

Preface

Welcome Aboard

The purpose of this Flightgear aircraft is to provide you with a selection of resources relevant to aerial navigation.

Next to links to online text, audio and hands on video resources you will also find a collection of hands on navigation practise flights.

These practise flights assume a comfortable level of flying your aircraft with or without auto pilot and a basic knowledge of aviation.

No consideration has been given to real world aspects such as communication with ATC, nor restrictions of other nature or multiplayer environment.

All of the practise flights can be performed offline provided one has access to pen, paper, ruler, copies of charts , etc.

You may need to download additional scenery from Terrasync as the flights more or less span around the globe.

Furthermore it is assumed that you are familiar with putting together a flightplan, how to calculate ETA and fuel consumption

The instructional material is by no means to be used for real world aviation and no guarantee of completeness or correctness can be given, the sole purpose being to provide examples of instrument usage within the context of the flight simulator.

For information on GPS/Waypoint navigation you need to search elsewhere as at present for small crafts there is no fully functional model available at the time of writing. For ATC vectoring look at the ATC topics like FGCOM, ATC etc.

Online links and references are valid at the time of writing, however should a link be broken you may find the relevant info by means of your favourite search engine. If you don't happen to have a dual monitor setup or experience internet connection problems you might wish to print what is important to you as a fall back position. We certainly recommend to have at least hardcopies of the practise flights handy.

To commence your journey I would recommend a leisurely read of Charles Wood's comprehensive yet easy to read **Flight Simulator Navigation**, www.navfltsm.addr.com or the downloadable pdf at

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

The practical side of it leans heavily on Microsoft FS, however most of the practise flights work in FG as well.

For instrument related info and usage here is another comprehensive online FG manual

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

You also find topics like pilotage and dead reckoning in there or you may wish to check out <http://www.experimentalaircraft.info/flight-planning/pilotage-dead-reckoning.php>

The FG Navigator is based on David Megginson`s original Piper Cherokee Warrior II (1979 model). For relevant details such as technical specification or info on how to fly look up Help and consult the online Wikis. If completely new to the world of aviation you may wish to start with Chapter 8 of the official Flightgear manual titled **A Basic Flight Simulator Tutorial** using the default aircraft a Cessna.

The focus of the FGNavigator however purely rests on navigational aspects and practical guidance of how to do it.

Topics like flightplanning, ATC comms, pertinent rules and regulations as such form no part of this package.

Enjoy your journey

Panel Configuration

First up, your cockpit:



Top Down Left to Right (snaking):

- Nav1 Nav2 Switch
- ELT (Emergency Locator Switch)
- Altimeter
- Radio Altimeter
- ASI (Airspeed Indicator)
- VSI (Vertical Speed Indicator)
- Tacho (RPM)
- AI (Attitude Indicator)
- TC (Turn Coordinator)
- Autopilot (Custom KAP140)
- RMI Config Switch (toggle VOR Needle on/off)

- RMI (Radio Magnetic Indicator for ADF NDB)
- DG HSI Switch
- DG or HSI (Digital Gyro or Horizontal Situation Indicator – KCS55)
- ILS Marker Beacon
- HobbsMeter
- VOR 1
- VOR 2
- GS in Range Light /manual toggle Landing Light
- Stall Warning Light
- Master Light Button (red)
- Flaps Status Light) blue
- Nav 1 Radio
- Nav 2 Radio
- DME (Distance Measuring Equipment)
- ADF (Automatic direction Finder)
- HSI Slave Switch
- Transponder Unit
- KMA20 Audio Panel
- KNS80 Unit for RNAV
- other gauges below the main panel include GPS, Fuelgauge, Amperimeter, Lightswitches, Clock, AOA, OAT, Flaplever and other. For general information refer to http://wiki.flightgear.org/Avionics_and_instruments , for more specific info on navigation instrument usage we recommend the reading of www.emmerich-j.de/HB/EN/RNAV

TIPS:

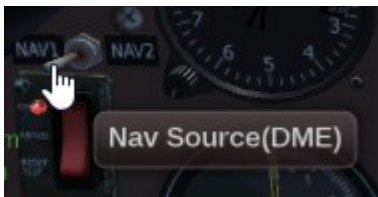
- *knobs work in both directions*
- *mouse buttons on knobs advance or regress one degree or unit at a time*
- *mouse wheel depending on instrument between 3 and ten degrees*
- *to match the Compass with HI/DG heading look at the tooltips*

Instrumentation

about your Navigation Instruments

Panel Switches:

Nav1-Nav2 Switch



This switch will toggle the Nav radio source for the Autopilot, GPS, the RMI VOR needle and the DME

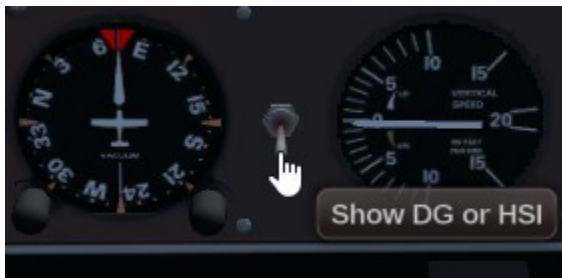
RMI+/-VOR Switch



This switch will toggle a green VOR needle on or off. Once displayed the VOR needle nav source is determined by the settings of the Nav1-Nav2 switch.

