



This planning is based at the fact that surface winds are still blowing from 045 at 07 as we initially inputted manually. Subsequently, runway 07 is the preferred one. If you are using different weather settings, plan accordingly.

That was the plan. Now back to where we were with our flight.

We have just confirmed we are over the fifth checkpoint. We reset the timer and prepare for the descent that begins when clock says 2 minutes and 12 seconds. Almost two minutes after we started descending, the VOR signal is alive and clearly received. At the same time we are within range to receive the "one-minute weather" report from KBIH's Automated Surface Observing System (ASOS) on 119.025.

As we are getting closer and closer, we need to switch to the correct frequency for our non-towered landing airport.

★ This is a guide for our communication with ATC from now on

We can assume that there aren't any facilities at KBIH by the time we'll be arriving, so we will self-announce on the CTAF/UNICOM frequency (123.0 MHZ as we can see in the A/FD and the sectional). This is very common practice around non-towered airports

(no operating tower) Recommended Communication Procedures			
Facility at Airport	**Frequency Use**	**OUTBOUND**	**INBOUND**
UNICOM (no tower or FSS)	Communicate with UNICOM on CTAF frequency **(122.7 122.8 122.725 122.975 123.0)** If unable to contact UNICOM: self-announce on CTAF	**Before taxiing & Before taxiing on the runway for departure**	**10 miles out. Entering downwind base & final. Leaving the runway.**
No tower, FSS or UNICOM	Self-announce on MULTICOM frequency **(122.9)**		
No tower in operation, FSS open	Communicate with FSS on CTAF frequency		
FSS closed (no tower)	Self-announce on CTAF		
Tower or FSS not in operation	Self-announce on CTAF		

So, as we are approaching 10 NM out, we can inform ATC that we are about to change frequency…

Riverside Radio, Comanche + full callsign, *switching to the CTAF frequency, One Two Three point Zero for Eastern Sierra Regional.*

Call sign, *have a great one, bye bye.*

…COM1 on 123.0 to self-announce our intentions on the CTAF frequency…

Eastern Sierra Traffic, *a Piper is ten miles north-northwest, descending through Seven thousand Fife hundred, will join the left downwind for runway Seven, East Sierra Regional.*

The basic rules of radio communication apply in this case too. We use **the four W's** to make the self announcements: **W**ho we are talking to, **W**ho we are, **W**here we are and **W**hat we want.
There is no need for a detailed call sign here (not useful info for any other pilot monitoring the CTAF). We must repeat the name of the airport at the end in each of our calls (this is to avoid misunderstandings as there are cases where many small airports near-by share the same traffic frequency).

Downwind Base & Final

Descending left turn, starting the **maneuver** that will lead us to the traffic pattern.

We will soon be leveling off at 5,124’ (TPA).

