

ANALOG MINI-PANEL PROJECT

Version 3.0, FSX ONLY

October 12, 2011

minor changes are Version 3.1 by Dr. Warren Lieuallen, March, 2014 (added comments in italics)



Look at all this stuff! There's so much in this "mini"-panel, you can completely obscure the view! But don't worry, you won't need all this all at once. You'll find your personal favorites, which suit your flying style. I don't fly military aircraft, so the amazing Pave Tack and radar panels aren't for me – but they might be just what you've been looking for!



Here's an image to show the improved view the mini-panel gives you. This is the view you use when flying (and especially landing!).

I like it so much, I use it in every aircraft I fly. Although this degree of consistency is perhaps a bit unrealistic, it makes it much easier to transition between different aircraft.

March 12, 2014

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INTRODUCTION

The Mini-Panel Project is a progressive project to implement and add improvements to the Mini-Panel system in FSX. It is primarily achieved by integrating many freeware gauges from authors who have granted me permission to use their outstanding gauges in this endeavor. By tweaking and upgrading the Mini-Panel, it should greatly aid the pilot in his tasks by providing optimal data presentation and versatility of functional capability. My thanks to all the authors who have so kindly agreed to let me use their gauges and documentation.

CHANGES INCLUDED IN THIS UPDATE

1. *The grouping of 19 icons (previously with 6 in “Icon Central” and the other 13 remaining as separate gauges) into the Icon Tower.*
2. *Several redundant or “missing” gauges have been removed or installed, as appropriate.*
3. *Minor adjustments have been made to gauge placement and resolution; text labels have been aligned. My goal was to provide for maximum visibility in the central and lower parts of the screen, to facilitate landing. A runway line-up marker (yellow triangle) was added.*
4. A new instrument has been added – it is a pop-up window called AI Hunter. It has a scrollable AI aircraft listing out to a distance of about 80 NM. Any of the listed aircraft can be selected and complete details are then shown in the lower portion of the instrument. It is a perfect complement to the radar display.
5. Data MFD (Multi-Function Display), lower right of panel, on the second page (WPT LEG), the following changes have been made:
 - a) The # LEG has had a current flight plan leg counter added, *i.e.* # LEG 3 - 17 signifies the third leg of a 17 leg flight plan is selected.
 - b) The PREV and NEXT (in the DATA MFD) change to selected flight plan leg has been fixed; it now works as it should. Clicking either PREV or NEXT now changes the leg selection without drama. This is an interesting and versatile facility for use on either multi-leg Flight Plans or Direct To.
6. The Elevator Trim (E-TRIM) instrument layout has been improved to make its use more intuitive.
7. A TFR Clearance Plane reset instrument has been added that allows the TFR height to be changed without having switch off either TFR or autopilot.
8. An ASP Airspace button has been added to the Radar that allows Airspace outline graphics screen overlay to be selected if desired.
9. New Altimeter, Airspeed, Attitude and Horizontal Situation Indicator (HSI) gauges have been added to the analog panel. Placement of the gauges has been changed to obtain maximum visibility.
10. Extensively updated documentation. *Further minor edits.*

FSX INSTALLATION

Note: throughout these instructions, references to folder locations will need to be changed if you installed FSX somewhere other than the default location (which is recommended on Windows machines).

Note: If you have a previous version installed just overwrite all files from the ZIP file's gauges folder into Program Files/Microsoft Flight Simulator X/Gauges folder.

1. Backup the minipanel.cfg file in the Program Files/Microsoft Flight Simulator X/Gauges folder so that you can change back to it if you need to.
2. Open the Gauges folder in the FSX_Minipanel_V3_1.zip and copy the contents into Program Files/Microsoft Flight Simulator X/Gauges. Yes to any overwrite message. If in doubt then backup the original gauge first!
3. Copy the TCAS folder and its contents into Program Files/Microsoft Flight Simulator X/Gauges folder. Yes to any overwrite message. If in doubt then backup the original gauge first! *Note that TCAS is not included with my version 3.1 of Mini-Panel.*

NOTE: If after installation the mini-panel does not work correctly you may need to edit the panel.cfg file. Go to the aircraft's panel folder and open panel.cfg file with Notepad. The list of window names is at the top of the page. Simply put // in front of any window named mini-panel (name may vary). Example: //Window06=mini-panel. If you decide to revert to the default mini-panel just remove the //. The name and number may be different in each panel.cfg file.

MINI-PANEL USAGE

To access the mini-panel from the main 2D panel press the W key. To return to the main panel press W two more times. You cannot access this mini-panel from the 3D virtual panel.

Most of the gauges on the panel are self-explanatory but I will describe or reference information on some of the more complex but very useful gauges on the mini-panel. There are several icons in the Icon Tower area of the mini-panel that will access the pop-up windows. Most of the pop-up windows can be re-sized and moved on the screen to wherever you desire.

If you click the center of any of the primary flight gauges they will be enlarged. Click in the center again to close the expanded gauge. There are also icons on the Icon Tower to show enlarged views of both the Glass Cockpit gauges and the Analog gauges.

The informational gauges for nearest airports and navigational information *were* transparent and sometimes the information is difficult to read in certain lighting conditions. If you click on either informational gauge it will add a black background that allows for easier visibility. I wanted to provide as much visibility as possible on the mini-panel that is why it was made them transparent. Since these are transparent it can be a bit difficult to find the "hot spot" to click. You will need to click on one of the letters or numbers. With a little experimentation you will find where it's easiest to click and bring up the data with a black background. You can return to a transparent state by clicking again on the black background. *I edited this to remove the nearest airport panel, and make the navigational information have a black background by default.*

There are several other icons on the Icon Tower that show pop-ups of the Nav Info, Nav Info Map, Fuel Status, SALS, Clock, Radar, Data MFD, TCAS, GPS, AI Hunter and Pave Tack.

TFR (TERRAIN FOLLOWING RADAR)

The TFR gauge by Karol Chlebowski allows you to fly Terrain-Following at any altitude you desire. There is a new TFR reset gauge that allows you to reset the TFR altitude while flying TFR operations. TFR works well down to 100 feet above the ground in flat and rolling terrain. In very mountainous areas you probably should not fly below about 800 ft. Occasionally you will have to take manual control of the aircraft in the mountains to pass safely across. Karol is working to solve this problem but even so this is a really fun gauge.

All you need to do to fly TFR is:

1. Set the altitude above the ground (known as clearance plane) you'd like to fly in the altitude window of the autopilot.
2. Click the **TFR** icon located near the lower right corner of the mini-panel.
3. Turn on the autopilot with the AP icon, click the ALT button and you're off.

TFR - CP RESET Documentation and gauge provided by Karol Chlebowski

This instrument allows the TFR height AGL to be varied on-the-go while both the Autopilot and TFR remain engaged.



1. Current TFR Clearance Plane setting display
2. Increase TFR-CP button
3. Decrease TFR-CP button

CP = Clearance Plane: The set height in feet that the TFR (Terrain Following Radar) will attempt to keep the aircraft AGL (Above Ground Level)

DATA MFD (MULTI-FUNCTION DISPLAY) Documentation and gauge provided by Karol Chlebowski



Accessed via the **Data** icon.

