New 300-m (LOD7) Terrain Mesh of British Columbia and Southeast Alaska

File Names: bcmesh7a.zip, bcmesh7b.zip, bcmesh7c.zip, bcmesh7d.zip (4 Parts)

Author: Holger Sandmann

Date of Release: January 2003

Version: 1.00

The files in this package contain a new mid-resolution terrain mesh for the entire province of British Columbia, southeast Alaska, and parts of the U.S. North Cascades. The source data for B.C. are 250-m digital elevation models and for the U.S. areas USGS 1-minute digital elevation models (90- or 180-m resolution). In addition, Canadian areas outside of B.C. but within the mesh grid are modeled from GTOPO30 data (~ 1000-m resolution). All data were compiled and edited in MicroDEM 6.0 and resampled to LOD (Level of Detail) 7, or 306 meters horizontal resolution, with the Microsoft Terrain Software Developer's Kit (SDK) utilities. The following sections provide information on installation, known technical issues, procedures used, and future updates.

Installation:

1) Extract the zipped files to a temporary directory, making sure that the "use folder names" option is enabled.

2) When the file is unzipped to the temporary directory you should see a folder, called "BC LOD7 terrain mesh", with the standard "scenery" and "texture" subfolders, and a third subfolder, called "mesh tile relief maps". Also, there should be a second folder, called "flights".

3) The "BC LOD7 terrain mesh" folder contains this read-me file in both Adobe .pdf and plain text format, as well as a couple of screenshots of the new terrain mesh.

4) The terrain mesh .bgl files are in the "scenery" subfolder, and labeled by their approximate geographic extent. For example, "L7_4951_120124.bgl" is the mesh tile of the area between 49 and 51 degrees latitude (North) and 120 to 124 degrees longitude (West). Each tile can be used independently, so you only have to keep those that you are interested in.

5) The "scenery" subfolder also contains a file called "patch_lm.bgl". This is the patch for the display error with the default terrain mesh, described below in Known Issues, Topic 1**. Note that this file is only contained in and relevant for bcmeshd.zip!**

6) The "texture" subfolder should be empty.

7) The "mesh tile relief maps" folder contains .jpg shaded-relief images of all the terrain mesh tiles, named in the same fashion as the .bgl files. A brief text file located in the subfolder explains how I produced these "maps". They don't serve any purpose other than being visual aids, so feel free to delete the "mesh tile relief maps" folder.

8) Move the "BC LOD7 mesh" folder into your "FS2002/AddOn Scenery" folder or wherever you keep your add-on sceneries. If you already have other parts of my B.C. LOD7 mesh series installed, Windows

will warn you of a potential for overwriting existing files. Click on "yes", as the only identical files contained in each package are the basic documentation.

9) The "BC terrain mesh flights" subfolder in the "flights" folder contains a few startup situations, which will place you at airfields or on lakes (in default aircraft) in interesting locations throughout the mesh area. If you want to use these, move the subfolder into your "FS2002/flights" folder and select a flight in the FS2002 startup screen.

10) That's it! Time to enjoy the scenery!

Known Issues:

I believe that you will enjoy this new terrain mesh. However, for the perfectionists among us—including myself—there are always imperfections to complain about and possible or impossible improvements to dream of. Here's a list of visual and technical problems with this terrain mesh that I am aware of:

1) Mesh display error: There appears to be a strange bug in the default terrain mesh file in at least two areas, which prevents the display of any terrain mesh with a resolution below LOD9: the Lower Mainland around Chilliwack, and the very southeastern corner of the province. I don't know the reason for this problem but I have found a work-around solution. For the Chilliwack area, I used 100-m elevation data to create a LOD9 mesh of the area impacted by the bug. This patch file is included in the "scenery" subfolder and thus automatically active whenever you activate the LOD7 mesh. If you want to test whether the bug is not just a problem on my system, move the "patch_lm.bgl" temporarily out of the "scenery" subfolder, then start a flight at Chilliwack airport and see whether the mountains around you show a marked lack of detail (i.e., the default terrain mesh).
For the southeastern problem area, I don't have an equivalent patch. Instead, you can deactivate the default terrain mesh while flying in the area: on the Settings > Scenery > Areas List screen, deselect the "default terrain", which is located at the bottom of the list. The proper way of doing this (i.e., to avoid texture display problems) is to load a flight with the default terrain still active, pause FS2002, deactivate the default terrain in the Areas List screen, then click OK to reload the scenery. While flying in B.C. and southeast Alaska you won't need the default terrain since my mesh covers the entire area. However, I can't guarantee that you won't see odd seams or texture dropouts somewhere and you definitely need to reactivate the default terrain if you fly anywhere else.

