

Coyote Avionics User's Guide



Coyote Avionics Design
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Introduction

The goal of Coyote Avionics Design is to provide modern, high quality avionics for the use of the flightsim community.

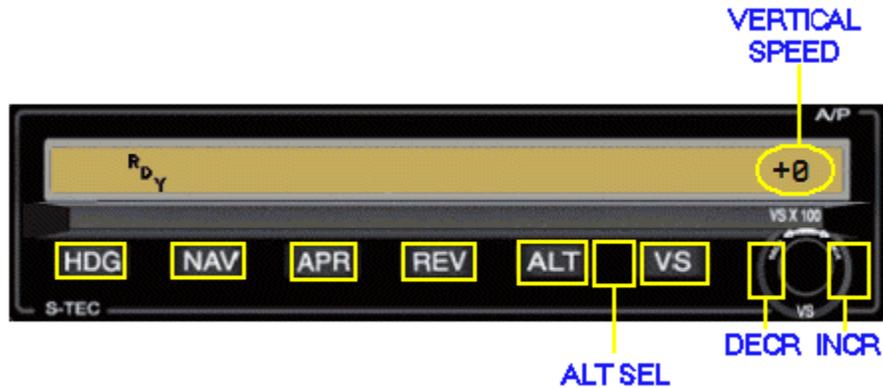
The purpose of this document is to provide a central reference for Coyote avionics as they are released. An updated version of this document will be included with each new release.

S-TEC Autopilot Set

The S-TEC autopilot set simulates the S-TEC System 55 autopilot. The set consists of autopilot, altitude selector/alerter, and annunciator.



S-TEC System 55 AUTOPILOT



Autopilot hotspots

The S-TEC autopilot can be used standalone, or with the Altitude Selector and/or Annunciator. The autopilot is turned on and off using an external switch. The AP button that is part of the Mooney_Bravo is perfect for this application.

The HDG, NAV, APR, and REV buttons work just like any other FS2002 autopilot. A GPS annunciator is provided to indicate that the GPS is providing the NAV source.

[ALT] button -- Selecting the ALT button will enter altitude hold mode with holding altitude = current altitude and VS = 0.

[VS] button -- Selecting the VS button will enter attitude hold with VS = current vertical rate.

[ALT SEL] -- Selecting the hotspot between ALT button and VS button will enter altitude select mode using Altitude Selector altitude and VS. This simulates the pressing of both the ALT button and the VS button.

VS knob -- The VS knob will increase/decrease the climb rate in VS mode or altitude select mode.

The vertical speed is displayed in 100 ft increments at the far right of the autopilot window next to the VS annunciator. A plus (+) value indicates climb and a minus (-) value indicates descent.

Gauge Size	:	500x119
Minimum Recommended width	:	240
Gauge name	:	cad_StecSys55ap!autopilot

S-TEC Altitude Selector/Alerter



altpreselector hotspots

The Altitude Selector/Alerter is an option which is used with the System 55 autopilot.

Display

The leftmost numerical indication is the altitude in 1000 ft increments and the right most numerical indication is the climb/descent rate in 100 ft increments. For example an altitude reading of 4.0 is 4000 ft and a climb rate of 7 is a climb rate of 700 ft/min.

The annunciators provided are ENT, ALT, ALT SEL, ALR, DH, VS, and BARO.

The Altitude Selector powers up in the ENT BARO mode displaying the current altimeter barometric pressure setting.

[BAR] button -- Toggles on and off the BARO display mode in ENT mode.

[DTA] button -- Toggles between ENT mode and operate mode. Selecting the DTA button places unit in ALT SEL mode, displaying altitude setting of 0.0.

[ALT] button -- Toggles between ALT SEL display mode and ALT display mode. When in ALT display mode the current pressure altitude is displayed.

ALT SEL mode displays the altitude setting.

To adjust selected altitude select [DTA] button to enter ENT ALT SEL mode, select the ALT button and adjust inc knob for desired reading. The knob defaults to 1000 ft increments and clicking the center of the knob will change it to 100 ft increments. Select [DTA] button after desired altitude setting is reached to return to operate mode.

[VS] button -- Toggles VS setting mode on and off. Select VS button to enter VS setting mode and adjust knob for desired climb/descent rate. In VS setting mode each click of the knob increments or decrements the vertical rate setting in 100 ft increments. VS adjustment is the default and it does not require being in the ENT mode.

