Fundamentals (Draft only)

Topic List:

Charts

Weather Settings

Calculations

Patterns/Procedure Turns

ADF/NDB

VOR/DME/Holds

ILS/PAPI/VASI

SIDS/STARS

GPS/RNAV

The Grand Final

Return to Topic List

Charts

Aviation Navigation

How did they do it? The Inkas at Machu Pichu knew exactly where North was. Navigation mishaps today are as common as they used to be in the past like the discovery of America being thought of having landed in India or some Pilots on a commercial airliner getting completely lost and ending up in the Amazonas jungle.

Everyday in our live we navigate by asking the same questions, where am I now, where do I want to be, how do I get there?

The answer of course is, we need a map or for the purpose of air navigation a chart.

The sky is full of airways, they have numbers and names, different altitudes, pointing in different directions and the traffic light is basically the ATC (Air Traffic Control). You also will find if flying VFR you need charts to find out headings, radio frequencies, ground elevations, distances etc.

Unlike the poor cousin -roadmaps for cars or hiking, aviation charts contain a lot more information and you will come across a myriad of acronyms/abbreviations. . Study them well, because there are subtleties like for instance DH is measured in ft AGL whereas DA is assumed to be MSL like MDA. At other times you may confront terms like IAS versus KIAS versus TAS and of course there also is ground speed.

Confusing at first, yet it will all fall into place once you take the time to study the charts. Here we have some resources to get you started:

An excellent introduction is found in the chapter AIR Navigation of Charles Wood

http://www.navfltsm.addr.com/ or the pdf version on page 14

http://www.anaspides.net/documents/flight_simulator_documents/Instrument%20course.pdf

Plain English, easy to follow with a bit of humour every now and then.

Alternativeley, if you are already familiar with the terminology, had some previous exposure to reading charts you may wish to visit the Delta Airlines Virtual Flight Academy at

http://www.dc3airways.com/technical/files/dva%20How%20to%20Read%20Charts.pdf

providing a good run down on different types of charts from Airport diagrams to SID, STAR, Approach Plates and more.

Return to Topic List

Now you may also want to get hold of two pdfs from Jeppesen

1. chart-examples http://ww1.jeppesen.com/documents/aviation/business/ifr-paper-services/chart-examples.pdf

2. glossary-legends http://ww1.jeppesen.com/documents/aviation/business/ifr-paper-services/glossary-legends.pdf
amongst other detail contains a nice listing of abbreviations, symbols, etc. The Jeppesen site also offers tons of other material and tips for free. (Just do your research)

Print out a couple of charts of your liking and study the details

All of the above is more likely then sufficient for casual use-

---

Ok, in case you want more try the FAA publications

Flight Navigator Handbook chapter 1

https://www.faa.gov/regulations_policies/handbooks_manuals/aviation/media/FAA-H-8083-18.pdf

Aeronautical Chart Users Guide

https://www.faa.gov/air_traffic/flight_info/aeronav/digital_products/aero_guide/media/Chart_Users_Guide_12thEd.pdf

---

All good and fine but where from do we get the charts we need for our flights?

Number one source for the aspiring Flight Simmer is most likely Skyvector offering an online worldwide IFR chart, airport info and more. Spend a bit of time to get to know the site.

https://skyvector.com/

Depending on the country you want to fly in and out charts can vary a bit in layout and detail, charts also happen to have an expiry date as things like frequencies or procedures change. Be aware that some detail may not match with the internal nav database of FG, in which case you can use the inbuilt map to find the frequencies to be used for the sim.

Other free sources of charts include Vatsim, VACC and many other organisations. (You may need to subscribe or become a member to have access to a range of good materials, not only charts.)

Flightgear also has a nice mp map (multiplayer). Likewise there is the option of a moving map found in the Equipment menu(for those with multiple monitors) but make sure your browser is not going to be hijacked.

http://wiki.flightgear.org/MPMap#NAV

http://mpmap02.flightgear.org/?key1=value1&key2=value2

Return to Topic List

http://wiki.flightgear.org/Phi#Map

In case you need more, there is lots of material available from FAA and other institutions relevant to your home country.

NOTE:

The charts you download for simulation purposes are just that, for simulation only, more often then not completely outdated, frequencies may have changed or there might be another runway or perhaps they shifted the runway as you land in the grass.

Return to Topic List

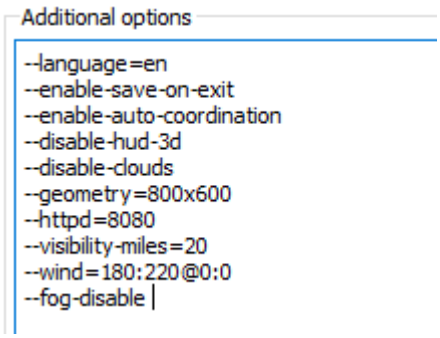
Weather Settings

There will be times when you want to start FG with some customised settings such as wind direction, better visibility, or simply turn off what you dont need. Memory hungry stuff like 3 d clouds for example. It may improve your framerate.

This can be accomplished by setting command line options. A full list of these is found here:

http://wiki.flightgear.org/Command_line_options

Lets say you want no wind at all, no clouds and a visibility of 20 miles you need to start FG from the menu, select your aircraft, select the airport and then click the Settings tab and add whatever command line option you wish, be it enable or disable.



be very careful with the wind settings, easy to get blown off the runway..... the above specifies no wind 0:0 from either direction

Having selected your options choose run and see the result. If you quit, your settings will not be saved unless you terminate the session with the file exit or ESC sequence.

The official manual also covers how to start FG direct from the commandline or how to start using different configs like midair etc depending on your installed operating system.

Some of the command line options vary from FG version to another.

Specific weather related details are found under *Environment,Weather, Basic Weather, Manual Configuration*

There you can make it rain, set cloud ceiling to a specific altitude (very nice expierence to see the runway as you get below the cloud cover)

For instance for a solid cloud cover at msl 2000 and 700m thick you would set the bottom layer like this:

Return to Topic List

Then of course you also can use real weather once online or you might prefer to make up your own fake metar string to suit your liking.