1. NAV speeds, current location, and waypoint
2. WPT LEGS Flight plan waypoint page, plus Leg selection
3. Engine data.
4. Control surface and trim positions
5. Attitude, AoA, pitch, dive angle.
6. Electrical loads
7. Target data
8. Magnetic Variation can be determined... Current aircraft weight and fuel
9. PREV...NEXT, cycle flight plan legs

CHANGES TO FLIGHT PLAN OR DIRECT TO: When a Flight plan or Direct To has been loaded, details are displayed in the DATA MFD located in the lower right corner of the panel.

FOR FLIGHT PLANS: by clicking on either PREV or NEXT the active Flight Plan legs are cycled. The Leg now displayed is set and is active. If the autopilot is on, the aircraft will now turn to honor the newly selected leg. This process can be repeated as required. By clicking the PREV button to its maximum extent it functions as an RTB (Return To Base).

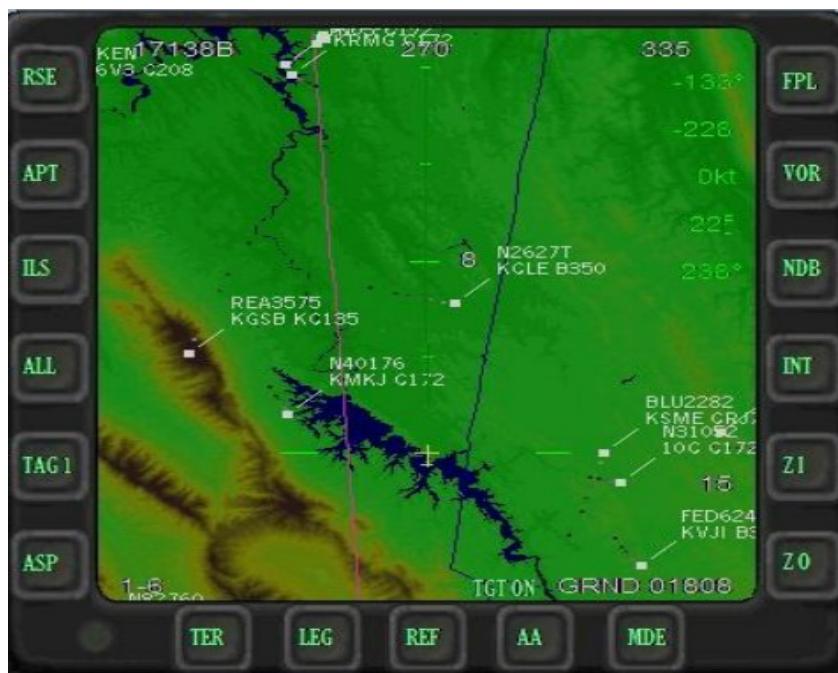
FOR DIRECT TO: If clicking PREV does not result in the top of screen LEG line changing to a blank entry, then cycle NEXT and PREV .

The autopilot enacts the RTB by flying to the vicinity of the Direct To origin, and then it resets to the Direct to destination.

CAUTION: the PREV...NEXT buttons actually changes the active leg, and is not just a data display change. The autopilot will now honor the new leg that has been set.

MULTI-MODE GROUND MAPPING RADAR Documentation and gauge provided by Karol Chlebowski

The Ground Mapping Radar is opened by clicking on the **Radar** icon on the Icon Tower.



Ground Mapping

1. The primary function of the radar is ground mapping and navigation. The earlier radar fitted to this panel provided extremely good ground mapping functions and contour elevations at lower elevations up to about 4-6,000' , but was virtually useless above 7,000'.

2. A Multi-Mode aspect has now been added to the radar to provide a comprehensive coverage of elevations from sea level to 17,000'.

3. A further addition is a Stand-Off detail view of a nominated Target area. This is enacted at the button labeled MDE. It comprises six steps which are annotated in the text at the lower left corner of the screen. *e.g.* 2-6, is the 2nd page of 6 pages.

4. The first five pages are used by the pilot to best portray the ground elevation contours. The page selected by the pilot is the one that is considered to best portray the elevation contours that are currently being flown over, and is a matter of the pilot's choice.

5. In steep and rugged mountains, the closeness of the contour lines will necessitate zooms of 3, 6, and 9 NM. These will need to be alternated with larger zooms to maintain a general awareness and orientation of the terrain being flown over, and of that ahead of the aircraft.

6. The differing contour elevation tint colors used on each page of the display are optimized to display contours at either low, medium or high elevations. The pages must be switched as required.

7. These pages have been tested at the following locations, and it is recommended that the radar be tried in each of these locations:

- KCVS Cannon AB, New Mexico USA
- KSEA Seattle, Washington USA
- LIPA Aviano AB Italy, Alps to North
- Kathmandu, Nepal in Himalayas
- YMML, YLIL Australia , mountains to the East

Interactive: Target or Flight Plan Waypoints - Mode 6

1. The sixth Mode introduced (6-6) is totally dependent upon either a Flight Plan or a Direct To existing in the background. Mode 6 will function regardless of that background flight plan being enacted or not. If there is no Flight Plan or Direct To, then page 6 will be blank.

2. Clicking MDE to Mode 6 will result in the radar screen portraying a display that is fixed at the next WPT (WayPoint) or Direct To.

3. It is irrelevant to the display where the next WPT is geographically. It can be on the other side of the world and it will still be displayed.

4. The display is fixed and centered at the point of the aircraft icon on the screen, and will not move regardless of the aircraft's travel. Page 6 differs from the first 5 pages as they do reflect the aircraft's movement as changes in on screen topography.

If the aircraft is turned through 180 degrees, the radar view rotates to reflect the aircraft's current heading.

5. At any time the radar can be selected from the WPT view to the aircraft's current position view by selecting any of the other 5 pages. The MDE button can be scrolled forward continuously, but only backwards to a limited degree.

MODE 6 VARIATION

6. Where a multi-leg Flight Plan exists, each of the waypoints in the Flight Plan can be viewed at will by the following procedure. At the DATA MFD (shown below) go to the 2nd page titled WPT, you will see PREV and NEXT. These are hot spot buttons to scroll forwards or backwards through the Flight Plan legs. The Mode 6 radar view will automatically display the scrolled WPT on the screen and the Data MFD will display the name/title of that WPT.
7. If RTB (Return To Base) is enacted by clicking PREV to its maximum extent, when a DIRECT TO is loaded, then the radar will depict the point at which the DIRECT TO was originated or created at *i.e.* anywhere in flight or on the ground that you were located when you originally set up the DIRECT TO.
8. Mode 6 was originally conceived to represent a close-in detail view of a Target area from a Stand-Off range. Typically this would be required immediately prior to a 'run in' on a bombing exercise.
9. The DIRECT TO function can be easily entered in flight using the WAAS instrument and can be changed as often as required in any flight.



* IMPORTANT NOTE *

Usage of both FLIGHT PLAN and DIRECT TO are an essential ingredient and aid to both navigation and situational awareness. That data is then reflected in various instruments. It is important to note that having them loaded in the background does not mandate the use of the autopilot, but having them loaded provides valuable navigational reference points.

10. It should be noted that in Mode 6 the normal radar button functions still work, *i.e.* radio NAVAIDS, airports, FLTPLN, and zoom levels, *etc.*

11. If the aircraft is on the ground taxiing around in circles will rotate the Mode 6 radar view.

12. Sitting on the ground at an airport will create a rectangular Flight Plan with relatively short legs. It should terminate at an airport that is extremely close to your airport. In the radar select page 6-6, select FLTPLN button to graphically show the flight plan, then zoom out to encompass the whole of the flight plan graphics on the screen, Now, in Data MFD page 2 toggle through the various legs with the NEXT and PREV buttons. Observe BOTH the screen display AND the location of the aircraft icon on the screen flight plan. Cycle both NEXT and PREV several times and observe.