NOTE : The VS button on the altitude selector toggles the VS setting mode on and off, it does not toggle the autopilot VS mode.

[ALR] button -- Toggles Altitude Alert mode on and off. Select the ALR button to turn on the Altitude Alert mode. If Altitude Alert is turned on the alert sound will occur at 1000 ft before selected altitude and 300 ft before selected altitude.

[DH] button -- Toggles Decision Height Alert mode on and off. To adjust Decision Height (DH), select DTA button to go to ENT mode and then select DH button. The gauge now indicates decision height setting in 1000 ft increments. At startup the setting is 0.0. Adjust the knob for the desired DH. The knob will adjust the DH in 100 ft increments. When DH adjustment is completed select the DTA button to return to operate mode, then toggle DH mode off until ready for approach. Toggle on DH mode when preparing for landing. When the aircraft descends to 50' about the DH setting an alert sound will be heard. As the aircraft continues to descend it will sound an alert again at DH - 50'.

In order for the Altitude Alert and Decision Height Alert system to work the snd gauge must be installed.

Gauge Size	:	213x100
Minimum Recommended width	:	100
Gauge name	:	cad_StecSys55ap!altpreselector

Other gauges and files required :

cad_StecSys55ap!snd	//	required for DH and Alt Alerts
fs2002\Sound\dingdong.wav	//	required for DH and Alt Alerts
fs2002\Modules\FSSound.dll	//	required for DH and Alt Alerts

S-TEC Annunciator



The annunciator is optional with the S-TEC System 55 autopilot. Most installations do not use it in order to conserve panel space. Only the modes supported by FS2002 are implemented.

Gauge Size : 208x98
Minimum Recommended width : 100
Gauge name : cad_StecSys55ap!annunciator

Garmin Avionics Set

The Garmin Avionics set consists of six pieces of rack mounted avionics equipment and a full function VOR/LOC/GS/GPS CDI for NAV2. Any piece can be used alone or in any combination with the other units. The only exception is that only one Nav1/Com1 set may be used. This means that either gns4301 or gns5301 can be used for COM1/NAV1, but not both.

The units are :

gma340	Audio panel
gns4301	COM1/NAV1/GPS
gns4302	COM2/NAV2/GPS
gtx327	Transponder
gns5301	COM1/NAV1/GPS with moving map display
gps500	standalone moving map display
GarminVor2	full function CDI for NAV2



GMA340



GNS430



GTX327

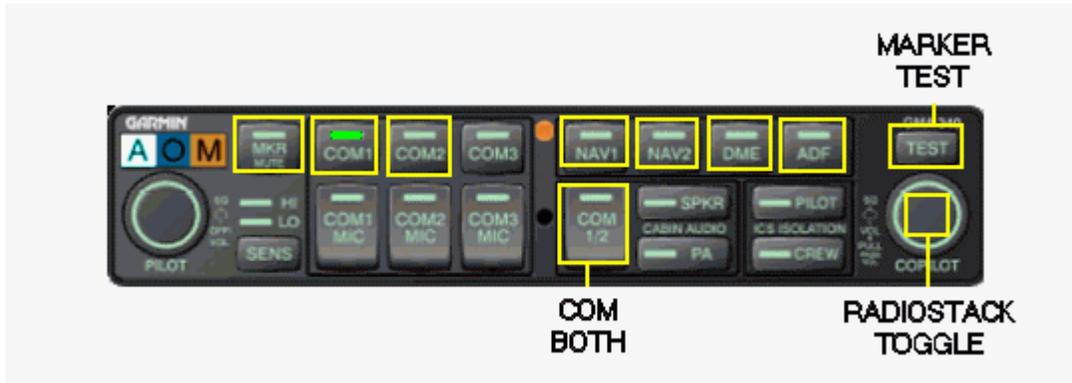


GNS530



GPS500

GMA340 Audio Panel



GMA340 hotspots

The audio panel provides full FS2002 audio panel functionality.