METAR and advanced weather resources can be found in various wikis.

Generally weather settiings are not saved between sessions.

Return to Topic List

Calculations/Formulaes for General Aviation

To work out the details associated with your flightplan are a number of calculations such as traveltime, fuel consumption, estimated time of arrival just to name a few. Needless to say these calculaions need to be as accurate as possible. (Just recently a small commuter aircraft with a football team crashed into the mountains in Bolivia due to empty tanks in mid air).

(Your aircraft is always fuelled up on startup) Normally the tanks are filled to the brim at the end of day to prevent condensation.

So just lets review chapter one of your instrument course.pdf by Charles Wood...

PRE FLIGHT CALCULATIONS

Distance:

Firstly we need to know the trip distance in nautical miles. For that you use an appropriate chart, a plotter and a pen. You measure the length of the lines drawn and add up all the legs. Done!

For your planning you might want to use some sort of worksheet to keep track of all the details.

Wind:

No wind conditions are extremely rare as such one might encounter headwind, tailwind, crosswind, winds and gusts from any direction at different velocities. You obtain the relevant info from METAR, or tune in to ATIS at Com1 or in your case both windspeed and direction are displayed at the bottom left of your HUD. (press h to activate, h to change colour, h to turn it off or <Shift>I to toggle between different HUDs.

Once you know the current/forecasted wind and direction you need to calculate the impact of it to your proposed course unless the autopilot does all your work. You can do this by using a wind triangle which is well and good to do on the ground, but you dont want to mess around with ruler and paper in midflight because all of a sudden the wind has changed.

An alternative is a tool called the E6B(usualy plastic). For our purposes we want to use a virtual E6B. Download links are found online, instructions how to use it on page 54 of Charles Wood from now on refered to as IC.pdf

Armed with this gadget you can now calculate the WCA short for wind correction angle.

To change wind pattern, things like cloud ceilings, turbulence, rain etc you can change startup commandlines or in midair use the Environment/Weather settings dialog.

The dialog boxes may vary in appearance depending on FG version and your operating system.

Return to Topic List

To keep it simple, you might find a commandline in the startup option or batchfile will do. Of course if you are an expierenced pilot, you might want to use real weather online, good fun in winter in places like northern Canada or in the tropics.

But back to calcs.

ETE (Estimated time en-route)

You need to calculate this to obtain the parameters for the ETA as well as fuel consumption which ultimately translates into money for your leisurely activity. Thanks to FG you are flying gratis.

Firstly we need the total **trip distance**, lets say just a to b =75 nm according to your chart.

Secondly you need to establish your proposed climb and descend rates and the cruising altitude as well as the cruising speed. For example you might decide to cruise at 110 knots @ 4000 feet you first need to climb to 4000 at lets say 500ft/m

Time to climb therefor will be round about 8 mins = 0.1 of an hour without wind consideration.

Distance covered by climb (using ground speed)

= 0.1 hrs x 95 kts = 9.5 nm

Time to descend lets say 400ft/m @ 100 kts will take about 10 mins or 0.13 of an hour

Distance covered by descend

= 0.13 hrs x 100 kts = 13 nm

Time to cruise

= 52.5 nm/110 kts = 0.47 hrs = 28 min

Return to Topic List

Our ETE is the total of climb, cruise and descend = 46 minutes or 0.76 hrs

Next on the agenda are

Fuel Calcs

There are many variables to fuel consumption (fuel burn rate) such as wind, motor efficiency, climb, descend, mixture adjustments between rich and lean. For small aircraft you base the calculation on your ETE and cruise speed. Perhaps add a margin of 10% for climb/descend...

So you look at the calculated ETE = 0.76 plus 10% = 0.84 hrs and assuming your engine needs 20 gallons per hour then total fuel consumption for the trip will be 20 x 0.84 = 16.8 gallons at $$$

Thats probably too simplistic as one should also factor in some contingencies for deviation to an alternate airport and a little extra for that extra sightseeing.....

Then of course the nerv wrecking calc once airborne realising the tank has less fuel then we thought there ought to be due to error, leaking tubes or other reasons. Probably boils down to a rough estimate like ok the needle shows 1/4 = x gallons, average burn rate is y so at best we have x minutes before we run dry.

IN FLIGHT CALCULATIONS

What speed are we talking abut? Groundspeed, Indicated Airspeed, True Airspeed, Calibrated Airspeed ?

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

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

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

Most of the in flight calculations are associated with change of altitude, approach type requirements in particular.

Rules of thumb

http://www.planeandpilotmag.com/article/top-10-rules-of-thumb/

Return to Topic List

Descend Speed and Vertical Speed on the Glide Slope

Speed	**VS Rate**
60	-300 fpm (easy to calculate as half the groundspeed and a 0 added)
90	-450 fpm
100	-500 fpm
110	-550 fpm

and so on

Strayed off course

Use the 1 in 60 rule

http://aviationknowledge.wikidot.com/aviation:60-to-1-rule

Also interesting:

add other links...

Return to Topic List

Patterns & Procedure Turns

A bit of reading

https://community.infinite-flight.com/t/how-to-fly-a-visual-pattern/5568

https://en.wikipedia.org/wiki/Holding_(aeronautics)

http://www.cfidarren.com/r-holding.htm

Practise Flights:

For the following exercises it may be beneficial to turn off the wind --wind=180:220@0:0

You also need to use the stopwatch for timing your legs. Equipment Menu, Stopwatch or just click the clock-face on the right.

022 – Instrument Flight Patterns

Get yourself a copy of the FAA Instrument Flying Handbook

https://www.faa.gov/regulations_policies/handbooks_manuals/aviation/media/FAA-H-8083-15B.pdf edition 2012 page 191

and work through the patterns starting on page 191 to page 193. Once comfortable fly each pattern again by mirror image. (a left turn becomes a right one, etc. …..)