PAVE TACK DISPLAY Documentation and gauge provided by Karol Chlebowski



Pave Tack is opened by clicking on the **Pv Tk** icon on the Icon Tower.

The Pave Tack Display unit provides the pilot views in all directions including up and down. These views can be physically moved to stand-off distances from the aircraft to enhance the desired view. Additionally the views can be magnified or zoomed.

Many viewing settings are available (refer to Table). This unit has 10 reset options that instantly set various useful views. Considering the speed of fast jets and the time constraints on a busy pilot, these reset options represent a vital pilot aid.

There are 4 text overlay options available, including an authentic simulation of a Pave Tack display.

Two of the reset views are configured to represent typical bombing views. Another reset view is the approach view configured for landing on either a runway or aircraft carrier.

This instrument has a variety of uses:

- Pave Tack views under the aircraft
- Targeting and Bombing
- BDA - Bomb Damage Assessment
- Look Down - if on the runway and altitude is increased, then a top down view of the airport or

adjacent city is available

- Reconnaissance - when at any altitude the screen altitude and zoom allow large areas to be viewed, this includes airport being approached at ranges of 10 NM while at 30,000'
- BVR - Beyond Visual Range, aircraft identification while conducting radar intercepts
- Approach observations of runway during approach to landing

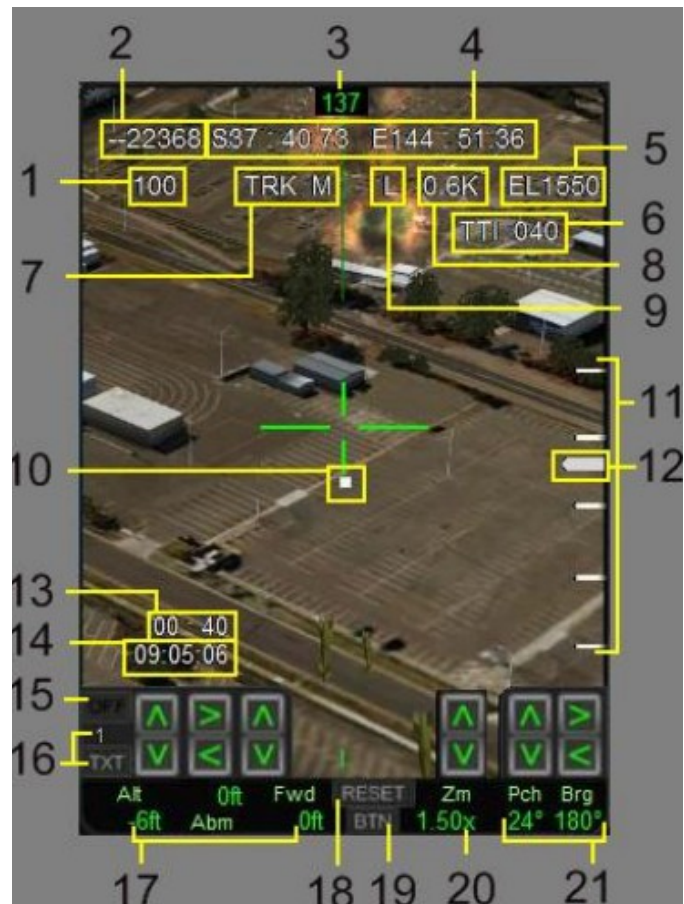
NOTE:

1. It is recommended that a multiple leg flight plan be flown and that Text page 1 be open when approaching the waypoints. The display actively responds to the waypoints in an interesting manner during the final 90 seconds. This display response also occurs with a Direct To.

2. The following pages detail buttons, resets and control functions together with the underlying function of this instrument and the included table lists the control settings available.

Pave Tack Display and Page One Text

1. Sequence No. 100 is departure point decreasing by 1 at each Wpt
2. Distance in feet to next Wpt (if below 99,999' else -00000)
3. Current heading
4. Current Latitude / Longitude
5. No function (cosmetic only)
6. Time in seconds to next Wpt
7. Orientation of display
8. Aircraft Radio Altitude in thousands of feet
9. Cue C or flashing L laser ranging on countdown
10. DoF , Direction of Flight rotating arrowhead or square indicator
11. Countdown ladder, 30 second range
12. Moving countdown index pointer
13. Time to next Wpt in minutes and seconds
14. Calendar date. YY:MM:DD
15. Off button to hide Pave Tack window
16. Text overlay button and counter
17. Stand-off buttons and readouts, moves viewpoint
18. Reset button - Left to Original, Right to Bomb views
19. Button clears/recalls button area to improve the screen view
20. Zoom button and readout
21. Steering buttons and readouts, change view angles. Buttons are single click or repeated if held down

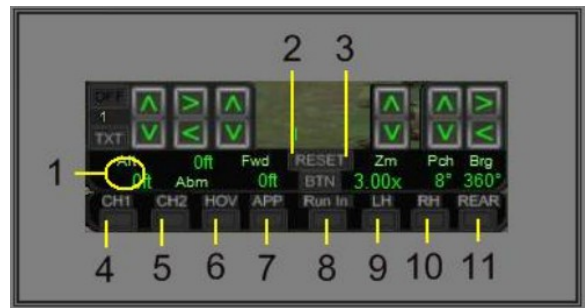


Pave Tack Optional Reset Buttons

1. Secret Hot spot area to open or hide Optional Buttons
2. Reset button Left selects original start up view
3. Reset button Right sets Low level Pave bomb view
4. CH 1 - 15 degree down Fwd, at 500' view
5. CH 2 - 45 degree down Fwd, at 500' view
6. HOVER - 90 degree down, at 500' view
7. APPROACH - 8 degree down Fwd, at 3.0 zoom
8. RUN IN - enables low level bomb targeting
9. LEFT view
10. Right view
11. REAR view, at 8 degree up

NOTES:

- On start up the lower buttons are hidden, they are called up by the Secret Hot Spot.
- Due to aircraft speed and time constraints it is often difficult to set the desired view configuration; the Resets greatly assist in that respect.
- The above buttons represent 10 optional views that are set instantaneously by the click of a single button.
- The selected Reset button is highlighted by an LED light.
- Having set any of these options, the view can then be further refined with the primary control buttons.
- The two Bomb Resets are "Run In for targeting and "Reset Lo Bomb" which displays a view of bombs falling and exploding if the Weapons Package is loaded and relevant saved flight is used.
- The central button BTN hides/opens the upper button area.



Low Level Targeting and Bombing

Pave Tack "Run In" Reset button option

This is a low level targeting and bombing configuration which will be reasonably accurate in the height range 200' to about 700' above ground.

For convenience when conducting this bombing exercise both the "Reset Lo Bomb" and "Run In" buttons are in close proximity and near vertical alignment.

Procedure:

- For Precision Fly at 500' to 550' AGL.
- Choose Flat level terrain.
- Level flight with Velocity vector on or very near Horizon bar in HUD.
- Having autopilot on helps.
- Select "Run In" button to obtain optimum view.
- From aircraft's current speed, use the table below, chose applicable angle and enter that angle with the PCH (Pitch) button.
- Fly accurately towards target, when cross-hair is on target click "Droppable Object" switch, then click" Reset Lo Bomb" switch which is above the "Run In" button. Your view will now be changed to the rear and down and you will see the bomb strike the target and explode.