Marker Beacon Lights	--	indicates which beacon is being received.
[MRKR] button	--	Selects Marker Beacon audio output.
[COM1] button	--	Selects COM1 audio output.
[COM2] button	--	Selects COM2 audio output.
[COM 1/2] button	--	Selects both COM1 and COM2 audio output.
[NAV1] button	--	Selects NAV1 cw id audio output.
[NAV2] button	--	Selects NAV2 cw id audio output.
[DME] button	--	Selects DME cw id audio output.
[ADF] button	--	Selects ADF cw id audio output.
[TEST] button	--	Cycles thru the Marker Beacon lights (A-O-M) and back to off.
[COPILOT] button	--	Toggles radio stack window on and off.

Gauge Size : 500x105
 Minimum Recommended width : 240
 Gauge name : cad_garminavionics!gma340

GNS4301 COM1/NAV1/GPS



GNS430 hotspots

The GNS4301 provides full COM1, NAV1 and GPS functions. The GPS portion is a readout of the default FS2002 gps.

Only the standby frequencies may be changed, then they are made active by selecting the appropriate active/standby frequency toggle.

COM1	Both active and standby frequencies are provided.
C<->	active/standby frequency toggle.
NAV1	Both active and standby frequencies are provided.
V<->	active/standby frequency toggle.
DIS	Displays DME distance in NM
GPS	Default navigation page is provided. Contains the following information :
CDI	-- Displays +/- 5 NM coarse deviation.
wptid	-- Displays next waypoint id.
DIS	-- Displays distance to next waypoint in NM.
DTK	-- Displays desired track to next waypoint.
BRG	-- Displays bearing to next waypoint.
GS	-- Displays ground speed.
TRK	-- Display current track.
ETE	-- Displays estimated time to next waypoint.

[CDI] button Toggles GPS/NAV autopilot NAV source. (same function as default gps/nav switch)

[PUSH CRSR] knob Toggles GPS display on/off.

```
Gauge Size           : 500x209
Minimum Recommended width : 240
Gauge name           : cad_garminavionics!gns4301
```

GNS4302 COM2/NAV2/GPS



GNS430 hotspots

The GNS4302 provides full COM2, NAV2 and GPS functions. The GPS portion is a readout of the default FS2002 gps.

Only the standby frequencies may be changed, then they are made active by selecting the appropriate active/standby frequency toggle.

- | | |
|------------------|--|
| COM2 | Both active and standby frequencies are provided.
C<-> active/standby frequency toggle. |
| NAV2 | Both active and standby frequencies are provided.
V<-> active/standby frequency toggle. |
| DIS | Displays DME distance in NM |
| GPS | Default navigation page is provided. Contains the following information : |
| CDI | -- Displays +/- 5 NM coarse deviation. |
| wptid | -- Displays next waypoint id. |
| DIS | -- Displays distance to next waypoint in NM. |
| DTK | -- Displays desired track to next waypoint. |
| BRG | -- Displays bearing to next waypoint. |
| GS | -- Displays ground speed. |
| TRK | -- Display current track. |
| ETE | -- Displays estimated time to next waypoint. |
| [CDI] button | Toggles GPS/NAV autopilot NAV source. (same function as default gps/nav switch) |
| [PUSH CRSR] knob | Toggles GPS display on/off. |

Gauge Size	:	500x209
Minimum Recommended width	:	240
Gauge name	:	cad_garminavionics!gns4302

GNS530 COM1/NAV1/GPS



GNS530 hotspots

The GNS530 provides full COM1, NAV1 and GPS functions. The GPS portion is a readout of the default FS2002 gps.

Only the standby frequencies may be changed, then they are made active by selecting the appropriate active/standby frequency toggle.

- | | |
|--------------------|---|
| COM1 | Both active and standby frequencies are provided. |
| C<-> | active/standby frequency toggle. |
| NAV1 | Both active and standby frequencies are provided. |
| V<-> | active/standby frequency toggle. |
| VOR | Displays VOR id. |
| RAD | Displays VOR radial |
| DIS | Displays DME distance in NM. |
| GPS | Default navigation page is provided. Contains the following information : |
| CDI | -- Displays +/- 5 NM coarse deviation. |
| wptid | -- Displays next waypoint id. |
| DIS | -- Displays distance to next waypoint in NM. |
| DTK | -- Displays desired track to next waypoint. |
| GS | -- Displays ground speed. |
| TRK | -- Display current track. |
| ETE | -- Displays estimated time to next waypoint. |
| compass rose | -- Indicates current heading |
| DTK pointer | -- Marks desired track |
| Wpt bearing needle | -- Points to bearing of next waypoint |