Once you have completed a pattern (pause) check out your map and display the Flight History !!!

023 – Another Practise Pattern

Grab the IC.pdf and turn to page 318. The instructions are pretty self explanatory

http://www.anaspides.net/documents/flight_simulator_documents/Instrument course.pdf

024 – Fly a left hand circuit at your favourite airport followed by a right one.

Return to Topic List

ADF/NDB

About ADF/NDB
Although this mode of radio navigation is gradually phased out, it will still be found and used for some time to come at smaller airport lacking other infrastructure.

The following links will provide you with the basics. As always a good starting point maybe the IC.pdf page 59 NDB Navigation/ADF Basics

Here are are couple of videos reinforcing what you may have read so far and adding some more illustration.

https://www.youtube.com/watch?v=nVDn32zDhKo

https://www.youtube.com/watch?v=I6RXFonFzo0

Now your Cherokee Navigator is equipped with a kr87 ADF receiver

and a ki227-228 RMI.

This instrument can be configured to show a yellow needle for the selected ADF frequency or the standby frequency.

To the left of the instrument there is a switch which will toggle the green needle representing VOR1 on or off.

Return to Topic List

Also at the top left corner to the right of the Altimeter is the Nav1/2 switch, which allows you to switch the RMI, the HSI and the DME between nav1 and nav2.

Another option of working through the ADF navigation practise flights is to use the standard pa28-161 Cherokee which features a fixed card.

The most common ADF procedures are

- ADF Time/Distance tracking
- Intercepting bearings in or outbound
- Tracking a bearing
- NDB approach
- Flying a DME Arc with the RMI

Most practise flights will take you about half an hour or less, so make sure you have the time to work without interruption.

Have the instructions found in the practise folder handy, fire up FG, choose a daytime option as we navigate around the globe and you don´t want to find yourself sitting on a runway in the dark. (for now)

The practise flights available from the Navigation Menu are:

T001_ADF_Time_Distance
T002_ADF_Intercept_Play
T003_ADF_Tracking
T004_ADF_NDB_Approach_OffField
T005_ADF_NDB_Approach_OnField

enjoy and have fun..

n.b Fly each practise flight more then just once until it clicks and then proceed to the next.

Return to Topic List

VOR(TAC) VOR DME Navigation

If the term VOR does not mean a thing to you, one of the best ways to get started is the free ebook (PDF) titled Instrument Course by Charles Wood chapter VOR Navigation page 118.

http://www.anaspides.net/documents/flight_simulator_documents/Instrument%20course.pdf

http://www.emmerich-j.de/HB/EN/RNAV

You also might find useful information on the following websites to get you right into it.

http://krepelka.com/fsweb/lessons/private/privatelessons03.htm

http://www.scottsasha.com/aviation/handbook/vor/VOR_navigation.html

http://simfliteminnesota.blogspot.cl/2006/09/using-hsi.html

And obviously there is excellent literature out there such as various publications from the FAA.

https://www.faa.gov/regulations_policies/handbooks_manuals/aviation/

Should you hit some mindblock with some of the concepts, you might want to try some of the online VOR simulators to aid the visual understanding.

There s tons of other info out there, but its a bit like finding a needle in a hay stack, but persistance usually pays off.

Here is a nice video (ignore the voice..)

https://www.youtube.com/watch?v=4pTbb0puo1Y

Your NAVIGATOR cockpit and VOR instrumentation

In the real world an aircraft may have one, perhaps two or no VOR (CDI) instrument on board. You are having the luxury of three units ie

VOR(CDI)1 tied to Nav1

VOR(CDI)2 tied to Nav2

A HSI (Horizontal Situation Indicator) being a slave to Nav1 interchangeable with a standard Gyro.

Moreover the CDI s differ in design which you will come across in different aircraft

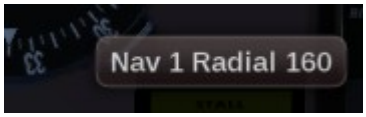
Return to Topic List

VOR1(CDI 1) to the right of the RMI

VOR2(CDI 2) to the right of the VSI

The HSI left to VSI

The units also show digital readouts to indicate which radial or bearing you are on.



Most of the hotspots will display the actual values and you can also crossreference readings with the compass found in the HUD at the top centre of the screen.

Note: The HUD shows magnetic bearings.

Return to Topic List

To help you putting the wealth of new knowledge acquired by your reading and research into practise, you will find the following flights in the practise folder:

006 Outbound radial intercepts

007 Tracking radials and bearings

008 VOR DME Approach

009 VOR intersections

010 VOR DME ARC (with VOR or RMI or HSI)

011 VOR Radial Hopping

012 VOR intersection at NDB

013 VOR/DME intercept and ILS cat I approach

014 VOR to VOR and ILS cat II approach

Note:

Precision approaches like ILS cat I, II, III in conjunction with Glideslope, Back Course, PAPI and VASI are covered separately...

Have fun and enjoy!

Return to Topic List

ILS/PAPI/VASI

The world of aviation has a large number of different precision and non-precision approaches available given the variety and different classes of aircrafts as well as different technology in terms of navigation equipment on board and or on the ground.

With the exception of smaller airports and poorer regions of the world the most common approach type is the precision ILS – Instrument Landing System approach executed in one of three categories.

Depending on the infrastructure of a particular airport the ILS setup may also see the installation of either a PAPI – Precision Approach Path Indicator or a VASI – Visual Approach Slope Indicator.

Both systems offer vertical guidance complementing the lateral guidance of the ILS.

PAPI and VASI can also be used for other approaches such as non precision approaches as well as VFR.

