FS9/FSX/P3D Generic GCA V2.1:
Classic Approach Pattern Control and Ground Controlled Approach

Ground Controlled Approach (GCA) was a revolutionary invention dating back to the 1940's. An early competitor of ILS, GCA enabled ground-based controllers to 'talk down' airplanes in all sorts of adverse weather conditions, and it is still in occasional use today. In order to simulate GCA communication in Flight Simulator the present application makes extensive use of Karol Chlebowski's AILA (Airborne Instrument Landing Approach) gauge, adapted by permission of the author, and Doug Dawson's sound DLL gauge. AILA provides guidance to any runway defined in FS9/FSX/P3D, and Doug Dawson's sound module allows the inclusion of verbal callouts. For more details on AILA and a historical account of GCA check out folder DOCS of the download zip.

V2.1 changes include: quick sound setup test; some menu items grayed out when not ready; activation of autopilot wholly at user's discretion; 'semi-automatic mode' now working for both Pattern Control and Precision Approach; better setup options for straight-in Precision Approach; improved sequencing of glidepath and centerline callouts; identical heading callouts in autopilot and manual modes; "slightly above/below glidepath" added to altitude callouts; left/right orientation bug added to centerline offset; revised manual.

Quick Checklist

APC: Approach Pattern Control

1. Set up AILA from approx. 20 miles out.
2. AILA > NRST/APP for airport, runway, and runway end.
   Optionally AILA > INT to set intercept distance 3-12 miles (default 8).
3. Check no potential terrain obstructions.
4. Call APC. Set and descend to intercept height.
5. Proceed until handover to PAR.

PAR: Precision Approach

1. For PAR without previous APC: set up AILA and line up for a straight-in approach several miles ahead of the intercept, at intercept height.
2. Follow instructions until you have the runway in sight or are able to take over.

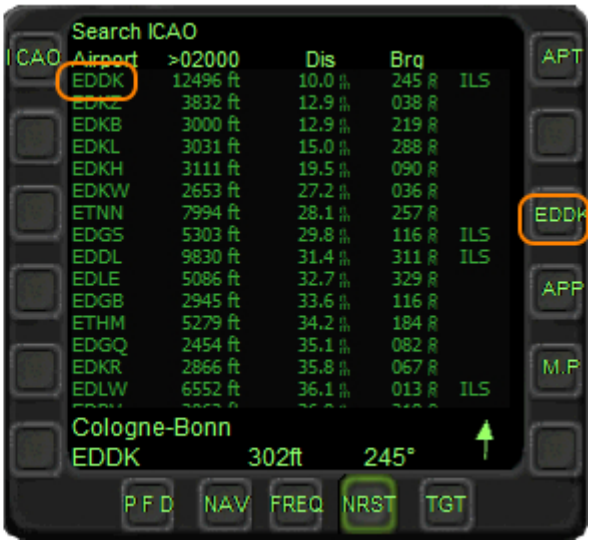
1. APC: Approach Pattern Control

Consider the following scenario. We are flying towards EDDK at an altitude of 5,000 and about 20 miles out. At this point, I usually go into SLEW or PAUSE mode. This is not absolutely necessary, but it gives us time to select a runway and set up a glideslope intercept from which to start our final descent. The GCA functions are contained in a small 2D panel window which accesses the AILA gauge and at the same time opens a custom Autopilot (AP).

Depending on where you have configured this panel window to be (see Appendix on installation below), you can call it up either by a Shift-n combination, or via the menu bar (Alt key) Views > Instrument Panel > GCA (in FS9 and FSX) or Vehicle > Instrument Panel > GCA (in the newer P3D versions). This opens the following 2D display:

Karol's AILA box is on top, the custom Autopilot is below. (The little green square on the AP panel allows you to hide or re-open AILA after the runway parameters have been set.) If initially the AILA box remains opaque, you may have to turn on the ship's battery and the Avionics switch. For a quick test of the sound system you can click either APC or PAR even when grayed out as above. If you hear a snippet of the controllers' initial messages, your sound setup is okay.