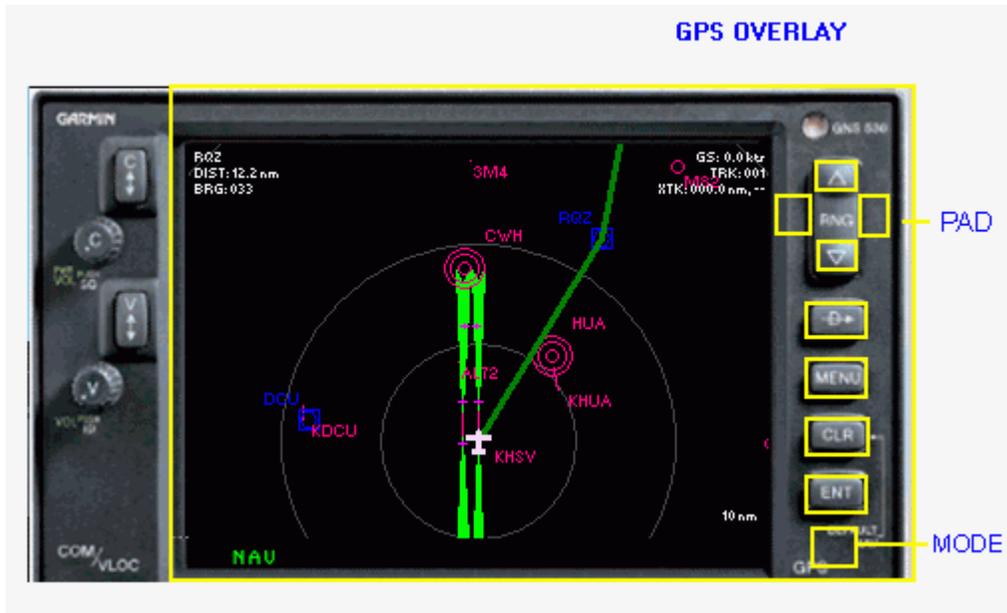
[CDI] button Toggles GPS/NAV autopilot NAV source. (same function as default gps/nav switch)

[PUSH CRSR] knob Toggles GPS display on/off. (same function as default GPS button)

Gauge Size : 500x364
Minimum Recommended width : 240 // 300 with gps overlay
Gauge name : cad_garminavionics!gns5301

NOTE : The GPS overlay is a temporary measure until I can build a moving map display into the GNS530. If the GNS530 is part of a radiostack, the moving map will be difficult to read at normal radiostack sizes. It is probably a better approach to use an external popup GPS instead of the gps overlay.

GNSGPS gps overlay



gps overlay for GNS530

Optional gps map overlay which overlays the nav screen of the GNS530 with the default gps moving map display. The gps map overlay is a repackaged version of the default FS2002 gps. It is only used for this application since it does not have a complete frame.

Hot spots overlaying RNG buttons -- Arrows pad used to navigate menus and pages.

[-D->] button -- Cycles between Direct To page/Emergency page/Normal page on gps screen.

[MENU] button -- Toggles gps Menu page on/off.

[CLR] button -- Same function as gps CANCEL button.

[ENT] button -- Same function as gps ENTER button.

hot spot below ENT button -- Cycles display Mode between moving map display, waypoint information display and route information display.

Gauge name : gnsgps!gps

NOTE : Since FS2002 only supports one GPS nav source toggling NAV source on either NAV1 radio or NAV2 radio has the same effect. In either case the FS2002 GPS becomes the NAV source.

GTX327 TRANSPONDER



GTX327 hotspots

The GTX327 Transponder provides modern transponder functions.

[**VFR**] button -- Toggles between previous code and VFR code (1200).

[**FUNC**] button -- Toggles between Pressure Altitude display and Flight Time display (flight time display not implemented)

Pressure Altitude is indicated in Flight Level (FL), i.e. altitude = displayed number x100 ft.

SQUAWK CODE -- Squawk Code is entered by clicking above digit to increase the value or below the digit to decrease it.