The following links will provide you with a good understanding of VASI and PAPI

http://wiki.flightgear.org/Precision_Approach_Path_Indicator

http://www.anaspides.net/documents/flight_simulator_documents/Instrument%20course.pdf p207

https://aviation.stackexchange.com/questions/5170/how-do-papi-lights-work

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

https://www.youtube.com/watch?v=4pTbb0puo1Y

https://www.faa.gov/regulations_policies/handbooks_manuals/aviation/media/FAA-H-8083-15B.pdf

https://www.youtube.com/watch?v=4pTbb0puo1Y

https://www.faa.gov/regulations_policies/handbooks_manuals/aviation/phak/media/pilot_handbook.pdf Chapter 14

After all that reading you may want to practise a little flying by hand just using throttle and pitch, in case you prefer the AP to take you down turn it off prior to landing.

015_PAPI

016_VASI

Return to Topic List

ILS Approaches

http://www.anaspides.net/documents/flight_simulator_documents/Instrument%20course.pdf
p178

https://aviation.stackexchange.com/questions/35264/what-is-the-purpose-of-having-different-ils-categories

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

https://www.youtube.com/watch?v=KVtEfDcNMO8 (turn the volume down!)

https://www.youtube.com/watch?v=wxFVoTPVhYs

Interesting to note is that once on the glide slope the VOR needles are 4 times as sensitive!!!

Although small aircrafts generally are restricted to Cat I for the purpose of the practise flights we just assume we are a big iron.

There will be times when pilots need to abandon the approach for a number of reasons. For precision approaches like ILS the decision must be made at DH (Decision Height) for non precision approaches the point is the MAP (Missed approach point)

Missed Approach Procedures

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

http://www.skybrary.aero/index.php/Missed_Approach

FAA Instrument Flying Handbook - Section Missed Approach

The following practise flights are available from the Navigation menu or can be found in the Docs folder, enjoy...

- 017_ILS_Cat I
- 018_ILS_Cat II
- 019_ILS_Cat III
- 020_Missed Approach procedure
- 021_Missed Approach procedure subsequent hold

Return to Topic List

lpma rw23 madeira papi gs5.2%

ORLY, LIRF, OTTOWA, genf, ASPEN, Barcelona, osaka

Return to Topic List

SIDS & STARS

025

026

027

028

Return to Topic List

GPS/RNAV – Route Manager

Fake GPS 029

Route Manager and waypoints navigation wiki

- standard usage 030
- altitudes for vnav 031
- adding waypoints for rnav stars 032
- creating fixes and intersections 033
- how to determine gps co ordinates 034
- saving retrieving routes 035

RNAV

- **creating and saving an rnav route** 036
- **using routemanager to fly the rnav route** 037
- **using the kns80** 038
- **other**

Return to Topic List

The Grand Final

039

3 leg journey with one stop over for refuel, one touch and go, heading to final destination and deviation to alternate combining all or most topics

duration max 2 hours

Return to Topic List

Where to go from here

Return to Topic List

Tutorial # 001

Category: ADF -How far the distance to the station and how long to get there

Prerequisites: ADF/RMI

Useful: Reading Charles Wood s chapter on NDB

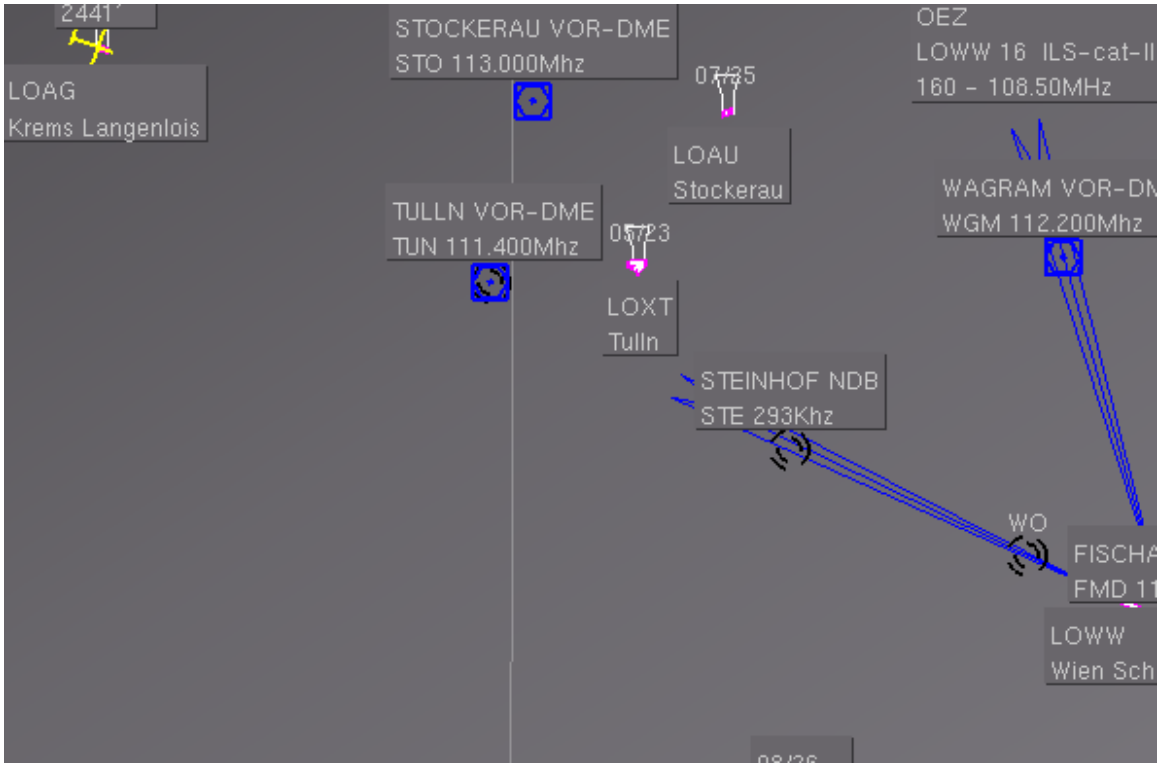
Duration: 25-30 mins depending on speed and wind

This workshop is adapted from an exercise of Charles Wood

How about a fine Wiener Schnitzel and a Sacher Torte for dessert

Fire up your Cherokee Navigator at LOAG (Krems Langenlois) Runway 11 and **turn off** your DME.