Let us go through the approach setup step by step. First, we use AILA to select destination airport and runway.



Click NRST in the bottom button line, to get a list of nearest airports. If the desired airport is not yet listed, you can use the "ICAO" button (top left) to type in id letters. *Any* four-letter ICAO is selectable, even if it is still thousands of miles away. In our case, after having picked EDDK from the list, we click the button showing EDDK on the right to proceed to the runway menu.

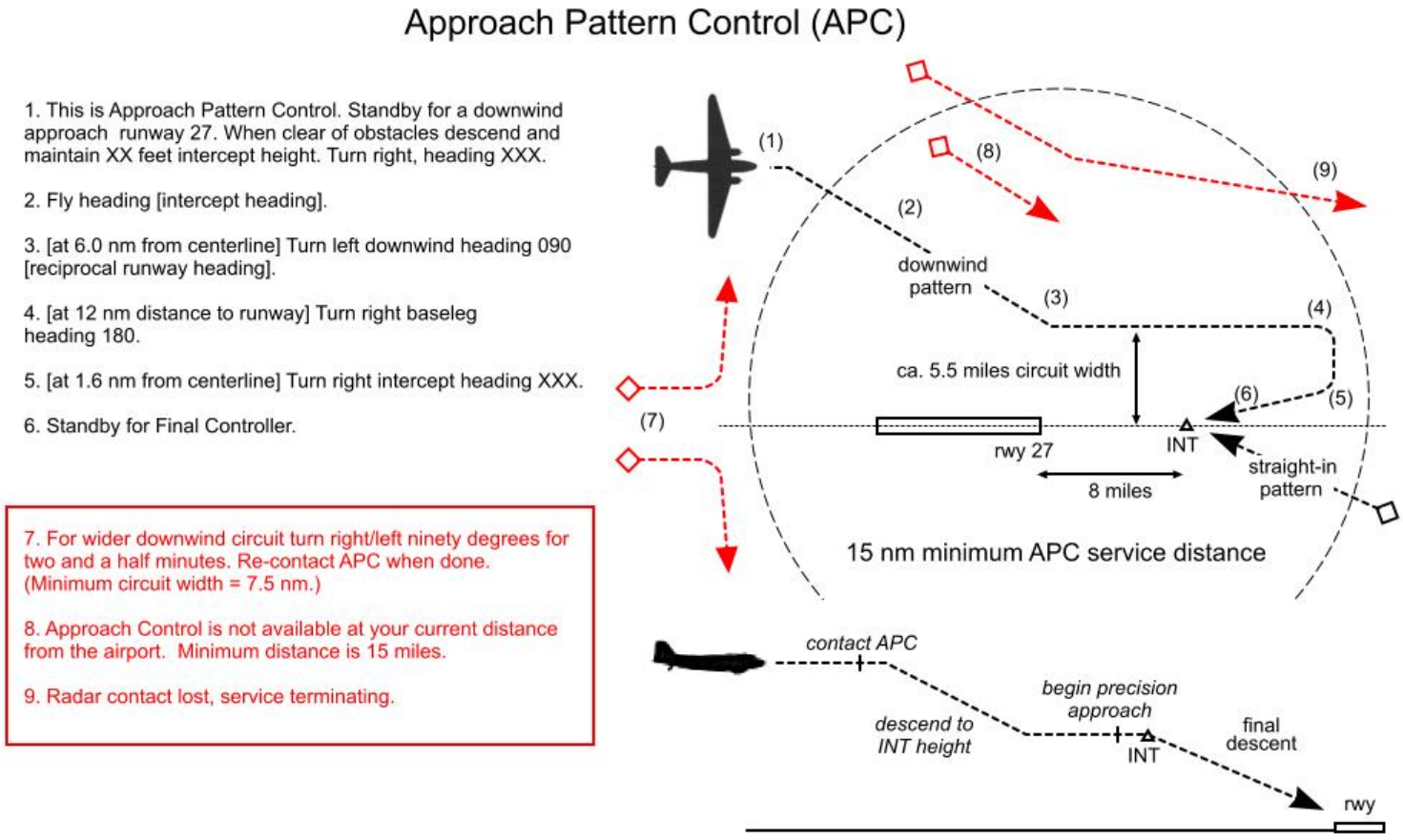
In the runway menu I am opting for 07-25. Next, I click APP to open the Approach page. On this page, I must make sure that the runway end shown is the one I want -- careful here, easy to get it wrong by leaving the default end selected. Clicking RWY top left toggles the ends; 244 is the one we want. Clicking the general area of the airport name presents additional data containing, among other things, wind velocity and direction. If you want to set the intercept distance to anything other than 8 (the acceptable margin is 3 to 12) you can do so by clicking INT and entering the appropriate numbers in the data entry cells. Use the shorter distances for relatively slow and easily maneuverable aircraft only.