Gauge Size	:	500x126
Minimum Recommended width	:	240
Gauge name	:	cad_garminavionics!gtx327

GPS500 Moving Map Display



GPS500 hotspots

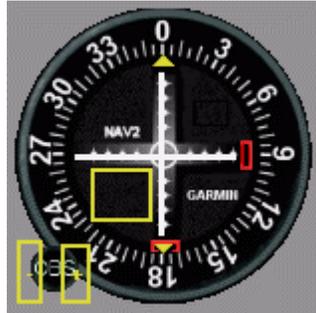
This gauge is a replacement for the default gps moving map display. This unit would typically be used with the gns4301/gns4302 combination. This is a repackaged version of the default FS2002 gps.

Hot spots overlaying RNG buttons -- Arrows pad used to navigate menus and pages.

- [-D->] button -- Cycles between Direct To page/Emergency page/Normal page on gps screen.
- [MENU] button -- Toggles gps Menu page on/off.
- [CLR] button -- Same function as gps CANCEL button.
- [ENT] button -- Same function as gps ENTER button.
- [PUSH CRSR] knob -- Cycles display Mode between moving map display, waypoint information display and route information display.

Gauge Size : 450x329
 Minimum Recommended width : 300
 Gauge name : cad_gps500!gps

Garmin VOR2 CDI



garminVOR2 hotspots

The garminVOR2 CDI is a full function CDI for NAV2. It provides both VOR/LOC course deviation information and glide slope information.

The OBI is adjusted by clicking to the right of the OBS knob to increase and to the left of the OBS knob to decrease.

Clicking inside the lower left quarter of the gauge will toggle digital readout of the course on/off.

Gauge Size	:	256x256
Minimum Recommended width	:	90
Gauge name	:	cad_GarminVor2!gi106b

Bendix-King Avionics

The Bendix-King Avionics currently available consists of three pieces of equipment.

The units are :

- EFS 40** Electronic Flight Instrument System consisting of :
 - ED461cdu** EHSI
 - ED462** EADI
 - CP468 Control Panel
- KR87** ADF Receiver



EFS 40 EFIS



KR87 Digital ADF

ED462 EADI

The ED462 EADI is an electronic attitude director indicator. It is part of the EFS 40 avionics set. A subset of both the Enroute display format and the Approach display format is supported.

The Enroute display format includes attitude, flight director command bar, and radio altitude.



Enroute display format

The Approach display format also includes a LOC deviation scale, a LOC glideslope scale, and marker beacon.



Approach display format

The deviation scale is displayed when a LOC frequency is tuned.

The glideslope scale is displayed when a LOC with ILS is tuned.

Gauge Size : 432x432
Minimum Recommended width : 160
Gauge name : cad_efs40!ed462eadi

ED461 CDU EHSI

The ED461 CDU features a built-in mode controller with all operating controls located on the unit's bezel.

The HSI display mode is implemented. The display includes the following :

- Compass Card Display
- Symbolic Aircraft
- Primary Nav Source Annunciation
- Heading Select Bug
- Course Select needle and digital readout
- Course Deviation Bar
- Distance, Ground Speed and Time-to-Station Display
- Wind Vector
- Two Bearing Pointer Displays
- Glideslope Display



ED461 CDU EHSI

The control operation is simple and uses the following buttons and knobs :

- [NAV] button -- Navigation Sensor Select button selects one of the four supported sensors. For FS2002 the following sensors are supported - VOR1, VOR2, GPS, and ADF. Selecting the NAV button cycles between the NAV supported sources. The selected NAV source is annunciated to the right of the NAV button on the display. The distance, ground speed and Time to Station for the selected NAV source are displayed in the upper right corner of the display in Green text.
- [->] button -- Bearing #1 pointer source selection. Selects source for the Bearing #1 pointer. Supported sources are VOR1, VOR2, GPS and ADF. The Bearing #1 needle is Cyan (light blue). The sensor annunciation and range information, if available, is displayed in the lower left corner of the display in Cyan text.
- [<=] button -- Bearing #2 pointer source selection. Selects source for the Bearing #2 pointer. Supported sources are VOR1, VOR2, GPS and ADF. The Bearing #2 needle is Magenta (light purple?). The sensor annunciation

CP468 CONTROL PANEL

The CP468 is a remote control panel for use with either the ED461 or the ED462 EHSI.