- Go back to “Run In” and proceed to your next target.

Following is ASI then degrees down:

<u>KIAS</u>	<u>PITCH</u> (degrees down)
350	22
360	21
380	20 (Default “Run In” setting)
400	19
420	18
435	17
460	16
485	15
510	14
545	13
610	12

Bomb placement accuracy is $\pm 20'$ (roads at right angles to the flight path used as targets during testing).

The default “Run In” button view is set at 20 degrees down, which matches the 380 knot airspeed. Check your current airspeed, enter table to determine optimum angle and enter that angle with the Pitch buttons, this adjusts the “Run In” button view cross-hairs to provide accurate and precise targeting for that specific airspeed.

Table 1 - Pave Tack Control Parameter Steps

1. ** STANDOFF

The Alt , Fwd and Abm all move the camera by the specified distance from the default position, which is the pilot’s eye-point in the aircraft.

Alt - altitude.

Above A/C

0' 6' 100' 200' 500' 800' 2,000' 4,000' 6,000' 10,000' 15,000' 20,000' 28,000' 35,000'

Below A/C

-6' -100' -500' -5,000' -10,000' -15,000' -20,000' -25,000' -30,000'

Fwd - forward

In front A/C

0' 3,000' 6,000' 10,000' 15,000' 20,000' 30,000' 40,000' 50,000' 60,000' 91,200' 121,520' 151,900'
182,280' 303,800' 486,080'

Behind A/C

-3,000' -6,000' -12,000'

Abm - abeam

Right or Stbd of A/C

0' 3,000' 6,000' 12,000' 18,000' 24,000'

Left or Pt of A/C

-3,000' -6,000' -12,000' -18,000' -24,000'

2. ** STEERING

Both Pch and Brg are used to point the camera in any required direction, regardless of the camera's current location.

Pch - pitch

From level 0 up 90 degrees

From level 0 down 90 degrees

Brg - bearing

From nose 360 degrees either Right or Left

3. ** ZOOM

Is the normal magnification.

0.25 0.50 0.75 1.00 1.50 2.00 2.50 3.00 4.00 6.00 8.00 10.00 12.00 15.00 20.00 25.00

General Notes

Pave Tack has several modifications to radically improve its capabilities:

1. Both the relative Bearing and Pitch control functions operate in one degree increments, this is both more pleasing, but more importantly it adds greater versatility. At higher zoom levels it eliminates visual gaps that previously existed under the older large increment steps.

2. Selectable four pages of text overlay has been added. The first page functions best if a Flight Plan or Direct To is loaded in the background. The Range or Distance to the next WPT provides a readout in both NM and Feet, the latter being important when used in conjunction with Stand Off and Ranging capabilities.

3. The control buttons can now be selected OFF or ON as required to maximize the screen view. Button control function only exists when the buttons are visible.

4. A small irritant with the flight simulator is LOD (Level Of Detail) at large distances or zooms. The simulator decreases the level of detail resulting in a featureless, bland and fuzzy image.

This aspect has now been overcome to a large degree by "Stand Off" a new feature that has now been added to the Pave Tack. In essence it enables crisp and highly detailed images at large Stand-Off distances.

5. For quick conversion purposes, 1 NM = ~ 6,000 feet (more precisely 6,076 - 6,080)

6. Stand Off -- Fore and Aft

The reason for this feature is to allow the pilot a clear and detailed view of the proposed Target area from a Stand-Off range prior to conducting a 'run in' on a bombing exercise. With the 'Fwd' button, the Camera view can be moved forward in steps in feet out to a distance of 80NM. The three negative steps

are to allow viewing of bomb falls if the 'Weapons Package' is installed .

7. Stand Off -- Left and Right move the camera abeam, and was added to provide a feature or option for the pilot to use as desired.

8. These control functions can be used together to achieve a desired view. Its versatility and variety are only limited by our imagination and inventiveness. It is worthy of a little persistence and experimentation.

9. It can be demanding in single pilot operations. The actual F-111 has a WSO to share the workload. The 10 Reset buttons are a positive pilot aid.

It is recommended that the following be tried: Hit pause to allow time to make desired changes; or Engage autopilot with or without TFR to free pilot to make your changes.

10. RANGING. In a dive place the velocity vector on a target, say a house, then set Stand Off to 6,000. When the house fills the Pave Tack screen your range is exactly 6,000' and it's time to execute a pull up. For this to work accurately all other button parameters must read 0.

11. Pave Tack cannot see your own aircraft. It can see the cockpit and the effects such as rotating beacons, exhaust, flares and dump and burn.

12. An interesting aspect is if flying towards an object, for example an aircraft either on the ground or airborne. set the Stand Off at a figure past that aircraft then pan the relative bearing to 180 degrees and you will be looking at the other side of that aircraft.

13. The Stand Off feature is also useful when conducting Aircraft Carrier approaches.

14. It is important to remain aware of all button settings and their consequent influence. If you are aimed at a tower and zoom in, but the screen is showing a completely different scene, it may well be something as simple as the Stand Off right is set at say 12,000, and as a consequence you are seeing scenery that is 12,000' to the right of your intended aim point.

15. A further addition to the Pave Tack is the DoF (Direction of Flight) arrowhead. This aids with orientation when the Pave Tack is panned about by the Relative Bearing buttons during flight.

16. Altitude in this instrument is a measure of 'up' displacement from the current plane of the aircraft, it is not an altimeter. If the aircraft is inverted, that measure is then in a downwards sense.

A DESCRIPTIVE EXAMPLE

In this example the aircraft is in level flight at 4,000'.

The first setting is Stand Off increase to 60,000 feet; this moves the camera that distance directly in front of your aircraft. Then we set Stand Off right to 12,000 feet; this moves the Camera from its current position laterally to a location 12,000' to the right. Then we set Altitude to 15,000'; this moves the

camera up from its present position by that amount. The camera has now been moved from the pilot's eye-point at the aircraft, forward and then right, then up, to its current location. We can now point it in the direction that we desire to get the view that we might want; for example, we turn it around by setting the relative bearing to 180 degrees. Then we tilt it downwards towards an object on the ground by setting the pitch to 45 degrees. We can now zoom in by the amount that we require to observe that object.

The sequence order of settings is irrelevant, as are the figures used above; it was just a description of the camera's movement and directional pointing relative to its origin at the aircraft. Experimenting with the settings will clarify what they are achieving for you.

Note Limitations:

1. This instrument will incur some degree of frame rate impact.
2. When setting Stand Off to large distances it may take the simulator a moment or two to load the Pave Tack screen scenery, suggest the Alt be popped up a few steps, then back down.
3. This instrument can cause transient confusion and disorientation which is only to be expected when you consider the complex spatial geometry that is being manipulated.
4. The pitch range is from 90 degrees down to 0 , then up to -90 degrees , please note there is no stop at 90 degrees down.

The following information is important to understanding the principles underlying Pave Tack and its control and possible uses.

- It is a sensor that we will call a Camera.
- Its fundamental starting point is the Pilot's Eye-point in the aircraft.
- The zoom function is the usual magnification of the current view.
- ALL the control buttons move the camera away from the standard reference point which is the Pilot's eye-point.