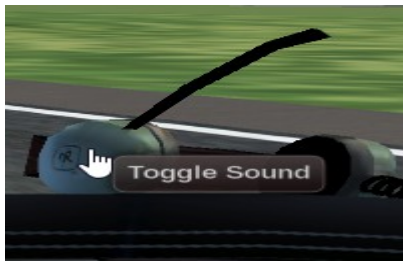
The instrument it self is a combination of the Bendix King KI228 and KI229 which often is coupled with the KR87 ADF receiver.

DG-HSI Switch



Switches between the two distinct instruments. When using the HSI be aware that by default it is slaved to Nav1 by means of the switch to the left of the clock.

The Toggle Sound Hotspot



Allows you to turn all sounds on or off. If left muted on closing down a session at the next startup sound will be enabled again.

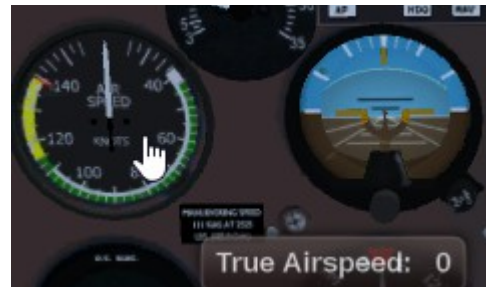
Hotspots in general are used to make an object clickable for some action to occur. If you want to see what is clickable on any aircraft within Flightgear simply press <CTRL> C (toggle)



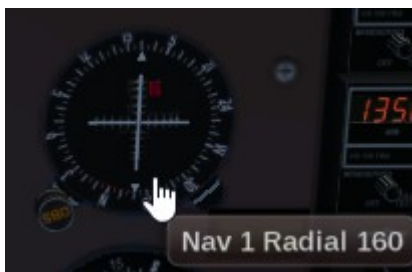
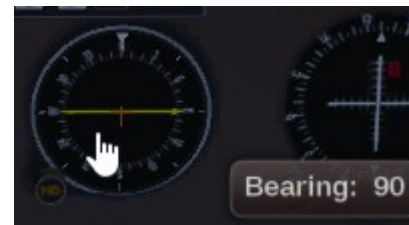
Hotspots & Digital Readouts(Tooltips)

Most of the hotspots are used to display instrument related properties such as speeds, rpm, radials, bearings etc. A select few however will invoke some action such as opening a dialog, turning knobs, pushing buttons and so forth.

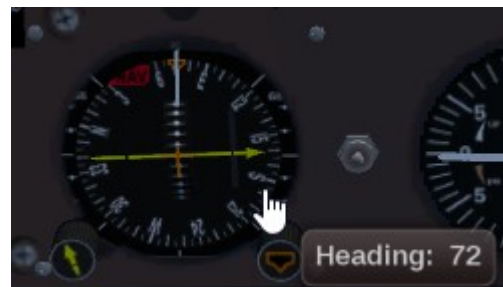
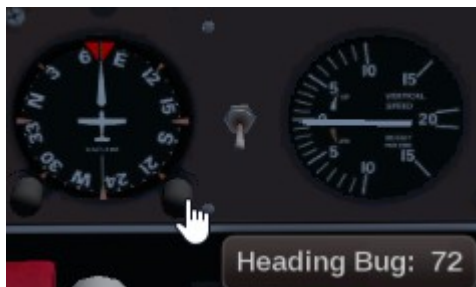
Hotspots for displaying static or dynamic information are:



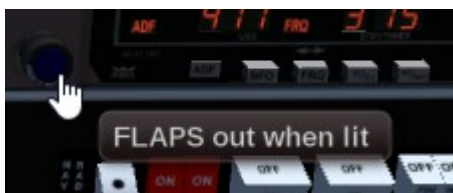
The ASI - air speed indicators needle shows IAS, whereas the tool tip on the face shows TAS



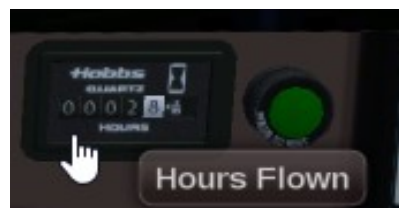
Lags in update, can use standard Hud as an alternative



Heading bug = current heading, Knob + or -



The blue light will be lit when flaps are not retracted.