CP468 Control Panel

The control operation is simple and uses the following buttons and knobs :

- [NAV] button -- Navigation Sensor Select button selects one of the four supported sensors. For FS2002 the following sensors are supported - VOR1, VOR2, GPS, and ADF. Selecting the NAV button cycles between the NAV supported sources. The selected NAV source is annunciated to the right of the NAV button on the display. The distance, ground speed and Time to Station for the selected NAV source are displayed in the upper right corner of the display in Green text.

- [->] button -- Bearing #1 pointer source selection. Selects source for the Bearing #1 pointer. Supported sources are VOR1, VOR2, GPS and ADF. The Bearing #1 needle is Cyan (light blue). The sensor annunciation and range information, if available, is displayed in the lower left corner of the display in Cyan text.

- [<=] button -- Bearing #2 pointer source selection. Selects source for the Bearing #2 pointer. Supported sources are VOR1, VOR2, GPS and ADF. The Bearing #2 needle is Magenta (light purple?). The sensor annunciation and range information, if available, is displayed in the lower right corner of the display in Magenta text.

- [TST REF] button -- The TST REF button toggles between Groundspeed and Time-To-Station display in the upper right corner of the display.

- [DIR] knob -- The Course Selector knob is used to adjust the CRS setting for the selected primary nav source to the desired course. The digital course readout of the selected course is displayed at the upper left corner of the display in Green text. The knob also provides a Direct To function. Selecting the knob center will slew the course needle and digital course readout to the direct course, according to the selected navaid or active GPS waypoint.

- [SYNC] knob -- The Heading Select knob is used to set the heading bug to the desired heading. The digital heading readout is displayed at the lower right corner of the display in Yellow text. Selecting the knob center will slew the heading bug to the current aircraft heading.



CP468 hotspots

Gauge Size : 413x132
Minimum Recommended width : 200
Gauge name : cad_efs40!cp468

NOTE : The EFS40 is a gauge set and some gauges are dependent upon the EHSI as they control parameters in the EHSI or they display parameters from the EHSI.

The ED461CDU EHSI may be used standalone.

The ED462EHSI may only be used in combination with the CP468.

The ED462 EADI may only be used with the ED461 or the ED462EHSI/CP468 combination.

The CP468 may only be used with the ED461 or the ED462EHSI as it controls data in the EHSI.

KR87 Digital ADF Receiver



KR87 ADF Receiver

The KR87 ADF receiver is a modern ADF receiver with a built-in timer. Both the Flight Time mode and the Elapsed Time mode of the timer are implemented.



KR87 hotspots

The receiver is tuned to the desired frequency using the tuning knobs. The frequency is displayed in KHZ on the left side of the display.

Tune in 100 KHZ steps by selecting the upper hotspots to the left and right of the knobs.

Tune in 10 KHZ or 1KHZ steps by selecting the lower hotspots to the left and right of the knobs.

Clicking the center of the tuning knob will toggle the lower tuning steps between 10 KHZ per step and 1 KHZ per step.

TIMERS

There are two timers. The Flight Time timer and the Elapsed Time timer. The desired timer mode is selected by toggling the FLT/ET button.

FLT Timer Mode

The FLT Timer mode is the default timer mode. The flight time is displayed in HH:MM format on the right side of the display. The FLT annunciator will be displayed if in the FLT mode.

The timer starts when FS2002 is started. To reset the FLT Timer to 00:00 click the ON/OFF knob just to the right of the display. The timer cannot be stopped, it can only be reset to 0. It will continue to count up as long as FS2002 is running.

ET Timer Mode

The Elapsed Timer counts in one second increments. The elapsed time is displayed in MM:SS format on the right side of the display. It may be reset to :00 by clicking the SET/RST button. It will continue to count until it reaches 59:59 then only the seconds display will continue to

increment until it is reset. The ET annunciator will be displayed if in the ET mode.

Gauge Size	:	500x103
Minimum Recommended width	:	240
Gauge name	:	cad_kr87adf!adfrcvr

Repackaged GPS Displays

There are several repackaged GPS displays in my collection. They are all the default FS2002 GPS with the front panel graphics bitmap changed and the buttons remapped to match the selected GPS. They all have the same functions as the default GPS.