E. The Relative Bearing and Pitch actually only rotate and steer the camera regardless of its current location.

F. This pilot's eye-point is locked to the plane of orientation of the aircraft in Pitch, Roll and Yaw.

The following applies to our concept of UP:

- Up in level flight = up.
- Up in 90 degree bank = horizontal
- Up in inverted flight = down
- Up in an absolute vertical climb = horizontal

All of the above applies to our Camera and its resultant views. This leads to interesting, but at times odd views. If flying at 2,000' and in a 45 degree dive and we have placed the Camera 10 NM ahead of our aircraft Guess where the Camera is? Correct, it's 9½ miles underground! Rather than being comical,

these properties afford rich opportunities with a little thoughtful manipulation.

AI TRAFFIC HUNTER Documentation and gauge provided by Karol Chlebowski

AI Traffic Hunter is opened by clicking on the **AI** icon on the Icon Tower.



1. Upper pane, scrollable AI aircraft listing
2. User aircraft, the one being flown
3. Scroll bar, single click or click and drag
4. Selected AI aircraft (selected on upper pane) displayed on lower pane
5. Close window hot spot
6. Lower pane, displays the selected AI aircraft detail

AI aircraft data instrument

1. Pop up window instrument.
2. Provides data on AI aircraft up to about 80 NM from user aircraft.
3. Lists AI on ground and in the air.

Uses

Situation awareness, air to air interception, location of tanker aircraft, hostile aircraft alerting, fighter duties.

Can locate and home in on AI aircraft that are beyond visual range or hidden in clouds, simply turn until relative bearing is 0 or near 0, apply power to achieve a reasonable Closing Speed and climb or descend to AI altitude.

Description

Upper pane = a scrollable listing of aircraft starting with user aircraft based on distance from that aircraft. Scroll is at right is single click or click and drag.

3rd column = distance

4th column = relative bearing of AI, bearing basis is:

0 degrees = nose of user aircraft

minus values = left of nose

positive values = right of nose

180 degrees = behind user aircraft

Clicking any of 8 lines in upper pane selects that AI aircraft, the selected aircraft is highlighted in green, and the selected aircraft's details are then displayed in lower pane.

Extra Notes

1. With the radar on, selecting an AI in this instrument is visually displayed as the AI turning red briefly, a neat indication.
2. Selecting an AI in this Hunter instrument does not nominate that AI in the radar. To nominate an AI in the radar the usual steps must be taken: switch AA button, and click radar screen till required AI turns red, then that nominated AI's details will show up on both radar screen and HUD.
3. The advantage of the above is that you can be tracking a specific AI in the radar/HUD, and at the same time be independently interrogating the AIs in the Hunter instrument.
4. The Hunter instrument by default lists 'all' AIs, both on the ground and airborne. However if the radar is ON then the radar controls the selection of 'air', 'grnd', 'all'. This selection can be varied for both the radar and Hunter by the fourth button down on left side of the radar.

E-TRIM ELEVATOR TRIM Documentation and gauge provided by Karol Chlebowski



1. Current elevator trims setting text
2. Null button, returns setting to 0
3. Nose up trim button
4. Nose down trim button

The function remains unchanged; however the new layout is more intuitive for use during the time-constrained TFR Lofting procedure required to clear mountains.

TCAS DISPLAY Documentation and gauge provided by Dietmar Loleit – *I have been unable to get TCAS working*

TCAS is opened by clicking on the **TCAS** icon on the Icon Tower

General TCAS Functionality

The Traffic Alert and Collision Avoidance System (TCAS) alerts the pilot in case of potential conflicts with other airplanes in the same area. TCAS tracks these other airplanes, if equipped with an Air Traffic Control Radar or a Beacon System. TCAS provides two types of collision avoidance alerts, they are: Traffic advisory (TA); and Resolution advisory (RA).

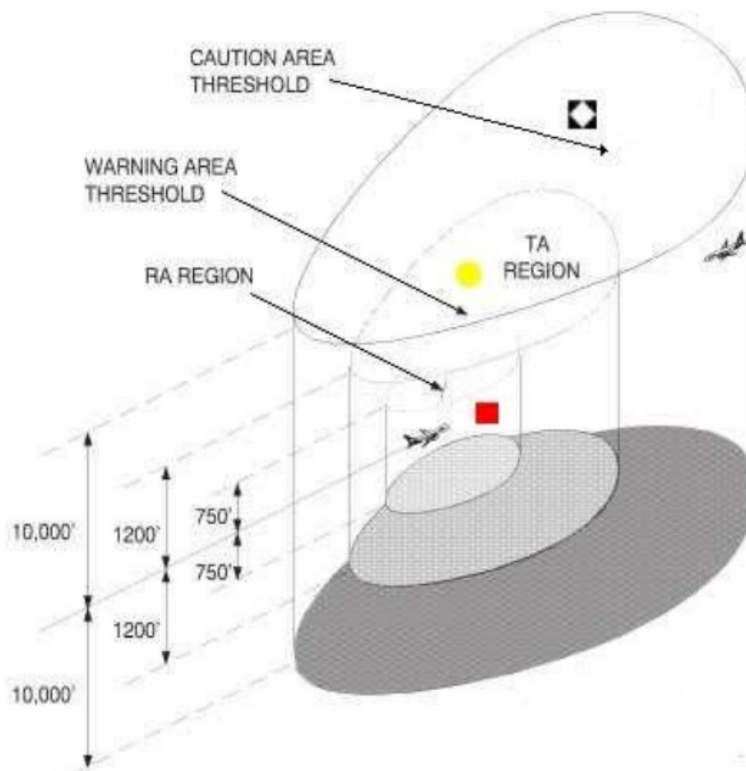
A TA shows the relative position of any AI airplane in FSX. An RA shows a vertical maneuver to avoid a possible airplane collision.

TCAS I is the system intended for use on small commuter or general aviation airplanes. TCAS I supplies proximity traffic advisories (TAs), but does not produce resolution advisories (RAs).

TCAS II is the system installed on all modern commercial airplanes. It supplies both visual and aural advisories to the pilot. Both TAs and RAs are generated by this system. All commercial airlines and some general aviation airplanes will be equipped with this system. As far as this gauge development for FSX is concerned, it provides the functionality as defined for TCAS I. A potential collision will warn the pilot with a sound and a blinking warning light on the panel. It is up to the pilot to resolve the conflict according to the information displayed by the TCAS gauge.

Functional Description of Buttons, Modes and Displays

The drawing below show the altitude threshold settings for the TCAS gauge. The distance rings are in the 15 nm range: 0-5nm (red), 5-10 nm (yellow), and 10-15 nm (white-filled diamond). As long as your aircraft is outside of the corridor of the defined distance and altitude in relation to the AI aircraft, you will see no symbols on the screen.



TCAS Displays

Non-Threat Displays:

Non-threat or other traffic shows as a white open diamond. These represent AI airplanes with a range > 15 nm or < 20 nm, and no altitude threshold settings.

Proximate Traffic:

Proximate traffic shows as a solid, white-filled diamond. These are AI airplanes within a range of > 10 nm and < 15 nm and a $\pm 10,000$ feet relative altitude. Proximate traffic is not considered a threat, but

only shows to assist the pilot in visually acquiring the AI traffic.

Traffic Advisory (TA) Traffic:

TAs show as a solid, yellow-filled circle. These are AI airplanes within a range of > 5 nm and < 10 nm and a $\pm 1,200$ feet relative altitude. This gives the pilot time to visually acquire the AI aircraft. A yellow TCAS display light is blinking on the panel along with a warning sound.