The Hobbs displays total accumulated flying time based on when the wheels are not on the ground.

Actions can be invoked by means of using the menu, shortcut (hotkeys) or alternatively hotspots

Hotspots for displaying static or dynamic information are:



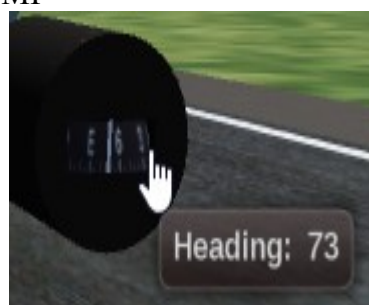
Resets the current view to default after moving around with the mouse or changes to zoom level



Clicking the knob will provide a nicer view for manoeuvring down the glide slope. Restore the view via OMI



If the stopwatch gets into the way use the timer of the ADF instead for timing legs, procedure turns..



Use the readout for adjustment of DG and or HSI



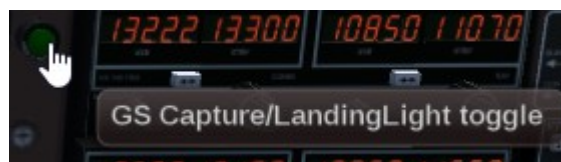
Opens the Radio Settings Dialog



Opens the FG internal GPS Dialog



Toggles all Lights, Fuelpump and Pitot Heat on/off except Landing light



Manual toggle of Landing Light

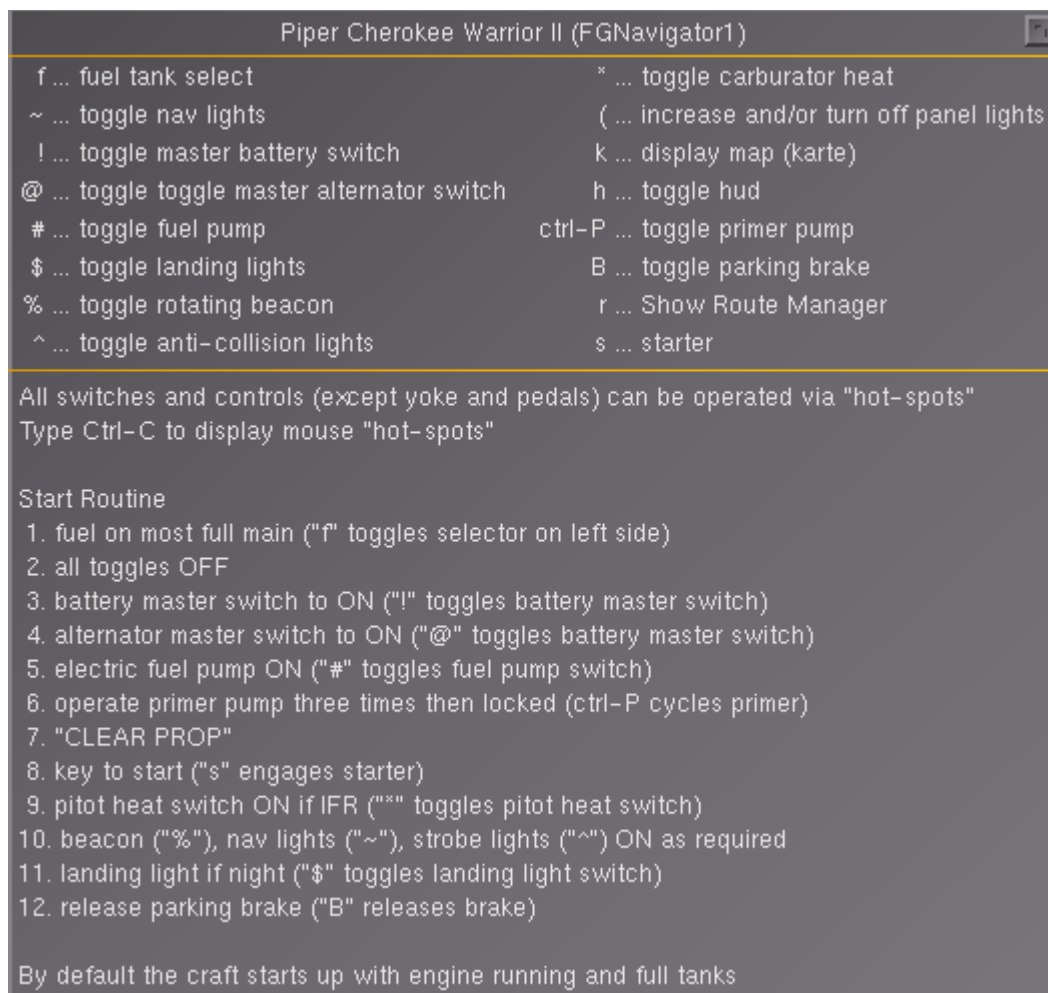
In addition clicking the altimeter will pop up the QNH dialog.