The following repackaged GPS are currently available :

- Apollo MX20 GPS display
- ArNav 2000 GPS display
- AvMap GPS display
- FlightMax GPS display
- Garmin GPS 500 GPS display
- Garmin GPSMAP 195 GPS display
- Garmin GPSMAP 295 GPS display
- Garmin GPS Pilot III GPS display
- Garmin Vista GPS display
- Honeywell GPS display

Most of them were done on request and I am sure the list will continue to grow. They consist of both handheld units and panel mounted units.

Typical units are :



AvMap GPS



MX20 GPS Display

DESIGN STATEMENT :

All of these gauges are original implementations by Coyote Avionics Design except for the repackaged GPS and the garminVOR2 CDI. The graphics used are either modified versions of vendor product information graphics available on the Internet, scanned images or digital pictures provided by other flightsimmers or graphics developed especially for Coyote Avionics Design projects.

The garminVOR2 CDI was implemented using the source code provided by Dai Griffith as part of his excellent tutorial FS2000/CFS SDK Gauge Creation.

The repackaged GPS displays were implemented using information provided by Chuck Dome.

NOTES :

Coyote Avionics are constantly being updated and I will release updates as required. If you have a project which uses my gauges send me an email and I will send you the latest version. Please send me an email if anything doesn't work as expected or if there are any questions.

I am always open for suggestions if you have any ideas on improvements that can be made.

INSTALLATION HINTS

ASPECT RATIO

Because of the details implemented in these gauges and the fact that most of the text displays are as close to scale as possible for maximum reality, the aspect ratio of the gauges should be maintained as close as possible.

This means that if a gauge is 500x100 pixels and you need a 240 pixel wide gauge, the size of the gauge in the panel should be 240x48. Since you usually know the width desired, the height of the gauge can be determined using the following approach.

Gauge size is 500x100 (WxH)

ratio is equal to H/W

therefore ratio = $100/500 = .20$

required_height is equal to ratio x required_width

therefore required_height = $0.20 * 240 = 48$

If the value is a decimal value such as 48.3 it is usually better to round up instead of down. For example use 49 if your calculation results are 48.3, etc.

The gauge size of all Coyote Avionics gauges are provided in the description.

GAUGE SIZE

For most gauges there is a minimum recommended size. The best way to determine the minimum size for a gauge is try it. The minimum size recommended in the description is only a guideline and they are based on a 1024x768 panel size.

If you follow these guidelines your panels will be a lot more realistic and a lot more readable.

Known Problems :

GNS530

The GNS530 has a strange problem which causes the scenery to dim when an aircraft with it installed is used. It goes away when another aircraft is selected. I am working on this problem and when I get it fixed I will release an updated version.

CREDITS :

Thanks to Rolf Dieter Bückmann for sharing his source code with others.

Thanks to Chuck Dome who designed gaubmp2 and many of the other utilities we all depend upon, who shared his knowledge and experience when I had questions.

Thanks to Dai Griffith for his great tutorials and for the help he has given myself and other gauge designers.

Thanks to Arne Bartels and all of the other guys out there who support the various Panel Design forums and are always willing to answer a fellow programmer's questions.

Thanks to Michael Verlin who always seems to be able to come up with good bitmaps when I need them the most.

Thanks to Joerg Banach and Clyde Niles who have been encouraging me and beta testing my gauges as development progressed. They both provide a lot of good ideas which help make my projects better.

REFERENCES :

S-TEC System 55 Pilot Information Manual
Cirrus SR-22 Pilot's Operating Handbook
Garmin GMA 340 Audio Panel Pilot's Guide
Garmin GNS 430 Pilot's Guide and Reference
Garmin GNS 530 Pilot's Guide and Reference
Garmin GPS 500 Pilot's Guide and Reference
Garmin GTX 327 Mode A/C Transponder Pilot's Guide
Bendix/King KR87 Digital ADF Brochure
Bendix/King EFS 40/50 EFIS Brochure
Bendix/King EHI 40/50 EHSI Brochure

How To Understand The Inner Workings Of The GPS by Stephen R. Goldsmith is a well written article that has good information on the default gps which also applies to my repackaged gps. It is a Flightsim.com Howto article which can be found at the following location :

<http://www.flightsim.com/cgi/kds?§=main/howto/gps-sg.htm>

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