Press k to display the map and resize it until you can see LOWW. Select the data and Navaids checkboxes, enlarge the chart and notice there is a nice NDB by the name of WO(Schwechat) in front of runway 11.



Close the map and press w to display the stopwatch and move it to the top right cornerbut do not yet start it.

Next press c to show the frequencies dialog and enter 303 into the ADF field, then close the dialog.

The yellow RMI ADF arrow should now be pointing to about 110. You also should hear the morse code. You might want to turn the volume down a bit using the volume knob at the ADF receiver or perhaps easier turn down your speakers, but do not turn it off. Display the HUD by pressing h and notice the ADF/NDB showing WO as the correct ident. However it is blinking indicating the signal is a bit flacky.

Return to Topic List

Before flying to Vienna, we need to figure out how much time we need to get to the beacon as well as the distance to be covered.

To find out, all we need to do is turn the plane so that the station is either of the left or right wing.

As such set your heading bug to 25 degrees, take off and turn to the heading while climbing to 3000 feet at roughly 80kts. As you climb the beeping should become more frequent.

Once nicely established and stable on your heading, the needle should point to the right wing.

Note the bearing, set the timer and stop the timer once the needle has moved by 2 degrees.

Pause the simulator for a moment.

Now simply divide the elapsed time (total seconds) by the change of degrees
e.g. 50/2=25 minutes to station

To translate our findings into an estimate of distance you use the formula:

(TAS(True airspeed(kts)x minutes flown)/change of degrees) e.g.

(90kts(assuming no wind)x5/6)/2 = 37nm

Reset the timer, unpause the simulator and restart the timer. Now turn your heading to the right until the yellow needle points to N (orth) and track the bearing to Vienna airport.

Mainting your speed and hold at 3000. Adjust your heading if necessary to counter act drift, the needle shows the way.

At about 25 minutes the ADF needle will flip a 180 degrees to indicate that you have passed the beacon and are now flying outbound. You may also have noticed the blue outer marker light blinking. This is only relevant for an ILS approach covered in another session.

You may wish to terminate the session or decide to fly a bit further, turn round and bring her down VFR freestyle on the opposite end of the runway you are crossing.

Return to Topic List

Tutorial # 002

Category: **ADF bearing and station intercepts**

Prerequisites: ADF/RMI with VOR needle turned off

Useful: http://iaip.iaa.ie/iaip/Published%20Files/AIP%20Files/AD/Chart%20Files/EIDW/EI_AD_2_EIDW_24-28_en.pdf

http://iaip.iaa.ie/iaip/Published%20Files/AIP%20Files/AD/Chart%20Files/EIDW/EI_AD_2_EIDW_24-1_en.pdf

Duration: 24 mins

How about a little NDB hopping. Ireland here we come for some cool Guinness on St.Patricks day.

The specifics:

1. We will start at Dublin (EIDW) runway 28 with the heading set to 278 degrees, climbing at 500fpm to 1500 and hold while tracking the outbound bearing 004 of the Dublin NDB OE 316. We also set the standby frequency to Garristown NDB GAR 407.

2. Take off and maintain the outbound brg 004, once the ADF needle drops down south after station passage initate a right turn to 60 degrees. Throughout the 4 station circuit maintain cruise speed at 100kts, distances being short and sharp turns.

3. Watch the needle and at about brg 112 left turn to intercept and track outbound brg 185, switch to the standby frequency and stir the needle to the North.

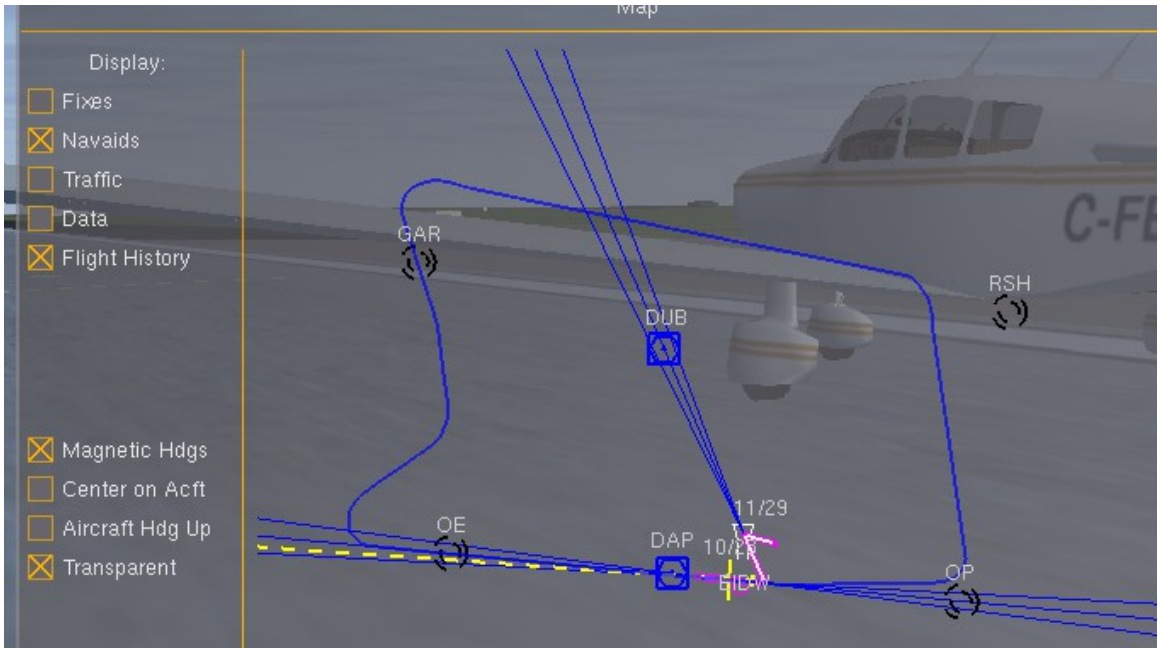
4. On station passage as the needle starts to drop, change the active NDB to Rush RSH 326 and turn to the nose to the station, maintain your heading and switch back to Dublin 316 and add NDB OP 397 as standby. Leave Dublin active.

