

Condor Scenery Creation

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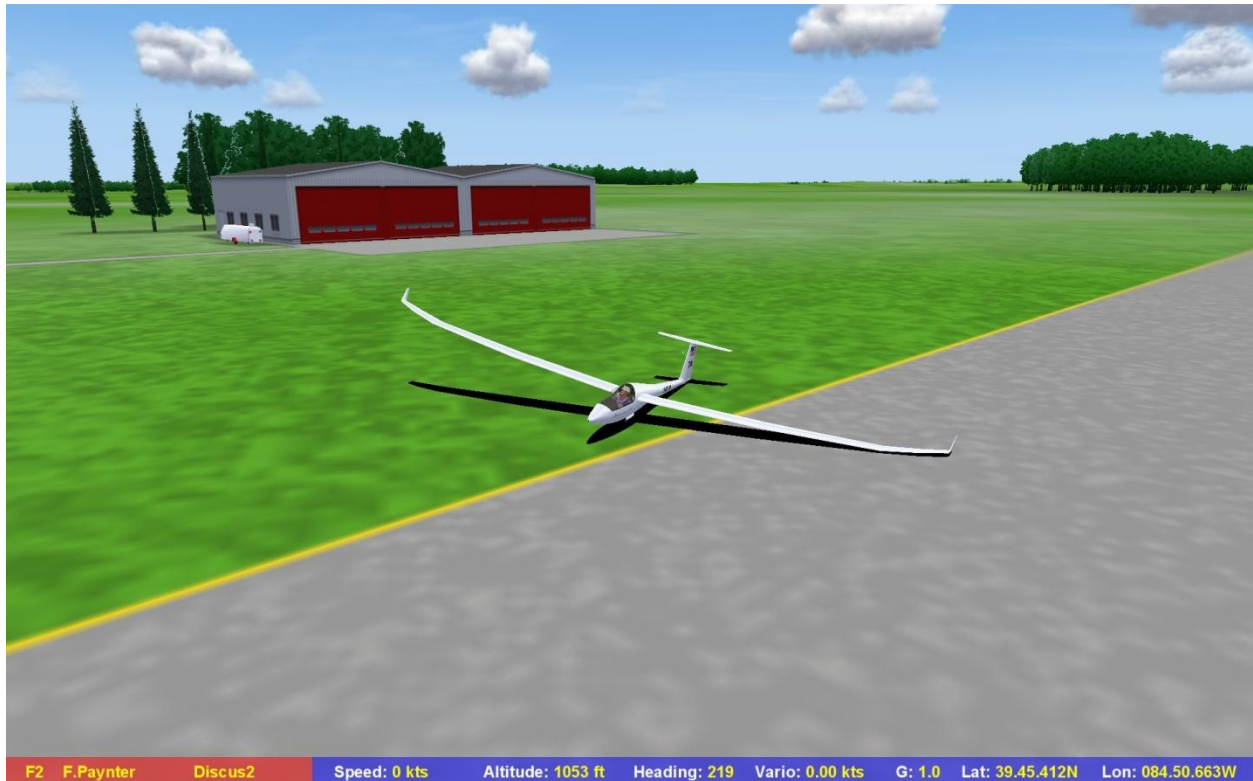


Figure 1: CCSC Gliderport in Caesar Creek Scenery

Lately I have been getting a lot of inquiries about how to create a Condor scenery for XYZ club's local soaring area. I recently spent almost a full year developing a Condor scenery for my home club's soaring area (Caesar Creek Soaring Club near Cincinnati, OH) and documented the process in a series of Soaring Café posts (<http://soaringcafe.com/series/condor-scenery-adventure/>). Although I am by no means any kind of expert on scenery development, I thought I would use this Condor Corner article to recap the process for others interested in doing the same thing for their club.

The good news regarding scenery development is that there is a LOT of good information and help out there in Condor-land, including a number of impressive and helpful YouTube video tutorials. In addition, SSA members Dave Leonard (ZL) and David Regula (DMR) have developed a number of superb sceneries including most of the western soaring areas (Minden, Uvalde, Moriarty just to mention a few) and some eastern ones as well (Mifflin, for instance).

The bad news is that the learning curve for scenery development is quite steep and long, so it is definitely NOT for the faint of heart. Starting from scratch, it's not unusual for it to take a year or more to get that first scenery up and running, and the end result is likely to look pretty shabby compared to ZL & DMR's beautiful photorealistic sceneries. Moreover, a prospective scenery designer is required to acquire expertise on several significantly complex software packages such as Terragen (required for basic terrain texture generation), the Condor Scenery Toolkit (CST) Landscape Editor (LE) and a reasonably current version of PhotoShop (PS). The CST is free, but PS is pretty expensive and the free version of Terragen can only handle 512x512 bit tiles. Any non-trivial scenery will exceed this limitation by a significant amount.

Oversimplifying hugely, there are seven main tasks associated with creating a scenery.