Resolution Advisory (RA) Traffic:

RAs show as a solid, red square. RAs are issued only when the AI aircraft is within a range of < 5 nm and a ± 750 feet relative altitude. A red TCAS display light is blinking on the panel along with an alert sound. These AI aircraft require an immediate maneuver to avoid a collision.

Vertical Motion Arrow:

An arrow pointing up or down in the same color as the traffic symbol, is placed on the right side of the symbol to show if the AI aircraft is either climbing or descending at a rate greater than 500 feet per minute.

Altitude Readout:

The AI's relative altitude shows as a decimal number that represents altitude in hundreds of feet and is placed on the right side of the symbol. The color is the same as the traffic symbol. If the AI's relative altitude is above you, the digits appear with a plus sign. If the AI is below you, the digits appear with a minus sign. If the relative altitude is zero the altitude readout is not displayed.

Distance Readout

The AI distance shows as a decimal number that represents the distance in miles and is placed on the top of the symbol. The color is the same as the traffic symbol.

Description of the buttons and control elements of the TCAS panel:

A) ON button. Turns TCAS in Mode 20 nm ON.

B) OFF button. Turns TCAS OFF. All other click spots are now inactive.

C) ON/OFF Compass Rose. If ON a compass rose will be displayed on the screen.

D) ON/OFF warn/alert sound. By default, the sounds are always ON.

1) Turns Display Mode 10 nm ON/OFF.

2) Turns Display Mode 20 nm ON/OFF.

3) Turns Display Mode 40 nm ON/OFF.

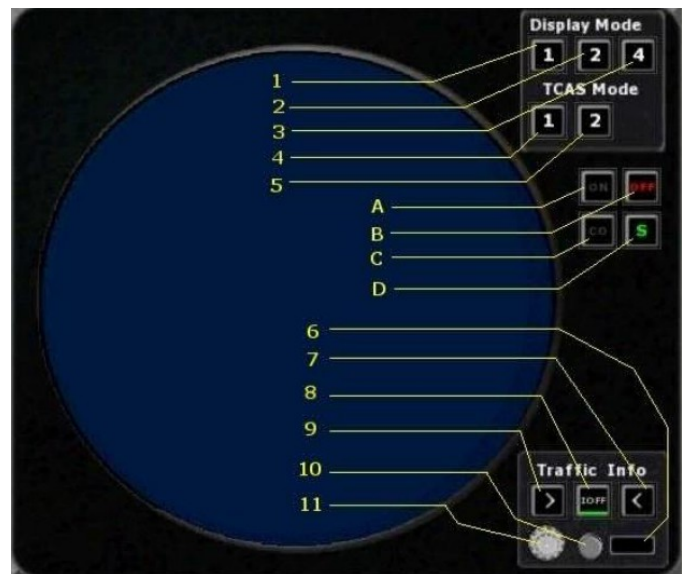
4), 5) Click buttons for TCAS Mode with the same function as in Display Mode.

6) Display bearing pointer position in degrees relative to your aircraft HDG.

7) Decrement AI index. Switches the additional text back to the previous AI.

8) ON/OFF for the base text information for all AIs.

9) Increment AI index. Switches the additional text to the next AI.



10) ON/OFF for the bearing pointer.

11) Button with two click spots (Incr./Decr.) to let the bearing pointer rotate.

Attention: All click spots are blocked as long as the TCAS and Traffic Display Mode is OFF.

View Examples

If you are in Display Mode and you switch ON the 40 nm view, you may see the following screen:

In Display Mode you will always see an AI symbol as a White Open Diamond. The symbol on the lower right tells you the AI is 22.5 miles away from you. It is 14,900 feet (+14.9) above your altitude and the vertical motion arrow tells you the AI is in climb mode. The little yellow pointer indicates the HDG of the AI. The 4 on the left side of the symbol is the AI Index ID. It is the 4th AI out of 20. A max of 20 AIs are displayed on a screen in Display Mode. 339 is the speed above ground.



The following screen shows additional information on the AI, if you click on the (11) button. You can step through all displayed AIs in order to turn on this additional information. For example:



Paci: 4 letter ATC Airline Name 5752 : the ATC Flight NBR
B738: the ATC Model D-ATUK: the ATC Tail NBR
59 : the altitude (5,900 feet) 328: airspeed
EDDH, UTAA: the flight plan; flying from EDDH to UTAA
The motion arrow indicates that the aircraft is in climb mode.

The following display is an example if you are in TCAS Mode for an AI which is in a TA area (yellow):



To see this display, you must have TCAS Mode selected. The AI is 5.1 miles away, in a climb, and 300 feet above your altitude. This display will also trigger a warning sound and turn on a yellow flashing light on the panel. The 1 is the AI Index ID. 262 is the speed.



In the example to the left, the bearing pointer has been turned on and points to the AI. The display below indicates that the bearing pointer selected is 13 degrees and the green color on the button next to the bearing display indicates that the pointer is ON.



In Display Mode the max number of AIs displayed on the screen is 20. The 20 closest AIs, in terms of the distance relative to your own position are displayed. Be aware that the Display Mode is just an extra function for this TCAS gauge in order to provide a overview for the PC pilot of the overall traffic situation.

TCAS Panel Light

On your aircraft panel you will see a TCAS Warn/Alert light. In all yellow/red situations you should immediately open your TCAS screen and check out what actions are appropriate.

Nav-Info Main is opened by clicking on the **Nav Info Main** icon on the Icon Tower.

This Gauge offers you a list of nearby VORs, NDBs, Intersections and Airports by clicking into the menu line.

VOR	Freq	Dis	Brg
SYI	109.00	24.2nm	114°
GHM	111.60	27.8nm	289°
BNA	114.10	27.9nm	026°
UXM	109.65	37.6nm	125°
RQZ	112.20	56.2nm	170°
CKV	110.60	60.2nm	339°
DCU	112.80	63.6nm	185°
HXW	114.90	64.8nm	337°
MSL	116.50	66.6nm	209°
JKS	109.40	71.3nm	269°
BWG	117.90	76.6nm	020°
HCH	117.60	93.8nm	090°
GQO	115.80	96.6nm	120°
MKL	112.00	98.1nm	270°
LVT	108.40	99.2nm	061°
CCT	109.80	102.0nm	354°
HAB	110.40	105.9nm	215°
GAD	112.30	111.4nm	162°
DYR	116.80	118.9nm	283°
VUZ	114.40	122.3nm	183°
CNG	113.10	121.8nm	314°
OWB	108.60	122.8nm	358°
RMG	115.40	127.6nm	139°
TUP	109.80	128.9nm	230°
EWO	110.80	129.7nm	030°
TDG	108.80	134.8nm	165°
MYS	108.20	135.0nm	017°
HLI	112.40	139.0nm	250°
FTK	109.60	139.4nm	022°
PXV	113.30	139.5nm	346°

Click spots on the menu:

VOR List: Click on Name; VOR info will be shown.

Click on Nav1, Stby1, Nav2 or Stby2 and the frequency from the highlighted VOR will be set.

There is an automatic NAV-Swap offered:

- If NAV is on and you are flying to VOR1.
- Stby1 and Nav2 must have the same VOR2 frequency.
- VOR1 must have DME-functionality.
- VOR2 must have NAV-functionality.
- About 8 nm before VOR1, the swap to VOR2 will occur.
- New course is counted automatically.

ADF List: click on Name; NDB info will be shown.

Click on ADF or Stby and the frequency from the highlighted NDB will be set.

INT List: Click on Name, Intersection info will be shown.

APT List: Click on the airport name, Airport info will be shown.