With airport and runway selected we are ready to un-slew or un-pause our plane. Once she is re-established in straight and level flight, we make sure she is heading in the general direction of the destination airport and still at least 15 miles away from the runway (the actual distance is now displayed both in AILA and AP). If okay, I can click APC for Approach Pattern Control. AILA/AP will now have the following information:

In the AILA window, the fat gray arrow represents the runway, the orange arrow points to runway end 244, and the blue arrow points to the intercept (look up the separate AILA pdf for further explanation of the display and a host of additional options). In the AP section we see that our current heading is 355 and that our upcoming heading to the intercept will be 019. Our vertical speed is -10 (-1000) as we are descending from 4900 (current) to 2900 (intercept height), our speed is 164, throttle 70%, trim +3.4, no flaps yet. Distance to the intercept is 24 miles (colored blue like AILA's intercept arrow), and distance to the runway end is 19.5 miles. Note that almost all of the AP's data fields are clickable mouse areas. When

you have a moment check out the tooltips for further detail. (Just to highlight some functions, a single AP click can put you on a parallel runway heading or its reciprocal, let you execute a 45-degree left- hand or right-hand turn -- 90 degrees when clicking twice, obviously -- set the intercept altitude, or set a direct course to virtually any airport in the world no matter how far away.)

After invoking APC, controller Alice identifies herself and your plane (she will prefix Air Force, Navy or Marine to your call sign if you have specified any of these in 'atc_airline' in your aircraft.cfg), reminds you of the runway selected, and tells you the intercept altitude. For initial practice, you want Alice's instructions executed directly and automatically by leaving the AP's Heading and Altitude locks engaged as shown in the pic above. We are calling this the **auto-learn** mode. Depending on where your entry point into the pattern happens to be your approach will either be straight-in or downwind – Alice will tell you which (but may occasionally change her mind). The general pattern logic plus Alice's main instructions are shown in the following diagram. Note that APC will not be able to accept entry points that are marked red.



As APC guides us to the intercept in auto-learn mode, we mainly have to watch speed, altitude, and vertical speed, unless we turn the AP off, in which case we have to manage descent and heading ourselves following the verbal instructions. While in auto-learn mode, you might want to verify that stages 3, 4, and 5 are passed as indicated.

Note: APC's initial warning *When clear of obstacles descend to intercept height* is of particular importance. Because APC has zero knowledge of possible terrain obstructions it is entirely up to the user to make sure that the pattern is a viable one. Internet resources such as SkyVector.com and EuroControl provide approach plates for most runways with ILS/VOR/GPS approaches which include 25 mile minimum safe altitude (MSA) information and other useful details.

For instance, suppose you are asking APC for vectors to runway 09 at Gibraltar AB (GBR). Here is a map view of the 12-mile downwind pattern that APC will generate without a care in the world.

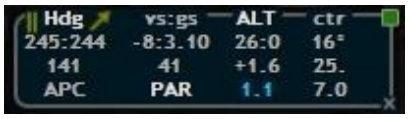
You better find out beforehand how high those mountains are, and whether it is even possible to avoid them. What you can do, within limits, is (a) change the intercept distance, or (b) change the glide slope angle via the AILA panel. Note that you cannot directly set an intercept height because that is determined by distance *and* angle, a calculation that APC must do for you. If the result is inacceptable given the terrain conditions, quit APC and try entering other values in AILA, or maybe select a different runway.