1. Defining the boundaries of the desired scenery. Quoting from the STK documentation "Condor is not designed for large sceneries, as it uses UTM projection and loads the entire digital elevation data at once". What this means is that the maximum scenery size is 400 x 400km, or about 240 x 240 miles. While this may sound like a lot, it's actually pretty constrained, especially for a western soaring area where the flight is just getting started after the first 250 miles or so. Even for our lowly CCSC area, it is easily 200 miles from one end of our area to the other.
2. Acquiring the basic terrain elevation data. This turns out to be one of the simplest and most straightforward parts of the entire project. Terrain elevation data for the entire world are available thanks to NASA's SRTM (Shuttle Radar Terrain Mapping) program and can be found at <http://dds.cr.usgs.gov/srtm>. This gets downloaded as .HGT (Height) files and then manipulated a bit for use with Condor.
3. Basic elevation coloring. A program called Terragen (short for Terrain Generation) allows a user to define what colors and color combinations are to be associated with elevation and slope characteristics of the terrain elevation data. This is one area where the available tutorials and documentation is a bit thin and/or contradictory, and where I spent a LOT of time chasing my tail before I figured it out. Once I did, however, it started to make a bit more sense. I get the impression that experienced developers of 'photorealistic' sceneries bypass this step altogether (more on this later). The result of the coloring exercise is a 'texture' (it took me a while to understand that 'generating a texture' meant 'coloring a tile').
4. Generating fields and forests. A basic (non photorealistic) scenery consists mostly of treed areas and agricultural areas, scattered somewhat randomly around the landscape. Treed areas are further differentiated into deciduous and evergreen forests, where deciduous trees occupy low areas and evergreen forests are at the higher elevations. Trees are 3D objects that give the scenery a more realistic look, and are helpful for creating a more realistic immersion. In most sceneries, forest and field areas are placed somewhat randomly via 2D bitmap templates or 'masks'. For a forest map, trees are created wherever the bitmap is black and not where it is white. Similarly, a field bitmap defines where fields appear. These two bitmaps are independent, so it is possible to have fields and forests overlapping, requiring potentially time-consuming editing operations to clean up trees in the middle of lakes and/or runways, etc.

5. Generating 'culture' (roads, rivers, towns and cities, etc) textures. Sceneries are pretty boring and unrealistic if they don't have at least basic culture features, but these items aren't trivial to generate even at the basic level. In my Caesar Creek scenery I settled for using an overlay copied from a SeeYou map of our soaring area, where cities and towns are represented by yellow blobs, roads by jagged red lines, and lakes/ivers by blue patches. In my scenery you are literally flying over a SeeYou map, with no 3D objects except for trees and the occasional canned airport package. 'Photorealistic' sceneries replace the SeeYou yellow blobs with actual aerial images of houses and buildings, but these still don't have any height, so extra work must be done to place custom-designed 3D objects on top of the imagery.
6. Defining and generating airports and airport structures. Basic airports in Condor are actually pretty easy to generate using the CST Landscape editor, but going beyond the default runway/hangar combination is another story. There are some sceneries out there where the airports are graced with detailed photorealistic hangars and other buildings, right down to the signage and fire extinguishers on the walls, but there is no easy way (at least none that I know of) to do this. Each scenery developer creates their own library of 3D objects and techniques for generating the desired 3D objects, and (as far as I know) they aren't available to mere mortals.
7. Defining the 'thermal map'. There is a built-in default thermal map for each scenery, and it defines a probability distribution for thermal generation. For a flatland scenery like Caesar Creek (where the highest thing around is an interstate overpass) this is basically a random distribution. If a scenery has significant elevation differentials, the probability gets tilted a bit to prefer the high ground. The default distribution can be changed, but again it's not a task for the faint of heart (I remember Dave Leonard relating to me his frustration at being unable to adequately model the sea breeze front at Uvalde – if ZL couldn't do it I don't know who can!).

Basic vs 'Photorealistic' Sceneries

When you look out through the canopy in Condor, what you see is the result of a very complex set of operations that creates, pixel-by-pixel, an image that tricks you into believing you are flying in a 3D environment. The raw material for creating this image is a set of color images for each 'tile' of the scenery. Each tile is divided into sub-tiles, and each sub-tile has associated with it a number of differently-scaled versions of the same scene. The Condor rendering engine selects which scaled image to use based on the distance from the viewer to that particular geometric location; a nearby tile will be rendered in full detail, including visible 3D trees and structures, while a distant tile might be rendered as a 4x4 bit single-colored smudge on the horizon. The scenery developer supplies the fully-detailed images, and the CST creates all the required sub-images. When the first Condor sceneries were developed, the underlying tile images were all created algorithmically using Terragen, with 3D trees and structures overlaid later. However, designers soon came to realize that *any* image could be used to represent a particular tile, including a cellphone photo of your favorite pet cat if you wished. In fact, one of the exercises I went through with my CCSC scenery was to do just that – and I found myself flying over a humungous set of cat teeth – yikes! Once developers figured this out, they soon realized they could bypass much of the tedious terrain coloring generation steps by 'simply' (it's not really simple,

but...) overlaying aerial photography onto the elevation data, and voila – a photorealistic scenery! Despite the appeal (and mind-blowing beauty) of this approach, there are three major problems in creating photorealistic sceneries