<ICAO 1/5> 5 pages of Airport info is available.

">5000" you can change runway length by clicking into the field .

<search icao> allows you select an airport.

<ICAO 1/5>Click in the menu line window will be changed into detailed airport information.

Detailed airport mode has got 5 subpages.

LOWG 1/5 for example

- + left part is previous, right part is next side

You get information about ILS, airport frequencies, nearby VOR, NDB and airports from this selected airport. VOR and NDB see above.

ILS-frq left click sends frequency to stby1

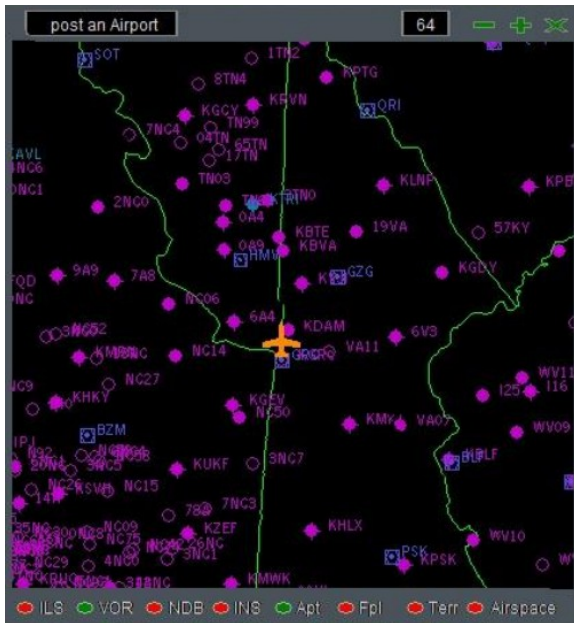
ILS-frq right click sends frequency to stby2

Course: click on course and course will be set.

Airport-Frequencies similar to VOR

NAV-INFO MAP Documentation and gauge provided by Edi Hirsch

Nav-Info Map is opened by clicking on the **Nav Info Map** icon on the Icon Tower (or the Map icon from the Nav Info Main screen).



If there an airport in the <ICAO 1/5> you can toggle the MAP-window between aircraft-page and airport-page.

In the airport page mode you can move the map by clicking on the left, right, top, bottom, 4 corners or center.

You can vary the distance displayed in the black box with numbers in it on the top of the gauge.

The buttons on the bottom of the gauge open and close various overlays such as ILS, VOR, NDB, Airports, Flight Plan, Terrain and Airspace.

COCKPIT COMMANDER Documentation and gauge provided by Glenn Copland

Features



- Numeric pad for easy entry of data including decimal.
- Input frequencies to five radios: Comm 1, Comm 2, Nav 1, Nav 2, and the ADF.
- Screen display will turn from green to orange when decimal key is pressed. This signals that the data is for radios. The input buttons for avionics are color-

coded using shades of orange. Any frequency with no decimal will remain green.

- Input data into five autopilot functions: heading, course, altitude, vertical speed, and IAS.
- To input "thousands" (000) for altitude quickly, press K-key on gauge.
- Data that is outside limits for radio frequencies and autopilot functions will display a red ERROR message on screen.
- Clear button will erase digits or ERROR from screen.
- All numerical keys on gauge will erase ERROR from screen.
- Very efficient ATC communications during hectic IFR approaches because menu keys are located on gauge near autopilot keys.
- Three Quick-Respond keys for the most frequently used ATC responses, menu items 1, 2, 3.
- Power button illuminates when gauge is turned ON.
- Heading bug rotates smoothly when a new heading value is sent to autopilot.
- Gauge can be installed on panel or into separate window.

- Icon gauge included to activate separate window.

Cockpit Commander Operation

1. Master Battery Power must be ON before gauge will operate.
2. Gauge power button (P) must be ON before other buttons on pad will function.
3. A red ERROR message will display on screen if values outside of design limits are entered into radios or autopilot. These limits are:
 - a) Comm 1 and 2: 118 - 136.975
 - b) Nav 1 and 2: 108 - 117.975
 - c) ADF: 100 - 1799.9
 - d) Autopilot heading and course: 0 - 360
 - e) Autopilot altitude: 361 - 99999
 - f) Autopilot VS: 0 - 3000
 - g) Autopilot (IAS) speed: 0 - 500
4. Radio frequencies can be entered to TWO decimal places.
5. Q-Respond keys 1, 2, 3 allow quick response to the corresponding ATC menu item. These three keys will cover the vast majority of all ATC responses. For responses 4-9, press the appropriate numeric key, then the ATC key.
6. If the screen is displaying a zero, pressing the ATC key will open/close the ATC window.

NOTE: Sending a value to the autopilot does not automatically cause the autopilot to acquire or hold the input value. It only makes those values available for use by the autopilot. To acquire/hold the entered values, the autopilot must be ON and the HOLD button for each desired feature must be active.

7. To clear a displayed value or ERROR from the gauge screen, press CLR button.
8. If ERROR is displayed, pressing any numerical button will first clear the message, and then enter the digit that was pressed.
9. Pressing the K-key will enter triple zeros (thousands). This allows most altitudes to be entered quickly.

SALS (SATELLITE ASSISTED LANDING SYSTEM) Documentation and gauge provided by Glenn Copland

The SALS is opened by clicking the **SALS** icon on the Icon Tower.

NOTE: SALS is a precision approach and landing guidance system. It will furnish both lateral and vertical guidance to the landing zone of any airport or seaplane base inside MS Flight Simulator. Like ILS, SALS does require a certain amount of piloting technique that can be easily acquired and honed by practice. That gives one a feel for the gauge and how to instinctively respond to its guidance display.



Features:

- Lateral guidance accuracy to within 10 feet of runway center.
- Provides updated list on all airports and seaplane bases within gauge limit of 30 nautical miles.
- Allows one airport to be selected from list as the destination airport.
- Allows one runway to be selected at the destination airport.
- Provides glidepath/glideslope guidance to a calculated landing zone at either end of selected runway.
- Has 1 glideslope needle that operates similar to an ILS glideslope.
- Has 3 glidepath needles; fine, medium, and course. The sensitivities of these needles vary, thus providing enhanced feedback on the rate of glidepath interception or correction.
- Illuminated directional arrows that show the tendency of the glidepath needles to move left/right. When no arrows are illuminated, the aircraft is centered over the glidepath.
- “GO VISUAL” message will alert pilot when 1 NM from landing zone.
- Screen provides climb out azimuth information in case of missed approaches.
- Backcourse indicator (BC) alerts pilot when glidepath needles are providing reversed information.

ACCURACY NOTE:

A) As the aircraft passes over the landing zone during a missed approach, glide needles may temporarily fluctuate in much the same way as a VOR needle when passing over the VOR station. Accuracy will be regained when the “GO VISUAL” message disappears as the aircraft gets further from the landing zone.

B) The glideslope angle used by SALS is a 3-degree incline to the landing zone. This zone is located 5 percent of runway length from the nearest end of the runway. Unlike certified ILS approaches, this calculated slope does not take into account any terrain or obstructions around the airport. Therefore, a happy descent should be confirmed visually!

SCREEN MESSAGES:

- 1) AIRPORT STANDBY (orange) - No airports within 30 NM.
- 2) GO VISUAL (red) - Within 1 NM of landing zone. Take over visually.
- 3) BC (yellow) - Selected runway is 90-degrees or more behind aircraft. The glidepath needle is in reverse mode when flying backcourse legs.
- 4) RANGE LIMIT (orange) - Aircraft is getting further from the selected runway and is nearing the 30 NM range limit. If course is continued, gauge will automatically switch into Approach Mode (see Operation below).