Keyboard

The standard Flightgear keys apply in addition to the aircraft specific shortcut keys. These are listed in the Help Menu or can be looked at by pressing ?

Most of the custom key bindings are identical with the original Piper Cherokee Warrior. So for instance

- h calls up the Hud toggle
- * toggles Carburator Heat
- k opens the map dialog
- r opens the Route Manager Dialog



Auto Pilot(s)

The Navigator comes equipped with an auto pilot namely a modified version of the Bendix King KAP140.

Whilst the unit looks the same as the standard version, its core functionality has been modified and extended by the seamless integration of the more sophisticated IT_Autoflight (ITAF) Autopilot developed by Joshua Davidson.

This means the Hybrid now supports waypoint navigation via Route Manager/GPS including VNAV capability resulting in two NAV modes, one to follow the Route Manager and one for the original VOR Lock mode.

The auto pilot can be activated from either the panel embedded KAP140 unit as shown below



or alternatively from the ITAF dialog



which provides both more functionality and a much friendlier interface. By default the dialog will open at the bottom left corner thus not obscuring the pilots view.

To display the ITAF press F11 or click the face of the Kap140 or choose the menu.

KAP140

If not already familiar with the operation of the generic KAP140, the following link will take you to a Wiki explaining its basic modus operandi. It is vital to be familiar with the equipment, its shortcomings in particular, as otherwise you might be in for some rather nasty surprises.

http://wiki.flightgear.org/Bendix/King_KAP140_Autopilot

Prior to examining the extended functionality the interface of the ITAF provides, a brief recap of the various modes:

AP turns the auto pilot on with ROL and VS modes activated, that is wings level and current pitch maintained be it level, ascent or descent.

WARNING

Pressing AP again will turn the autopilot off, however not immediately. It will flash for a little while prior to receeding control to the pilot.

Due to that delay in release the auto pilot should not be used at take off and turned off well before touch down.

HDG the AP will follow the direction of the heading bug of either the digital gyro or the HSI

CAUTION

The Autopilot will always turn the shortest way to the left or right. A turn must not exceed 180 degrees or the autopilot will suddenly turn in the opposite direction midturn because the other side now has less degrees to turn to.

In order to turn more than 180 degrees you need to break up the turn into phases like the first turn to 120 and just before there turn another 90.

VS the AP will ascend or descend continuously at the fpm rate specified using the UP/DN buttons. (Increments/Decrements are in 100ft lots)

One problem with VS may occur just after takeoff, when the AP senses the required VS based on pitch, air pressure and other parameters and sets your VS at 1500fpm or more. Your low powered engine can not sustain that and you will stall.

ALT activates the altitude control. Pressing ALT will stop the plane from its current climb or descend by levelling out provided no desired altitude has been preset.

If a wanted (preset) altitude has been set and armed, ALT will automatically activate with at first the plane slightly overshooting the target and levelling out on target.

Subtleties

If the armed preset altitude differs from the current altitude you are going to climb or descend based on the +/-fpm (UP/DN) settings.

preset/armed 6000	current 3000	+600fpm	result altitude hold in 5 minutes
preset/armed 4000	current 4200	+500fpm	result climb until out of fuel
preset/armed 5000	current 3000	-300fpm	result crash in 10 minutes

Clicking ALT again will cancel altitude hold whereas pressing (UP/DN) will take you back into VS mode.

Note:

To set the desired altitude using KAP140 use the wheel to increment/decrement setting by 100ft lots, using ITAF you simply nominate the wanted altitude in the ALT: box and then press the ARM button.

NAV switches from ROL or HDG mode to follow the course set in "NAV1" or "NAV2". The AP will then attempt to intercept the radial set in the OBS and track it following the VOR CDI. The intercept angle however should be less than 60 degrees.

RM JOSHUA please note: Nav dual modus based on your switch for both vorlock and route manager or separate button RM or WP for waypoint???

APR arms the approach mode and activates the ILS/GS-Approach once the Nav receiver senses the Glide-slope in range.

REV switches to GS Back Course mode (refer to the ILS topic)

ITAF

compose once final

Flight Settings Reference Tables

[illegible]

Add your specific scenarios

[illegible]

Tools and Resources

Collections of tips, tools and links

- Equipment Hardware Software
- Instrument related pilot handbooks
- Aviation Related
- Useful Tools
- If I would have known this