5. Once the needle passes brg 135 switch to standby and turn the needle to the north and maintain heading to the station. Reduce your speed to 80 knots.

6. At the slightest drop of the needle switch back to 316 and turn to the Dublin station and land the plane. It maybe a little tight, can be done, however perhaps better to do a missed approach, maintain heading, do a procedure turn and come back from the other side.

Your map should look something like this...

Return to Topic List



Ready for a pint?

Return to Topic List

Tutorial # 003

Category: ADF - Track Intercept

Prerequisites: ADF/RMI

Useful: https://www.crc.id.au/xplane/charts/DAPS-2017-Mar-02/Launceston%20(YMLT).pdf

Duration: approx 25 mins

Launceston, Tasmania, Australia

==========

The journey starts off at Launceston Airport **YMLT Runway 32L** and will take us to the East tracking the 360 BRG (bearing) of the St. Helens ADF. We will then return to base by turning South, then to the West followed by a final turn to intercept the 181 BRG and lining up with the runway we departed from.

This flight can be executed in three different scenarios, first with no wind at all, then with wind and if you dare at night time.

For the first scenario under settings add the command line option **--wind=359:291@0:0**

For the second time round chose something like **--wind=97:133@8:3**

---

1. Once ready to go, sitting on runway 32L open the comms menu by clicking the face of the comm1 radio and tune the ADF frequencies in to the Launceston NDB called Nile (NIE) 230 , then add the St.Helens NDB STH 392 into standby. The NIE station should give you an earful of morse loud and clear, the HUD (press h) shows the station ID. Notice the BRG the ADF needle points to (181).

2. Switch the frequencies, deadly silence. We will get the signal about 3 minutes into the trip. As a quick glance at the FG map reveals, the St.Helens station is roughly 60 degrees to the right or 107 from the runway heading, so set the heading bug to 62.

3. On take off quickly turn to that heading or let the ap do the work. Climb to 4500 at 700fpm, then hold.Make sure the active frequency is set to 392. The initial signal will be flaky as there are mountains around. Reduce your climb speed gradually and adjust your mixture.

4. Once stable at 60 degrees and altitude hold of 4500 point reduce your speed to 120kts. Point over the RMI to check the bearing. Should be around 2 or 361, watch it for a few seconds as to whether it stays that way, set your timer for one minute and check again, the BRG should still be the same as we have not changed heading nor is there any wind. We are tracking the bearing in a straight line to the station.

5. Now lets turn, first switch the frequency back to 230 Nile. We should get the morse signal. Now turn to a heading of 160. The ADF needle swings to about brg 40. As you prod along, notice the needle

Return to Topic List

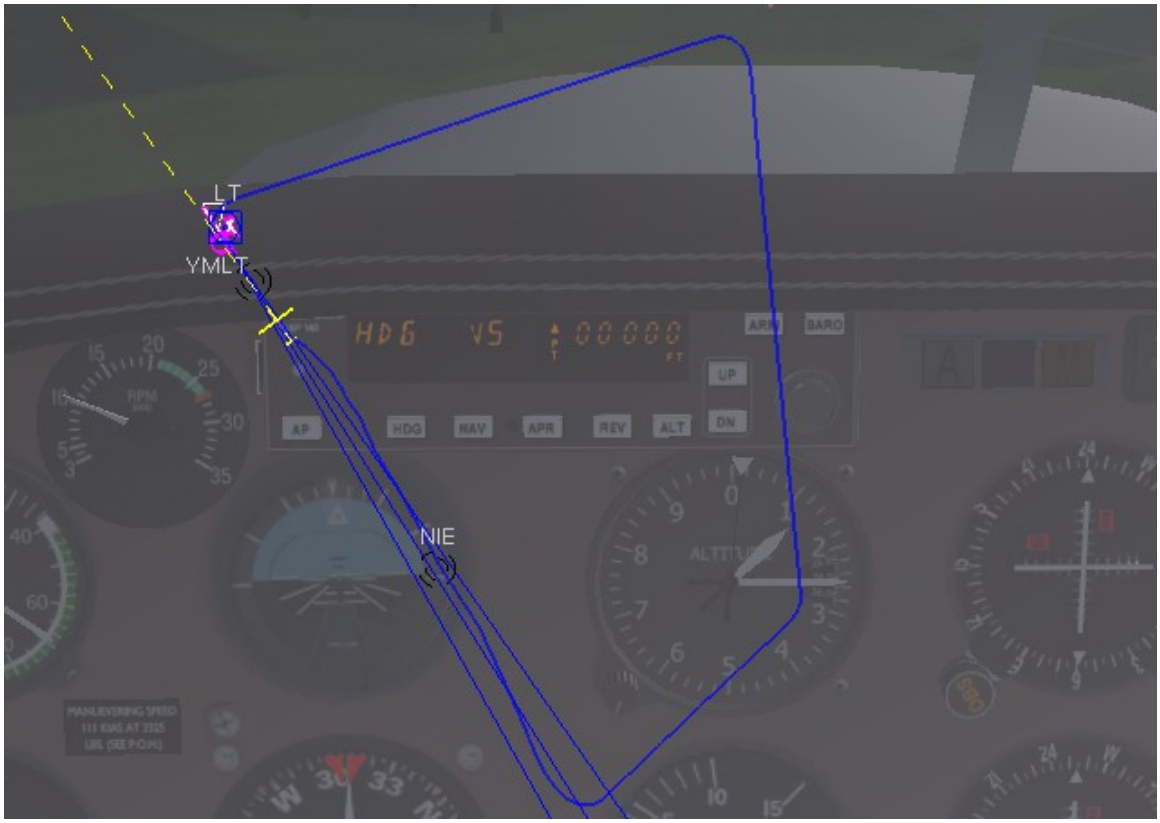
slowly dropping as we cross several bearings. Once at the 100 mark change your heading to 210 to the right. The needle will rise,

6. Once the needle drops down again to the 100 mark (just let the mouse pointer sit in the face of the RMI), start your descent at 500fpm and turn right to 320 degrees. Reduce speed to about 85kts. Adjust your heading one notch at a time until your bearing shows 360 or 361 and no change. On passing the station keep the heading aligned with the bearing now being 181 flying away from the station and towards the runway.