2) Raised or sunken airports and lakes: The default scenery components, such as lakes, shorelines, and airports, are optimized for the default terrain mesh and fixed in location and elevation. Any add-on terrain mesh can disrupt this "balance" and, even if technically more accurate, may look worse in some places: lakes or airports sit on "plateaus" or in "sinkholes", and extreme cliffs show up in unexpected places. In most cases, the error lies within the default scenery, specifically incorrect lake elevations (see below) and airport locations (such as Lytton, Cache Creek, and Tsuniah Lodge in B.C., all of which are more than 1 km away from their true location). I experimented with scaling elevation values, e.g., multiplying all elevation data with 0.95 or 1.05. Unfortunately, most tiles show both raised and sunken features; while re-scaling eliminates one problem it increases another. More successful were my efforts of fine-tuning the location offset of each mesh tile by using steep valleys and shorelines as visual guides. However, you'll still encounter some of the oddities listed above. Complete fixes of elevation problems would require extensive editing of the default scenery or the terrain mesh, or both.

3) Steep shorelines along dammed lakes: FS 2002 terrain meshes of B.C. in particular have problems with many of the larger lakes, such as Williston Lake, Kinbasket Lake, Kootenay Lake, and the Arrow Lakes. Hydroelectric dams raise their real-world levels but lake elevations in the default scenery appear

to be set to the pre-dam outlet level. The effect is that the closer one moves down the lake toward the location of the dam, the steeper and higher the lakeshore becomes (take a flight around Castlegar or Nelson and you'll see what I mean). These "eyesores" are visible in the default mesh as well, though the effect is less pronounced. Perhaps someone could build add-on sceneries of each lake, which correct the water level and include the dams …

4) Unsightly rectangular flatten areas: I am aware of only one such site in my terrain mesh—the Kamloops airport area—but it sure looks ugly! Again, extent and elevation of the flattened area are hardcoded in the default scenery file and I don't know of any practical fix. Let me know if you do.

5) Jagged "seams" along mesh tile and provincial boundaries: In some areas, particularly along the boundary of B.C., you will come across unrealistic looking straight lines or jagged ridges. These are the result of merging source data of different geographic projections or resolution, and are impossible to avoid without extensive hand editing.

6) Incompatibility with other 3rd-party scenery add-ons: Scenery add-ons that are placed outside of default airports (i.e., their flatten areas) might be negatively impacted by this terrain mesh. In some cases, adding or adjusting a flatten switch will work, in others the scenery itself might have to be changed. I apologize for the inconvenience! Hopefully, the authors will like this new mesh and post updates to their scenery add-ons in the future. I will gladly assist with any such updates if the problem can best be fixed by editing the mesh itself.

7) Incompatibility with other terrain meshes. If you are using 3rd-party terrain meshes for adjacent areas, such as some of the mid- or high-resolution meshes for the U.S., you may experience unsightly "seams" where the meshes overlap. It might be possible to eliminate or reduce such effects by experimenting with the scenery priorities in the FS2002 Areas List window of the Scenery Library. Keep in mind, though, that FS2002 will always display the active mesh with the highest LOD (unless there's a bug, such as the one in the Lower Mainland).

8) Impact on frame rates: Steep mountains modeled with high-resolution terrain meshes do need high CPU power for acceptable frame rates. If you experience frame rate drops that are clearly due to the terrain mesh (i.e., while flying out of sight of airports, scenery add-ons, AI aircraft), try reducing the terrain mesh quality slider to 80% or less, autogen density to normal or less, and perhaps the water effects slider as well (all of these are on the Settings > Graphics screen). Reducing visibility to 20 miles or less (in the World > Weather window) helps but is not necessarily desirable for sightseeing. Finally, I keep the target frame rate locked to around 20, (in the Settings > Hardware window) which helps with texture and terrain refreshing when flying fast planes.

Source Data:

The 250-m digital elevation model for B.C. was contained in a single 0.5 GB ArcInfo grid file, in Albers Equal Area Conic projection.
Note that these data are NOT to be confused with the provincial TRIM II high-resolution elevation data, which are available at http://www.landdata.gov.bc.ca/, for measly CAN$400 for each of over 4,000 map sheets.

Since the LOD grid I use extends beyond the boundaries of B.C., I needed to fill in those areas with other elevation data. For the Alaska panhandle and areas of Washington, Idaho, and Montana, I used USGS 1-degree elevation models (also called 1:250k DEMs), available free of charge at the EROS Data Center

website at http://edc.usgs.gov/geodata/. These data have a horizontal resolution of approx. 90 meters in the conterminous US, and approx. 180 m in Alaska.
For the Canadian areas outside of B.C., I used USGS GTOPO30 data, specifically the file "W140N90" file, available free of charge at http://edcdaac.usgs.gov/gtopo30/gtopo30.html. These data have a horizontal resolution of approx. 1 km, which is similar to the FS2002 default scenery.

Outline of my Procedures:

1) Setting up an EXCEL spreadsheet to calculate the Level of Detail (LOD) grid boundaries that need to be used for a seamless display of terrain mesh tiles. The spreadsheet also allows me to calculate the input parameters required by the Microsoft Terrain Maker SDK utilities.