1. Where to get the required high-quality aerial photography? An obvious choice would be Google Earth, but those images are all copyrighted – oops! Another possibility might be NASA's WorldWind project, as it might be arguable that this is 'public domain'.
2. Even modest photorealistic sceneries generate **huge** scenery file sizes. It's not unusual for a 4096 x 4096 bit photorealistic scenery to be several GB in size, leading to download difficulties and a degradation in flying performance due to frame rate reduction.
3. The beauty and detail of photorealistic sceneries creates an expectation that the remaining components of the scenery will be just as detailed and beautiful. It is a bit disconcerting to be flying over a detailed photograph of a city, only to realize it is completely **flat** – no height to it at all. So, the developers wind up investing huge amounts of time making the 3D structures live up to the level of the photography. Talk about being 'hoist by one's own petard'!

The bottom line for this very short and crude explanation of the trials and tribulations of scenery development is this: If you are thinking of developing a scenery for your club, you should realistically expect to spend a year on the project, and the result will probably be very crude compared to most of the other popular sceneries. Then you get to spend another six months to a year re-doing the scenery to get it to the point where you are willing to have your name associated with it. The good news is, when you get to that point (and I haven't yet – just hoping here) you'll have something that is a real accomplishment, and something that might well become a permanent part of your club's history.

My Caesar Creek scenery is a very basic – nay crude – 512 x 512 bit scenery. It is perfectly flyable in Condor, but not very interesting visually. Actually, it is 'butt ugly', but what can you expect after only 10 months of work? One of the reasons I decided to talk about sceneries in this column is to motivate myself to redo it over the coming winter season, with improved resolution and maybe some 3D airport structures and city buildings, etc. I would love to be able to land my Condor glider at CCSC and see the clubhouse, barn and other 3D structures, but that's a horse of a different color entirely.

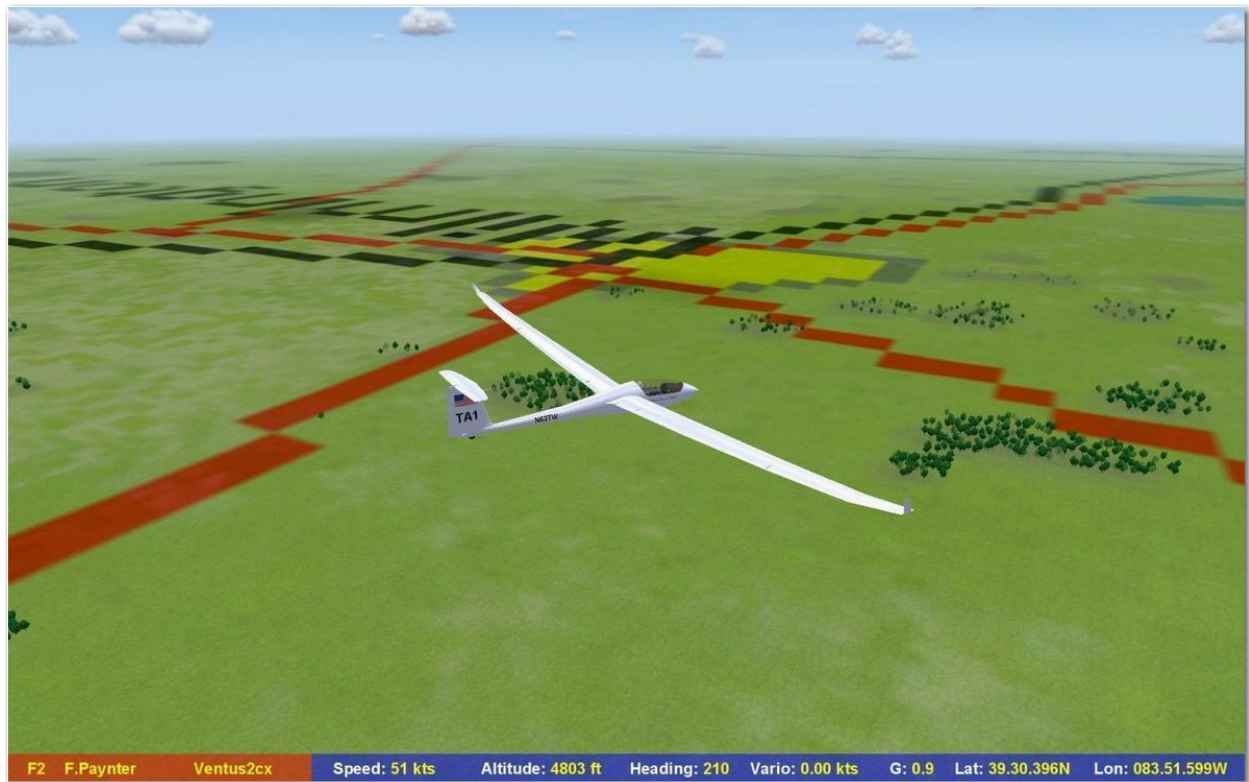


Figure 2: Culture Map from SeeYou