

Problems:

When hiking, I want to use my phone (in Airplane mode), with GPS,

- a. to show my position.
- b. to show the actual route I took (breadcrumbs).
- c. To show a planned route.

As an android user, I have found the best program to handle the above is "OruxMaps". This application will take any .JPG or .KMZ (and others) as a base layer and show live GPS data on top without any need for cellular connection or WIFI. On my Samsung phone, I can use the GPS while the phone is in airplane mode thus the battery life is EXCELLENT!! So most any paper map can be used once you get it into the format that OruxMaps prefers. This document will review the process that I use for this.

About me. I am a regular user of all applications mentioned in this write-up. I am not associated or have any connection whatsoever to these vendors. I am a very satisfied user that have made several donations as I feel these guys have done so much work and ask so little. This writeup is but a very small attempt to give back and otherwise provide something I wish was available to me in the early days.

How do I get a paper map onto my phone for use by OruxMaps ?

What are the required steps:

1. Scan full size map into a .JPG file ("E" size plotter/scanner is the right size).
2. Position the .JPG onto a GIS system to align/scale/rotate/stretch etc. so the items on the .JPG overlay exactly with landmarks on the ground. This is called "Geo-Referencing".
3. Take the output from step 2 and convert into a format that OruxMaps likes.

As for 1, there is not much to say, goto a local copy shop (Staples etc..) and have them scan in your map.

As for 2. There are many options. Originally I used GE google earth (free version). I would open GE and from there, ADD a map. I would then align/scale/rotate/stretch as needed so the roads on my .JPG exactly overlay the same roads on GE. For smaller maps, this could be seemingly quick (15 minutes) to 1 hour, per map. It works but is very frustrating.

As for 3. OruxMaps offers a Microsoft Windows tool to convert the output from step 2 (a .KMZ file) into the format OruxMaps likes.

So far, all this is free, but step 2 is very arduous.

Whats a better way ?

Step 1 is the same.

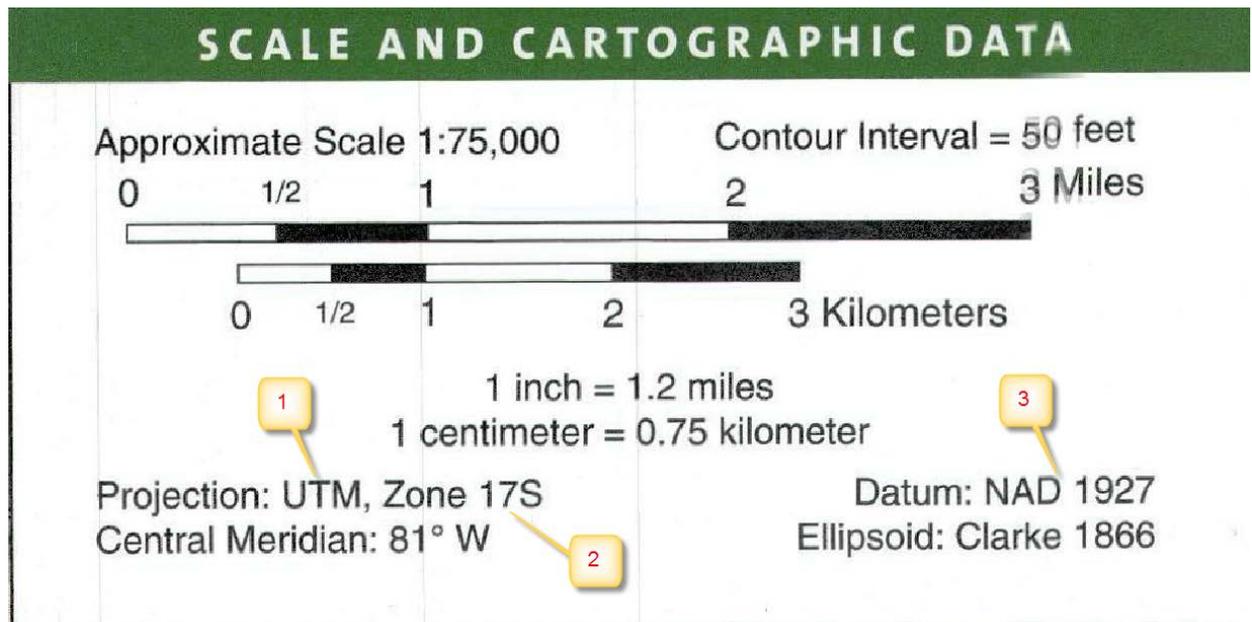
Step 2: use MAPC2MAPC64 program. Within this program, you click on a specific position and tell the program exactly what coordinates this point represents. Repeat this for 8 or so points and it will do all

the align/scale/rotate/stretch by itself. When this step is done, you can convert the now geo-referenced .JPG into many other program formats; one of which is OruxMaps.