If all goes well, APC will eventually position you close to the intercept at the correct altitude, at which point Alice terminates and hands you over to PAR, the Precision Approach Radar, for the actual talk-down.

2. PAR: Precision Approach

Although it is not recommended, PAR can be called up without prior use of APC. When using it on its own you first need to set up the four AILA pages as described above, selecting airport, runway, runway end, and (possibly) intercept distance. Because PAR cannot manage complex approach patterns you have to make sure that you are on a viable straight-in line, with all AILA arrows pointing forward, and you must also be reasonably close to the intercept height. This can be quite tricky, so be advised that it is much better to let APC manage all these pre-PAR matters.

During the PAR talk-down – our PAR controller's name is Alan - the AP displays many crucial bits of information. Here is what it shows as we pass the seven-miles-from-the-runway mark, again in auto-learn mode.



We are flying a heading of 245 moving towards the AP's current heading bug of 244. Current altitude is around 26 (2600) and the ALT lock has been set to 0, in other words, we are descending until AP gets turned off when over the runway. The **vs:gs** cell tells us that our current vertical speed is -8 (-800), and that we are on a 3.10-degree slope angle, which is quite close to the ideal value of 3.0. Our offset from **ctr** (centerline) is a mere 16 feet, which at this distance is as good as being perfect, and we can expect Alan to call out "on glidepath, on centerline" on regular intervals. The ' ° ' mark next to the **16** additionally advises us that we could still bear a fraction further to the right. Earlier, Alan told us to check wheels down and locked, and **25.** indicates that our flaps are at 25% with gear down. Rate of descent will be corrected automatically as long as PAR is in auto-learn mode, but it is crucial to fully understand how the system ticks before attempting any of the more demanding "realism challenges" detailed below.

The rest of the PAR talk-down is pretty straightforward with continuous instructions mainly on headings, glidepath alignment, and distance from the runway. Even in auto-learn mode not everything is handled automatically: speed, gear, flaps, and the final flare remain your responsibility (auto-land this isn't!). At 0.6 miles to go, PAR asks you to "take over visually when you have the runway in sight", and at this point it will force the Autopilot OFF (feel free to turn it off earlier using the **Z** key). PAR will officially terminate with the call "over the runway."

Flying Tips

While the GCA gauges are 'generic,' we must acknowledge that each type of aircraft operates and behaves differently – indeed, real-life controllers had to learn the typical speeds and rates of turn of different types of aircraft, and to adjust their instructions accordingly.

To align on the glideslope, you can use AILA's ILS crosshairs or watch the current figures for **gs** (glideslope) and **vs (**vertical speed) in the AP's glideslope cell. Given an approach speed of about 150 knots I use the following rules of thumb.

glidepath call	**action**
well above glidepath	sink -1300 fpm
above glidepath	sink -1100 fpm
slightly above glidepath	sink -900 fpm
on glidepath	**sink -700 fpm**
slightly below glidepath	stay level
below glidepath	stay level or climb +200 fpm
well below glidepath	stay level or climb +300 fpm

For the heading instructions, the GCA panel provides fairly exact data on how many feet you are off the centerline. Watching the AP's **ctr** number decrease or increase you can easily see whether you are correcting or not, **0/zero** being the target number and the little bug ° indicating the required left/right orientation of the correction. Unfortunately, PAR controller Alan can give no trend calls such as "slightly left of centerline and correcting," as a real PAR controller would. However, the following pointers apply when AP is turned off or hidden

course call	**action/information**
on centerline	fly runway heading (use exact heading, not runway number)
turn left/right 3 degrees	you are 80-180 feet off centerline
turn left/right 5 degrees	180-600 feet off
turn left/right 10 degrees	more than 600 feet off

3. Realism Challenges

Most of the processes described above are executed automatically in auto-learn mode, requiring little hands-on interaction. Of course, no auto-learn mode was available to pilots in real life. Therefore, after having done a few auto-learn runs in fair weather, and having become thoroughly acquainted with the general processes of AILA, AP, APC and PAR, here is what you can do to make your life as a sim pilot a whole lot more realistic and exciting. Or miserable, as the case may be.