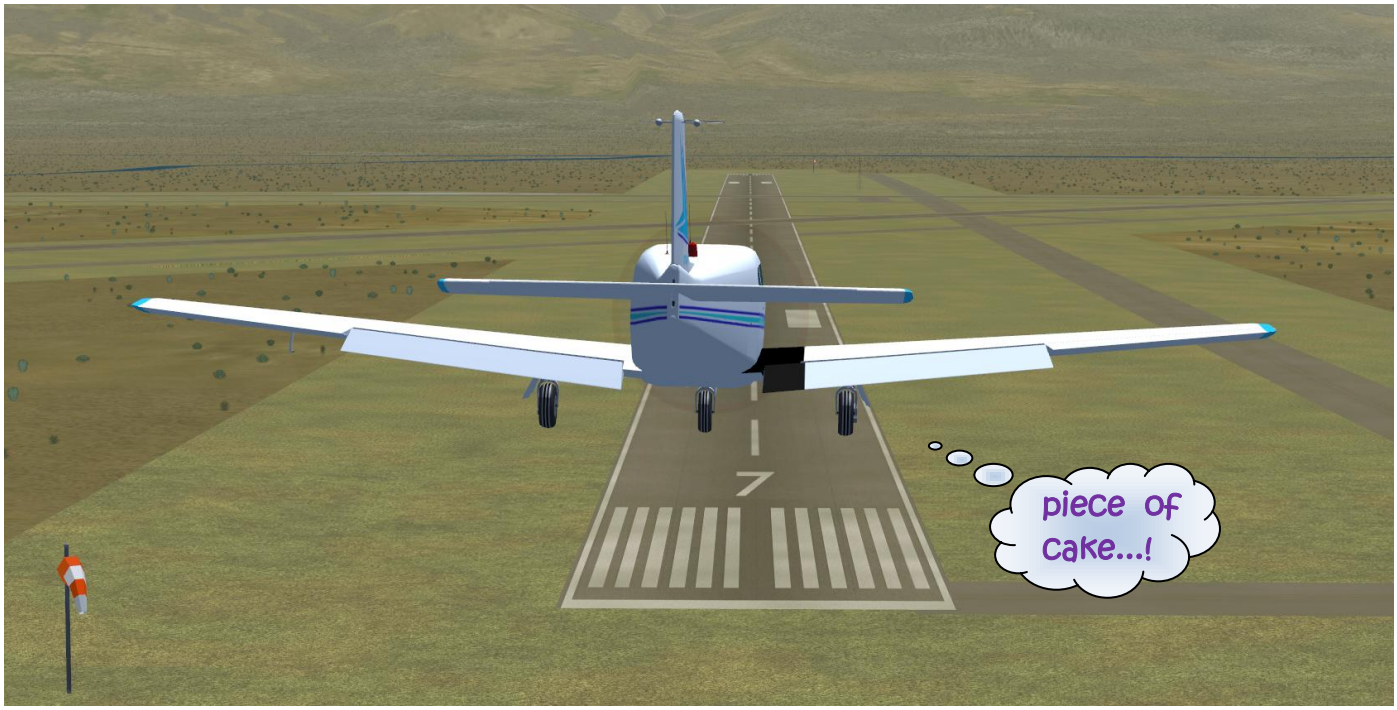
We completed the maneuver and we are about to enter the downwind…

Abeam the threshold of 07 we reduced power to start losing some altitude and deployed some flaps.

Now (07 threshold at our 7 o' clock), we begin our turn to base (along with the second flap deployment)…

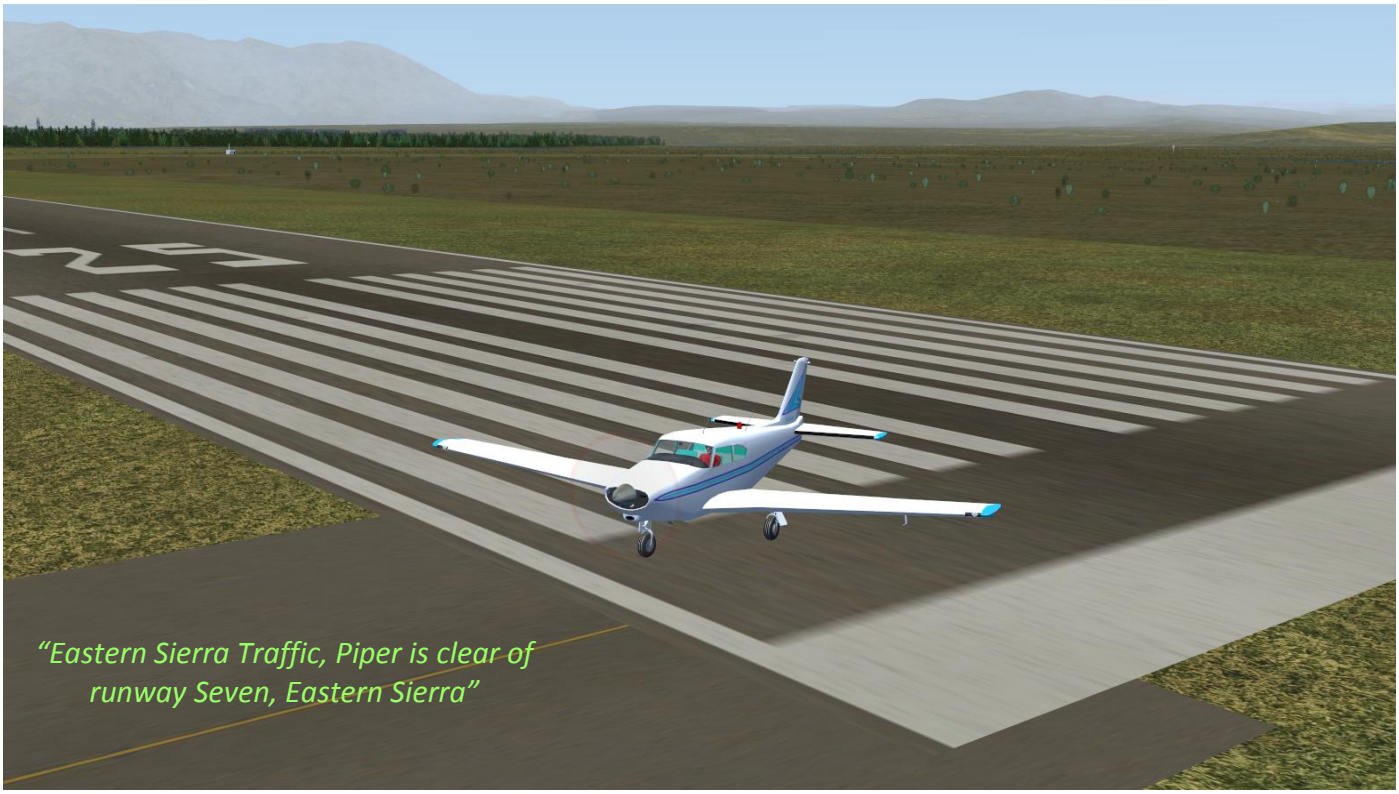
Full flaps and gear down as we begin the turn to final just before crossing that river…