GLIDEPATH NEEDLE TRIO

*Fine needle (top): Half scale deflection = 250' or more from center of glidepath.

*Medium needle (center): Half scale deflection = 1250' or more from center of glidepath.

*Course needle (bottom): Half scale deflection = 3125' or more from center of glidepath.
(Fine is 5 times as sensitive as Medium. Medium is 2 1/2 times as sensitive as Course. The aircraft is within 10 ft. of glidepath center when all three needles are aligned at mid-scale.)

SALS Operation

1. Master Battery Power must be ON before gauge will operate.
2. Button (A) has a dual function. The first function is to control electrical power to the gauge. Pressing this button will turn the gauge ON/OFF. The second function of the A-button is to place gauge in Approach mode when gauge power is first applied.
3. When in Approach mode, the gauge will identify airports within an approach range of 30 nautical miles from the aircraft. A maximum of eight ICAOs can be listed on the screen. They are shown in the order of their proximity to the aircraft with the closest at the number 1 spot on the list. These will constantly be updated as the aircraft changes location. If there are no airports within the 30 NM range, the AIRPORT STANDBY message will be displayed.
4. It is possible in regions with a heavy concentration of airports to not see the destination ICAO on the list of seven even when it is relatively close. That will change as the destination ICAO gets nearer and as other listed airports disappear from the screen.
5. Pressing the DOWN ARROW button on the gauge will allow the listed ICAOs to be scrolled. As each airport is selected, the ICAO will turn from orange to green.
6. When the desired airport has been selected, press the ENTER button. That will enter the airport into SALS and inform the gauge at what airport you intend to land.
7. After pressing the ENTER button, the gauge will display every runway designation associated with the entered airport.
8. Using the arrow button, scroll through the runway list to select the desired runway designation for landing, then press ENTER.
9. The gauge will then enter the glidepath/glideslope mode. The following data is associated with this screen:
 - a) Title box confirming the ICAO of the destination airport.
 - b) The two magnetic headings of the selected runway.
 - c) The length (ft.) of the runway.
 - d) The elevation (ft.) of the runway.
 - e) The distance (NM) to the landing zone.
 - f) The glidepath/glideslope screen containing guidance needles.
 - g) Glidepath arrows that show tendency for glidepath needle movement.
10. SALS will automatically determine which runway heading to use for its computations when you turn onto the final leg. The runway heading that is within 25-degrees of the aircraft heading will be used for

this purpose.

11. Keep the three glidepath needles centered left/right to remain astride the centerline of runway. Turn aircraft TOWARD the needles for heading corrections.

12. a) To intercept the glidepath, fly toward the needles. Having three glidepath needles, SALS provides more advanced notice that the glidepath is nearing interception. This means the initial angle of interception can be a fairly sharp angle (40-60 degrees). This is much sharper than a typical ILS localizer interception. The angle of interception flown will depend upon flight characteristics (speed, turn radius, *etc.*) of the aircraft. The Course needle will be the first to become centered. As it nears the center of the screen, adjust the angle of glidepath interception to a shallower angle.

b) The Medium needle will be the second needle to become centered. As it approaches center scale, adjust aircraft heading by making the angle of glidepath interception increasingly shallower.

c) The Fine needle will be the last to become centered. The aircraft should be very close to the runway heading as the Fine needle is approaching center because it moves rather quickly in 10 ft. steps.

d) The illuminated left/right arrows indicate in what direction the glidepath needles have a tendency to move. The arrows are even more sensitive than the Fine needle and indicate the direction of potential needle movement. If neither arrow is illuminated, all needles are at rest with no tendency for movement. This means the aircraft is directly over the glidepath.

13. Tendency arrows are not active on backcourse legs.

14. Keep glideslope needle centered up/down to remain in center of glide descent to landing zone. Move the aircraft TOWARD the needle for glideslope (altitude) corrections.

Note: See included SALS Design Parameters.doc for illustrated glidepath/glideslope information.

15. When the GO VISUAL message appears on screen, you are 1 NM from landing zone and should verify by sight the relationship of aircraft to runway and make adjustments accordingly.

16. When the GO VISUAL message is displayed on screen, the glideslope needle and two glidepath needles (Fine/Medium) remain visible and useable. They retain accuracy until distance to landing zone nears zero miles.

17. At touchdown, the GO VISUAL message will disappear from screen and all needles will center.

18. C-button will clear screen display and return gauge to Approach mode showing the list of nearby airports. NOTE: For this gauge, BACKCOURSE is defined as any course being flown that places the selected runway 90-degrees or more behind the aircraft and within 30 nautical miles.

19. On backcourse legs, a "BC" message will be displayed at the right side of the ICAO title box. This message means the glidepath needle is to be used in reverse. Turn the aircraft AWAY FROM the needle for backcourse heading corrections.

20. On missed approaches, continue flying at runway heading. When the GO VISUAL message disappears (when bearing to airport lies behind the aircraft and is outside mileage limits), the glidepath needles go into BC mode (reversed) and can be used to guide aircraft away from airport. Keeping needles centered will align the runway directly behind the aircraft. More on this in the TIPS below.

21. After you get within 30 NM of the destination airport and after entering into SALS the runway designation, the aircraft may traverse various legs of the landing pattern. As it does, the BC message may light up as the aircraft passes through areas that meet the backcourse definition. This is normal and only means the gauge does not yet know which end of the selected runway you intend to land on. The "BC" message will turn off once the aircraft has turned onto the final leg of the runway. At that point SALS knows your landing intentions and will begin calculating all glide information accordingly.

SALS Tips

a) The proper use of the tendency arrows will greatly aid in intercepting and following glidepaths. Once established on the path, the arrows will then allow the pilot to anticipate heading changes before the needles actually indicates a correction is needed.

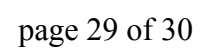
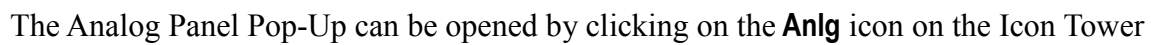
b) When an arrow is lit, it shows in what direction the Fine needle will travel once it begins to move. If the Fine needle is at its limit, then the arrows show what direction the Medium needle will move. If the Medium needle is at its limit, the arrow shows what direction the Course needle will move. If all needles are at their limit, the arrow indicates that the aircraft is continuing to get further from the center of the glidepath and in what direction.

c) When no arrows are lit, the aircraft is following the center of the glidepath. Should an arrow light up when in this situation, it is a signal that the aircraft should be turned slightly in the direction of the lit arrow. This will cancel out any needle movement before it actually occurs.

THROTTLE POP-UP

The Throttle (**Throt**) pop-up window is dependent on the aircraft you are flying. They may not work on some aircraft (those with throttle panels) but will not work on others.

The Glass Panel Pop-Up can be opened by clicking on the **Glass** icon on the Icon Tower.



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- Thanks to Robert K. Guy for his fuelstat gauge.
- Thanks to Ed Struzynski for FS Panel Studio, which was used to assemble this panel.
- Other unidentified / unknown authors, whose efforts are also deeply appreciated.

RADAR: Eric Marciano refused permission for it to be packaged with this panel, therefore unless you have the Kirk Olsson F-16, with F-16.GAU showing in the Gauges folder of FSX it will not show up.

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