7. Depending on the timing of your turns you may need to adjust the runway lineup.

PAUSE the simulator

Display the map, place a check into show navaids and history



This is your flown route. Now you can take her down or do a missed approach starting through and go sightseeing. Do the usual... approach speed descent, flaps....

You may want to try this with wind and make corrections by way of bracketing and then of course there is also the option to fly this at night.

Return to Topic List

Tutorial # 004

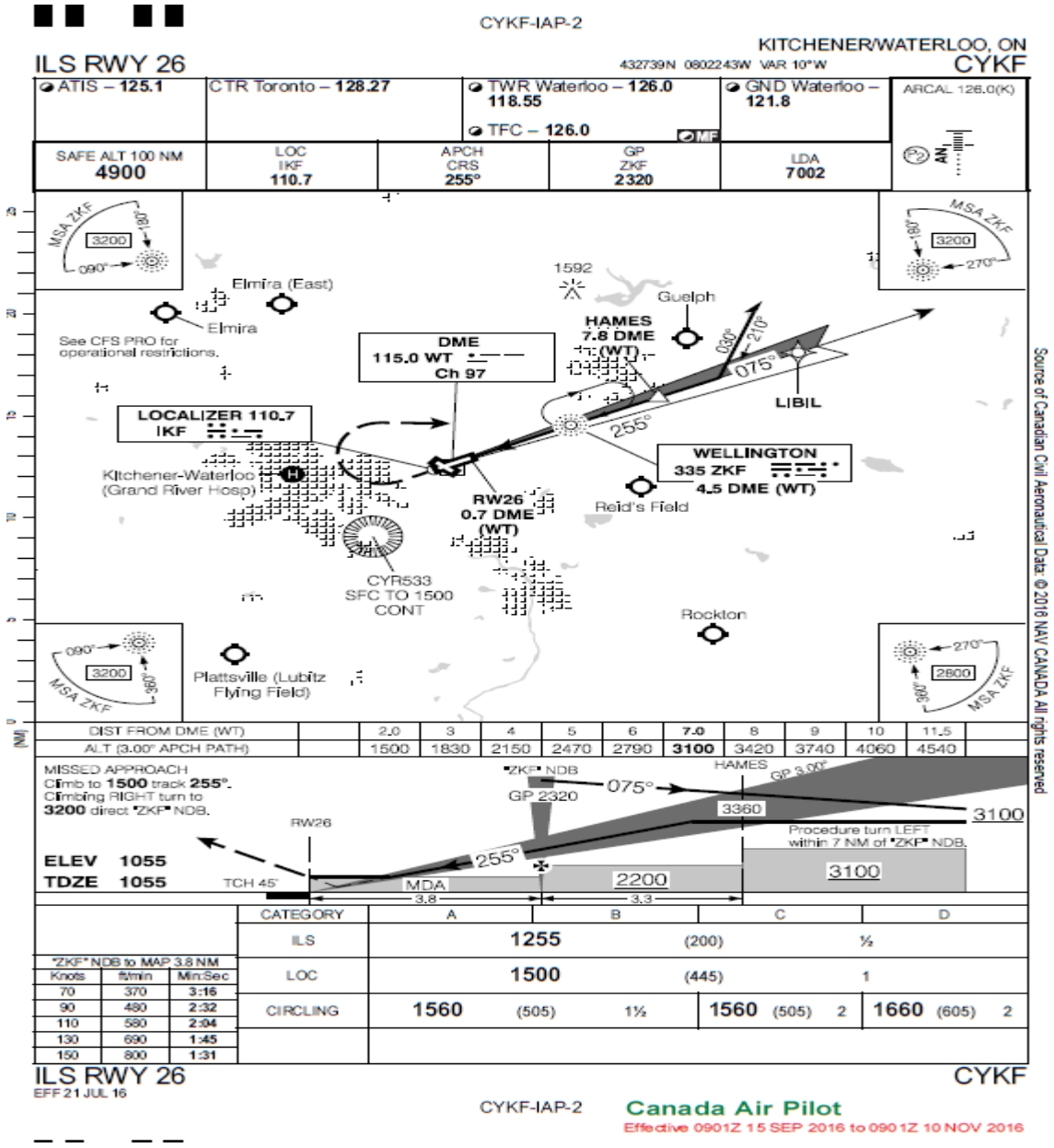
Category: **ADF Approach NDB Off Field**

Prerequisites: ADF/RMI with VOR needle turned off

Useful: https://www.czyz.ca/files/charts/class-c/CYKF_All.pdf

Duration: 20 mins depending on speed and wind

Ok, Our journey today takes us from Guelph - CNC3 runway 26 to Waterloo CYKF runway 25 in Canada. CNC3 is close to Toronto, Ontario, a beautiful, vibrant and clean city, good time to visit in autumn when all the maples display their beautiful colours



Return to Topic List

Looking at the charts (Airport Diagram and NDB/DME RWY26) we notice the runway elevation at Waterloo on the approach side is 1055, at the other end 1023, that means its going slightly downhill and In case of a missed approach there are are some trees around.

ATIS is 125.1, NDB =ZKF 335

MSA is 3200 as we are coming in between 180 and 270, however we need to be at 2200 just before passing the station and commence our descent.

ZKF to MAP 2.32 minutes based on 90kts and VS of -480fpm

You have been cleared for a straight in, no need for the pattern. So lets do this, fire up FG, choose whatever weather settings you fancy.Once on the runway, point to the face of the compass and note the heading, point to the face of the HI, the headings should be the same. Set the heading bug to 210 degrees as we want to intercept the NDB at an angle of close to 45 degrees.