(have a look here for what the real airport we are about to land in, looks like…)



Touchdown

We must stay focused and positively control the aircraft throughout the landing roll, until we slow down to taxiing speed. Then we can relax knowing we made a good job and take the last exit to the right…



Don't forget to close the flight plan and submit any comments, thoughts or questions at the "cross-country tutorial II" forum post!

I hope you enjoyed !

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:)

Appendix

Airports That Do Not Have a Tower (or they have but it's closed...)

It is essential that pilots be alert and look for other traffic and exchange traffic information when approaching or departing an airport without an operating control tower. This is of particular importance since other aircraft may not have communication capability or, in some cases, pilots may not communicate their presence or intentions when operating into or out of such airports. To achieve the greatest degree of safety, it is essential* that all radio-equipped aircraft transmit / receive on a common frequency. By monitoring the same frequency, VFR aircraft flying to and from Bishop can also hear each other and understand each other intentions and position.

FSS and UNICOMs may provide Airport Advisory service in non-towered airports. It includes wind direction and velocity, favored or designated runway, altimeter setting, known airborne and ground traffic, NOTAMs, airport taxi routes, airport traffic pattern information, and instrument approach procedures. These elements are varied so as to best serve the current traffic situation. Pilots should advise the FSS of the runway they intend to use.

If they are aware of other aircraft activity in a 10 miles radius around the airport, they will inform you e.g.:

"...traffic, a Cessna One Seven Two on downwind for runway Three Zero..." or

"...ground traffic, a Cessna One Seven Two taxiing for runway Three Zero..."

You could expect UNICOM airport advisory at KBIH, at the CTAF frequency (123.0) but at the time we'll get there they will be off for launch. That's not a problem because we've read the "VFR X-Country II Tutorial", so we know very well what to do...!

Now that I'm thinking, I could just skip all this writing by giving you the link for the "Operations at Nontowered Airports" guide by the Air Safety Institute of AOPA USA (scroll down that page and you'll get to it – linking directly to that pdf, doesn't seem to work).

*Keep in mind that it is not obligatory for VFR to have an ATC clearance or to be in radio contact with ATC, for flying in Class Echo and Golf. This means I could have left out all communications after exiting Class Charlie - literally turn off the radios...!

click to go back...

Altimeter Setting

In this guide we have been through some basics about altitude and altimeter.

In reality, you need to receive from ATC the altimeter setting for the airport you will be departing or arriving and input it on the barometric window of the aircraft's Altimeter. That is called *"setting the altimeter"* and only after the altimeter is set does it indicate the correct altitude (the word "correct" will need to be better explained when referring to types of altitudes, but is commonly used in this case to denote the approximate altitude above sea level).

Unless you are using the “Live Data” weather setting (then FlightGear will automatically be updated with real weather updates and thus correct altimeter settings for you to use), there seems to be a problem in this procedure in the FG environment and that, in a few words, is:

The altimeter setting is preset for each FG weather scenario (like 29.97 for “Fair Weather”) and in many cases - like when the airport is considerably high elevated - it does not correspond to what it should be in order to get the true airport elevation after setting your altimeter.