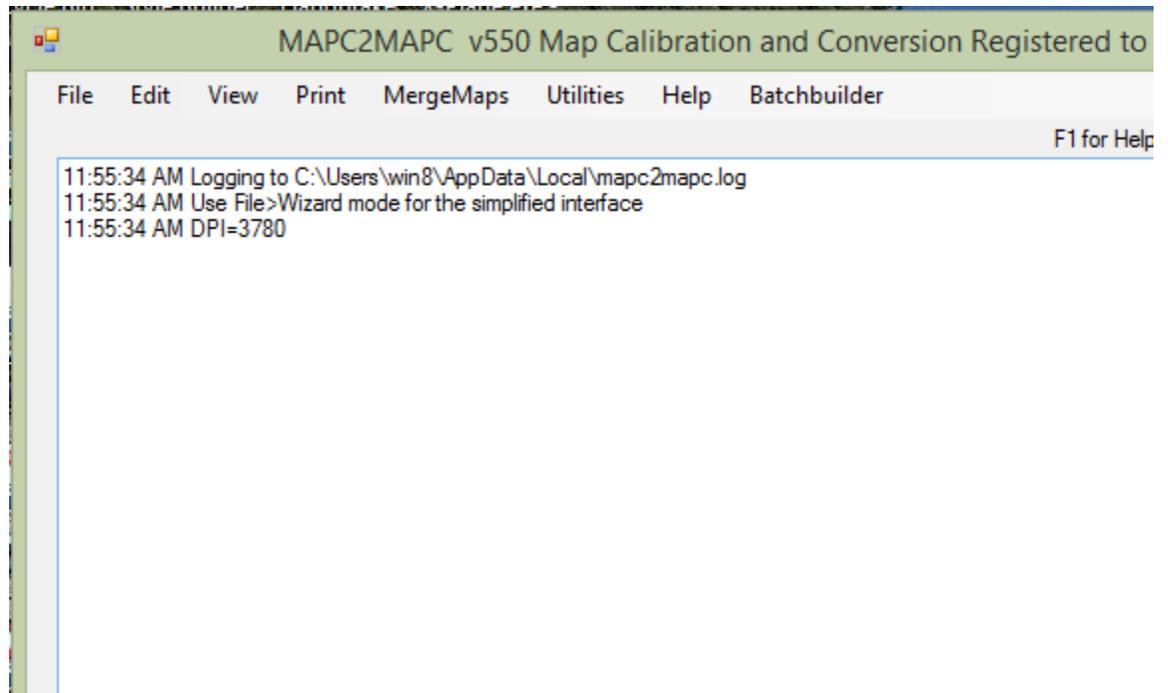
Step 3: use MAPC2MAPC64 program and choose "Write to Mobile" then choose "OruxMaps sqllite" format. The result is a folder on your computer that contains the exact files/format that Oruxmaps likes. You need to get those files into your phone and the OruxMaps program will incorporate them.

Now lets see this in action.

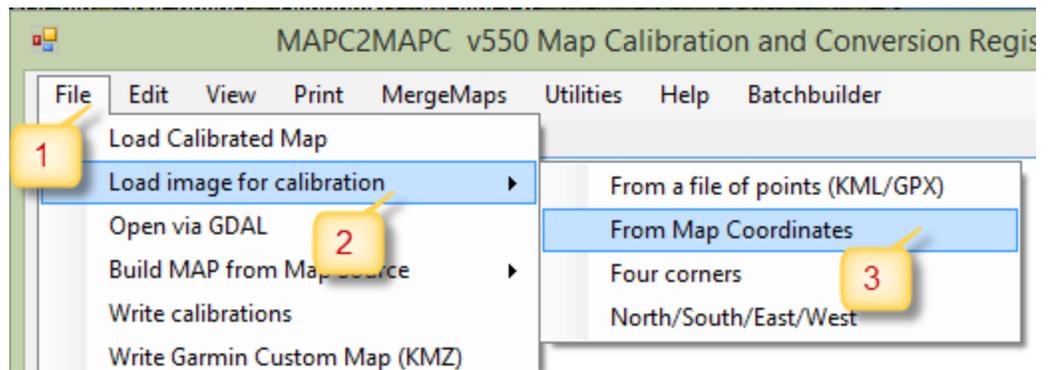
1. Scan into .JPG file format.
2. Use MAPC2MAPC64 program. Since I have a 64bit computer, I use the 64bit version of this program.
 - a. First, we must know the some info about how the .JPG map was built. There must be some type of grid on the map. Observe below, in my example of a National Geographic map:
 - i. 1. Projection is UTM and specifically zone 17.
 - ii. The Datum is NAD1927. Since this map is an area in the Continental United States, the datum that this map was drawn in is "NAD27, CONUS". This means: North American Datum 1927, Continental United States. So, in my example,
 1. Projection = UTM
 2. Datum: NAD27, CONUS