1. Tune in ATIS at COM1 125.1 and listen to the recorded message, then turn down the volume or just click the headphones to mute.
2. Set your ADF to 335, you should immediately hear the morse code, turn on the HUD by pressing h, the ADF ident is displayed is ZKF (not blinking) so we are tuned in to the correct station.The ADF needle points to bearing 339 . Hold your altitude once at 3200.
3. Now lets take off and turn to our heading while climbing at 500 fpm to 3200 ft.
4. Cruise at 115 knots, once steady on 210 degrees the ADF needle(Yellow) will now point to a bearing between 31 and 35, once it drops to 45 turn right to 253 degrees.
5. Now you have about 9 minutes to descend to 2200 then hold and adjust your heading for wind and follow the ADF needle nicely pointing to the North. Reduce your speed gradually to about 85kts once reaching the station.
6. On station passage, needle head falling, immedeately start descent at 500fpm , adjust both pitch and vs to match the VASI and bring her down in one piece. Once the runway in sight youmay need to make some adjustment to line up.

Annotation:

Why change the heading once the ADF needle points to bearing 45?

At Brampton the needle pointed to 339, with our inital heading of 210 the needle points to 31, a deviation of 52 bearings and as we turn at 45 our approximate intercept angle we bring the needle back.

Inbound we follow the head, outbound the tail.
Recommended additional Flight: Charles Wood pdf page 10

KAIY to KMIV, contains a nice procedure turn

Return to Topic List

Tutorial # 005

Category: **ADF Approach NDB On Field**

Prerequisites: ADF/RMI with VOR needle turned off

Useful: decent charts

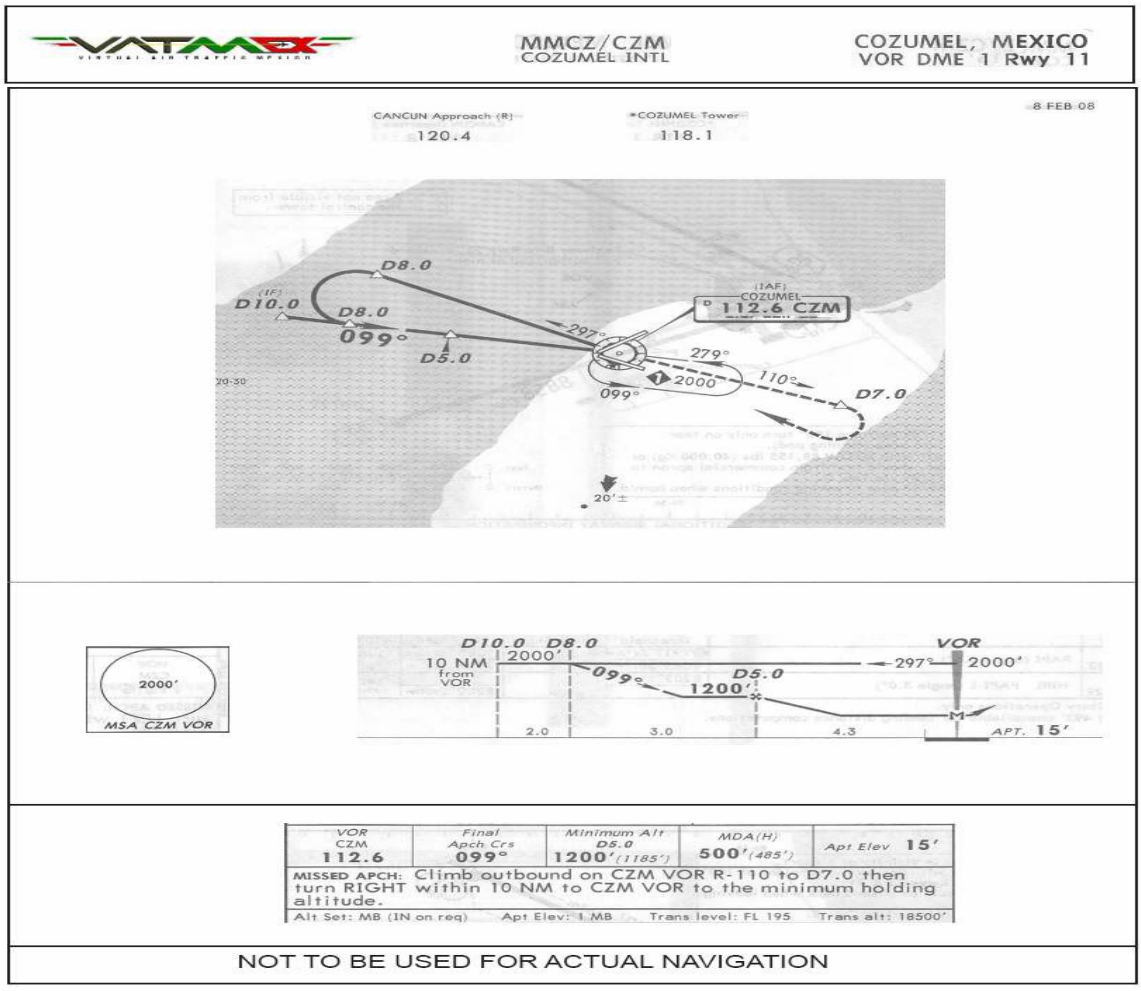
Duration: 10 mins plus the most

Tropical settings, Cozumel, Playa Del Carmen Mexico. Ancient Maya ruins nearby, great food. The FG airport PlayaCa at the moment is a bit under developed to put it mildly as you are literally starting off with the gear in the sand, so its a flaps job to get up. Rev her up with brakes on.

This is your challenge, good luck ...

Start at MMPY (Playa Del Carmen) runway 11 (no need to worry about snow here)Tune in Cozumel (MMCZ) NDB - CZM 330 and or use the VOR DME - CZM 112.600

Here s a chart



Return to Topic List

Return to Topic List