When at the airport surface, before take-off, you can correct this by reversing the whole process:

- Disregard the ATIS or ASOS altimeter setting broadcast.
- Check the charts or the A/FD for the true airport elevation.
- Turn the altimeter setting knob until your altimeter displays the true airport elevation.
- The pressure setting you selected this way is what the ATIS or ASOS should broadcast.

I have not found a solution to this problem for when you are preparing your descent to land (other than a “cheaty” look for true altitude in the Equipment > GPS tab and adjusting the altimeter accordingly).

click to go back...

Automated Surface Observing System (ASOS)

This is the primary surface weather observing system of the U.S.A.
It’s a weather observing system that provides minute-by minute weather observations such as temperature, dew point, wind, altimeter setting, visibility, sky condition, and precipitation. Some ASOS stations include a precipitation discriminator which can differentiate between liquid and frozen precipitation.

The one−minute updated airport weather should be available to you within approximately 25 NM of the airport below 10,000 feet. The frequency for the weather broadcast will be published on sectional charts and in the Airport/Facility Directory.

As of the FlightGear 2.10 release, there is no difference in content between the ASOS and ATIS broadcasts.

click to go back...

Automatic Terminal Information Service (ATIS)

Is the continuous broadcast of recorded non-control information in selected high activity terminal areas. Its purpose is to improve controller effectiveness and to relieve frequency congestion by automating the repetitive transmission of essential but routine information.

ATIS information includes:

1. Time (of the latest weather sequence)
2. Ceiling, visibility and obstructions to visibility
   (may be omitted if the ceiling is above 5,000 feet and the visibility is more than 5 miles)
3. Temperature, dew point (if available)
4. Wind direction (**magnetic**) and velocity
5. Altimeter
6. Other pertinent remarks
7. Instrument approach and runway in use.

The departure runway will only be given if different from the landing runway (except at locations having a separate ATIS for departure).

ATIS transmissions are engineered to be receivable to a maximum of 60 NM from the ATIS site and a maximum altitude of 25,000 feet AGL. At most locations, ATIS signals may be received on the surface of the airport. The A/FD indicates airports for which ATIS is provided.

click to go back...

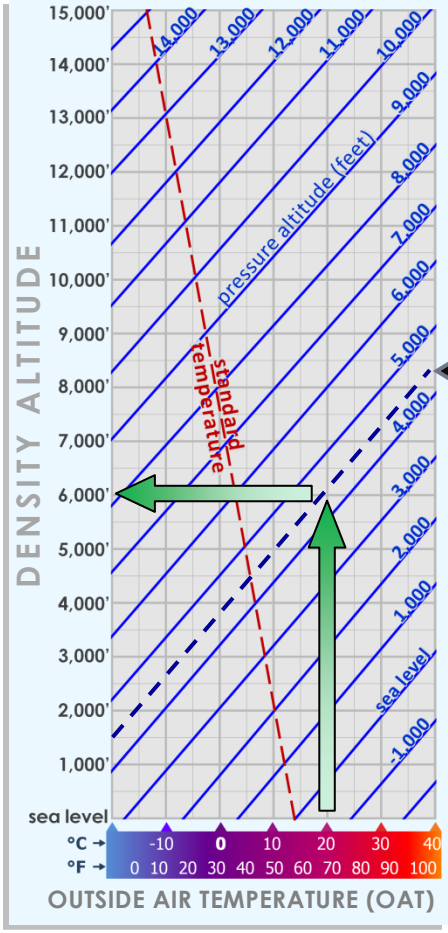
Compass Error in FG

The FG-run Equipment > Instrument Settings tab, includes the heading indicator (HI) adjusting option (=HI offset). When I startup on several FG aircraft, I encounter an obvious disagreement between the magnetic heading displayed at the aircraft's HI and the one I get from the in-game map ("Aircraft Hdg Up" selected). In this screenshot you can see that although the airplane is heading at 071° magnetic (in-game map never lies), the HI is pointing at 091°.

By clicking the arrows at the "HI offset" menu (or by turning the one of two knobs below the HI) you can adjust the HI readout to be equal with the correct magnetic heading of the in-game map.

click to go back...

Density Altitude



This is an example for calculating density altitude:
You are parked at KRNO; the atmospheric conditions are the same with those we use in this tutorial, so the temperature is 20 degrees Celsius.

First, find the pressure altitude by setting the barometer of the altimeter at 29.92"Hg:

it's about 4,400 feet, as indicated in the aircraft's altimeter.

Then use the graph from page 8, to compute the density altitude:

it is just about 6,000 feet!