2) Import B.C. source data into PAMAP GIS to change the geographic projection from Albers Equal Area to UTM WGS84, as required by MicroDEM and FS2002.

3) Export B.C. data (now in WGS84 projection) in 6-degree wide (E-W) strips, conforming to the four UTM zones (8 to 11) covering the province (this also reduces the potential for geographic distortions).

4) Import UTM strips into MicroDEM and subset these into 3-degree high (North-South) tiles to improve handling and further decrease risk of distortions.

5) Export each tile as DTED format at 8 arcsec (approx. 240 m) resolution and load and resave as MicroDEM .dem file. This turns the tiles into perfectly rectangular grids.

6) Download USGS DEMs and GTOPO30 data of areas outside B.C. but inside the LOD grid. Process in MicroDEM as the B.C. data (i.e., convert to 8-arcsec DTED DEMs) and cut subsections that cover the area needed for each mesh tile.

7) Merge B.C. mesh tiles with the USGS and GTOPO30 data.

8) Check success of merging and edit obvious seams or holes.

9) Subset each tile to its final size. Do final hand-edits of obvious problems.

10) Use MicroDEM's Calculate > Map Window Corners and Analyze > Header features to transfer tile boundaries, rows, and columns into the EXCEL spreadsheet.

11) Use John Child's mdem6bsq.exe utility to convert each .dem tile from MicroDEM format to .bsq format.

12) Setting up the .inf files for each tile as required by MS Terrain SDK software.

13) Using resample.exe, tmfcompress.exe, and tmf2bgl.exe utilities (MS Terrain SDK) in sequence to reformat each mesh tile from .bsq to .bgl format.

14) Installing the .bgl files and testing in MS FS2002. Go back to steps 9 or 12 if required (i.e., many times).

Software Used:

1) MicroDEM 6.0 (August 2002) freeware, by Professor Peter Guth of the Oceanography Department, U.S. Naval Academy: http://www.usna.edu/Users/oceano/pguth/website/microdem.htm

2) MDEM6BSQ.exe freeware utility to convert MicroDEM .dem files to .bsq flat binary format, by John Childs: mdem2bsq.zip, available at http://www.terrainmap.com/

3) FS2000 Terrain Software Developer's Kit (SDK) freeware utilities: http://zone.msn.com/flightsim/FS02DevDeskSDK15.asp

In addition I used MS EXCEL97 for the LOD spreadsheets, Photoshop for image editing, PAMAP GIS (http://www.pcigeomatics.com/; no longer available) for changing data projections, and FS Screen for in-flight screenshots.

Additional Documentation:

This was my first mesh design project. It turned out to be much tougher than expected due to the large area involved and the problem that the source data were not in the common projection. During my struggles with the technicalities, I found the following sources of information extremely useful:

1) Microsoft's Flight Simulator 2002 Terrain SDK documentation, available at http://zone.msn.com/flightsim/FS02DevDeskSDK15.asp

2) Steve Greenwood's (Flight-Sim Traveler) webpages, which are full of excellent information, tips, his own add-on meshes, and links to other resources: http://www.fs-traveler.com/fs-traveler.html

3) Various discussion threads on AVSIM's Mesh Scenery Design conference: http://ftp.avsim.com/cgi-bin/dcforum/dcboard.cgi/

4) John Child's bottomless "Digital Terrain Modeling and Mapping Journal" webpages: http://www.terrainmap.com/

5) The USGS Guide to their 1-Degree DEMs: http://edc.usgs.gov/glis/hyper/guide/1_dgr_dem

---

Future Versions:

I consider this terrain mesh a work in progress. If I come across other high-resolution data I will certainly upload them as add-ons. Also, I am open for suggestions regarding manual changes to particularly unsightly areas. I have already hand-edited the terrain mesh around Tsuniah Lake Lodge (CAF4) and Trail (CAD4); the FS2002 airfields are in the wrong locations and ended up in big holes in the middle of mountainsides. The approach I intend to follow regarding further edits is to collect a list of desired work and post and discuss it in one of the AVSIM mesh design or bush flying forums.

Acknowledgements:

Obviously, any digital elevation data would be worthless for FS2002 enthusiasts without the wonderful free software tools to put the data into Flight Simulator. I am very grateful to the authors of the software I used. Also, many thanks to everyone in the active Flight Simulator community for providing such great and diverse freeware add-ons and active discussion forums. Finally, thanks to J for her blank but simpatico stare at my time-consuming 'hobby' ;-)

Disclaimer:

The author is not responsible for any damage, which may result from the use of this product.
Use at your own risk. No warranty is offered.

License:

Author:

Holger Sandmann
hsandman@sfu.ca

My aging system: P3 750Mhz, 256MB RAM, Radeon 8500 (64MB), 20GB HD, Windows 98SE.

January, 2003