1. A good initial exercise is to turn off the AP's HDG lock leaving the ALT lock engaged, thus delegating proper PAR descent to the co-pilot, so to speak. Here you basically practice your manual heading adjustment skills.

2. You can turn on a **semi-automatic** mode by clicking the middle mouse button on APC or PAR. The APC/PAR lettering will turn **green**, indicating that from here on in you have to actively dial in the controllers' instructions on headings and descent into the AP's HDG and ALT locks. Not too difficult, but watch out, ALT is the tricky bit.

3. You can turn off both HDG and ALT lock and execute the controllers' instructions solely by using yoke, trim, throttle, etc. Difficult!

4. You can completely close and thus hide the AILA/AP readouts and fly the plane purely manually, following the instructions. Very difficult!

5. Finally, you can select various kinds of weather – down to the infamous zero/zero condition of zero ceiling and zero visibility. Very very difficult!

Credits

"Alice" at fromtexttospeech.com (APC controller's voice); Alan G. Ampolsk (PAR controller's voice); Karol "COBS" Chlebowsky (AILA gauge); Nick Cooper (testing and voice file laundering); Doug Dawson (sound gauges); Bill Douglas (Calclassic FS9 testing); Tom Gibson (AILA FS9 mods and testing); Tom Harnish (testing, research and documentation, tech support, videos); Manfred Jahn (GCA gauges); Ralf Scholten (compatibility testing).

Please direct all FS9/FS2004 related questions to the CalClassic Discussion Forum:
http://calclassic.proboards.com/board/3/calclassic-discussion

27 October 2019

Appendix: Installation

(1) From the zip copy the complete folder called "GCA" and the two files "**GCA_dsd_fsx_xml_sound.gau"** and "**GCA_dsd_P3Dv4_xml_x64_sound.dll**" to the sim's main "Gauges" folder. Allow the overwriting of files from a previous install.

(2) Go to your plane's "panel" folder. In the interest of housekeeping you could check if there is a "GCA" subfolder from a previous install. If so, remove it. Likewise remove any files beginning with **GCA_dsd….**

(3) If you had a previous install of V2.0 you can probably leave your panel.cfg as is. Otherwise, using a text editor, add the following lines to your panel.cfg:

```
Window08=GCA  //add as last entry under [Window Titles];
              //if necessary replace '08' by the next number in sequence
...
[Window08]    //this should be the same number as above
Background_color=0,0,0
size_mm=300,340
pixel_size=300,340
visible=1
ident=10010
position=8
type=special
gauge00=GCA!zzDAT37_FS9, 0,0,280,264
gauge01=GCA!apsmall, 40,266,202,55
//gauge02=GCA_dsd_fsx_xml_sound!Sound, 1,1,1,1,.\Gauges\GCA\gcacalls.ini
//gauge02=GCA_dsd_P3Dv4_xml_x64_sound!Sound, 1,1,1,1,.\Gauges\GCA\gcacalls.ini
gauge03=GCA!PAR, 0,0,1,1
gauge04=GCA!APC, 0,0,1,1
```

(4) One final step. As you can see, there are two comment lines defining "gauge02". We need to activate one of them by deleting its '//' comment mark. So, **FS9, FSX, and P3D users up to V3.4**: un-comment the line referencing **GCA_dsd_fsx_xml_sound**. And **P3D V4+ users**: un-comment the line referencing **GCA_dsd_P3Dv4_xml_x64_sound**. That's it.

As you know, if your panel window is numbered 08, as above, Shift-9 will open it in sim. If it has a higher number then select Menu bar > Views > Instrument Panel > GCA (in FSX) or Menu bar > Vehicle > Instrument Panel > GCA (in P3D). For a quick test of the sound system click either APC or PAR even when grayed out or on the ground. If you hear a snippet of the controllers' initial messages your sound setup is okay.

Manfred [dot] Jahn [at] uni-koeln [dot] de