Some thoughts on this outcome:

I. The aircraft will perform as if it was at 6,000 feet. With that in mind, you can accurately calculate things like takeoff roll distance and climb power settings by consulting the AFM/POH.
II. In the same graph from page 8, if you draw a vertical from the point the two broken lines meet (the 4,400' one and the standard temperature one) down to the temperature axis; you get the standard temperature for 4,400 feet which is about 6°C.
III. So we are operating at 14 degrees Celsius above the standard temperature for this altitude. The hotter the air, the thinner the air.
IV. This method helps us realize that the conditions would be the same (same density altitude) if we were at 6,000' pressure altitude and the temperature was 3°C / at 7,200' and -10°C / at 3,500' and 29°C etc.

click to go back...

Different Airspace Rules

...between FAA and ICAO are summarized in the following table:

Airspace	Class A	Class B	Class C	Class D	Class E	Class G
Differs from ICAO	No	ICAO does not have speed restriction	ICAO does not have speed restriction / ICAO requires ATC clearance	ICAO requires ATC clearance	No	ICAO requires 3 statute miles visibility

Also ICAO has another kind of uncontrolled airspace (Class F).

In order to understand how a country's airspace rules work, you should study and familiarize with that particular country's publications and charts. I don't think that summarizing tables are good enough. This one is just a proof for that...

click to go back...

Mountain Flying

When flying in mountainous regions, there are some things to keep in mind.

While the wind flows smoothly up the windward side of the mountain and the upward currents help to carry an aircraft over the peak of the mountain, the wind on the leeward side does not act in a similar manner. As the air flows down the leeward side of the mountain, the air follows the contour of the terrain and is increasingly turbulent. This tends to push an aircraft into the side of a mountain. The stronger the wind, the greater the downward pressure and turbulence become. Due to the effect terrain has on the wind in valleys or canyons, downdrafts can be severe.

This is something you will not experience in a non-professional flight simulator. Dreaming that one day these conditions will be simulated, here are some mountain flying rules:

✈ Plan your flight carefully and file a flight plan.

✈ Don't fly a light aircraft when the winds aloft, at your proposed altitude, exceed 35 miles per hour. Expect the winds to be of much greater velocity over mountain passes than reported a few miles from them.

✈ Approach mountain passes with as much altitude as possible. Downdrafts of from 1,500 to 2,000 feet per minute are not uncommon on the leeward side.

✈ Don't fly near or above abrupt changes in terrain. Severe turbulence can be expected, especially in high wind conditions.

✈ In mountainous regions, a high airport elevation is commonplace. Density altitude becomes a key factor: Takeoff roll increases at higher density altitude. Landing rolls are also longer because while the indicated approach airspeed must remain the same as at sea level, it is translated in considerably higher true airspeed due to high elevation.

click to go back...

Shouldn't we draw another wind triangle for this...?

Back in the Basic Concepts chapter - wind triangle section, there is a powerful statement:

Either consciously or unconsciously,
every good pilot thinks of the flight in terms of wind triangle.

When planning flights, I really like drawing these triangles but it's good to have an alternative, sometimes more suitable for cockpit use:

DCA = sin^{-1}[(V ÷ TAS) × *sin*(W – TC)]

or Drift Angle = *asin*((Wind Speed ÷ True Airspeed) × *sin*(Wind Direction – True Course))

GS = TAS × *cos*(DCA) – V × *cos*(W – TC)

or Groundspeed = True Airspeed × *cos*(True Heading – True Course) – Wind Speed × *cos*(Wind Direction – True Course)

I used the windows calculator to solve these equations with **data from the first leg of the climb**:

DCA = sin^{-1}[(10 ÷ 95) × *sin*(85 – 180)] = sin^{-1}[0.1053 × -0.9962] = sin^{-1}(-0.1049) = -6.02 degrees

GS = 95 × *cos*(-6.02) – 10 × *cos*(85 – 180) = 95 × 0.9945 – 10 × -0.0872 = 95.35 Knots

So we should fly 174° True or (MH = TH ± MV) 160° Magnetic and our TAS practically equals GS (because the wind is almost perpendicular to our course).

These formulae can be found in Appendix B of the Flight Navigator Handbook.
(if you want to get really **deep in navigation**, this is your handbook!)

click to go back...

The real KBIH - Eastern Sierra Regional airport...

...as seen from above...

these images:
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USDA Farm Service Agency

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