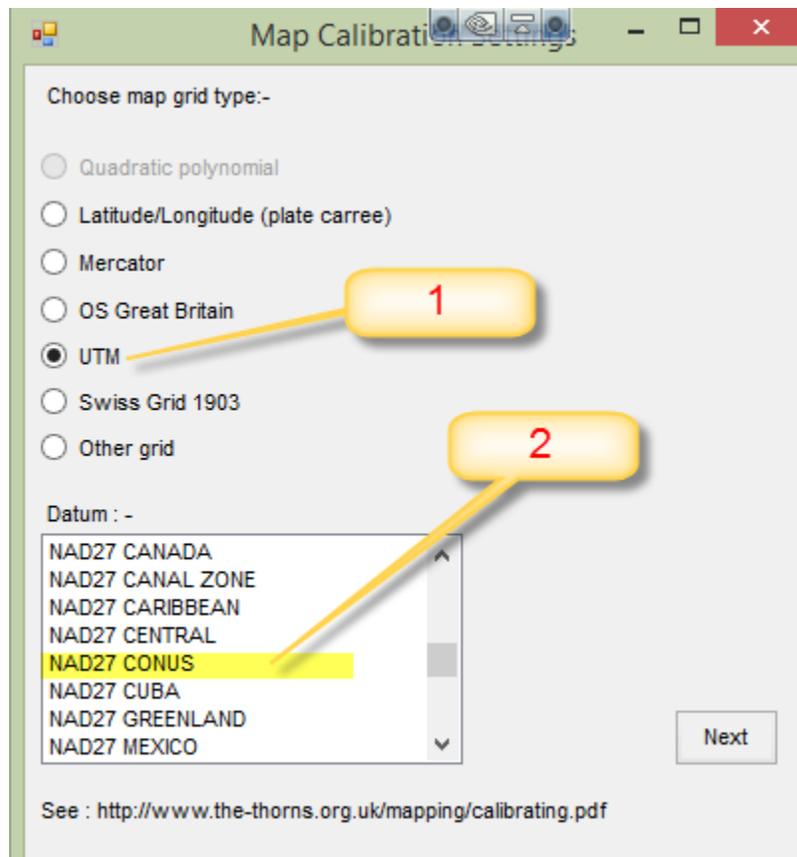
- b. Before you go any further, you must know the "Projection" and "Datum" for your .JPG
- c. We now start program by double clicking the MAPC2MAPC64 icon on desktop.
- d. You should see a screen with something like the below:



- e. Now lets load in a .JPG file to Geo-Reference like below:

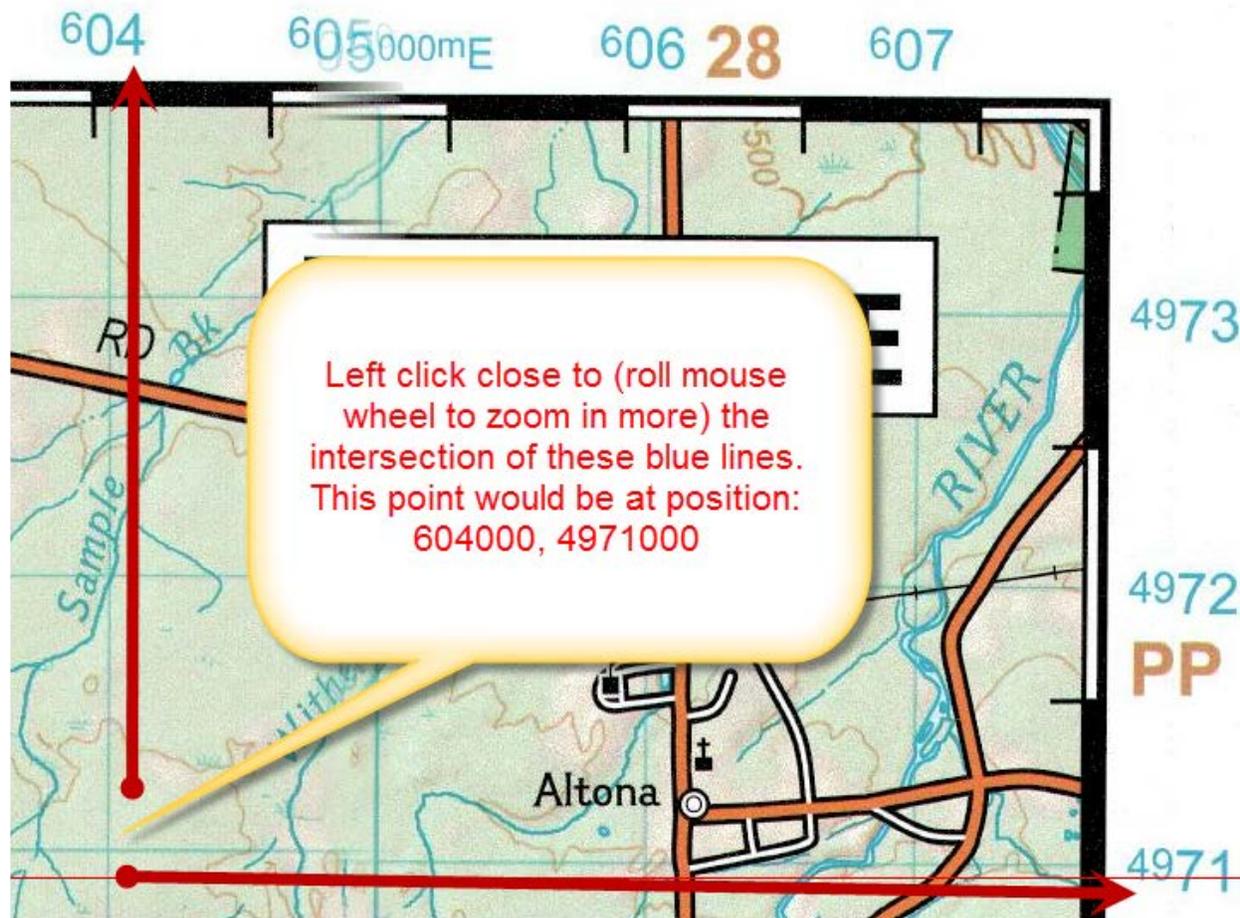


- f. Choose your .JPG file when the file chooser box opens.
g. You will now be presented with this screen:

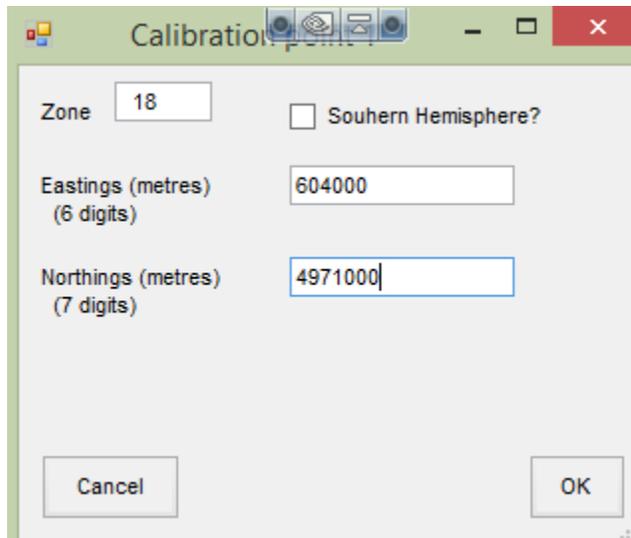


- h. In my example, you choose the Projection (item 1) and Datum (item 2). When you hit NEXT button, a map will open. Roll the mouse wheel to zoom into upper right corner.

After you zoom in a lot, you will see something like this below



- i. In my example, I zoomed into an area where the blue grid lines intersection somewhere in the open. I then LEFT click the mouse right at the intersection. You do NOT need to be exactly on the intersection. The closer the better, but don't get crazy.
- j. The LEFT click will open this dialog box below.

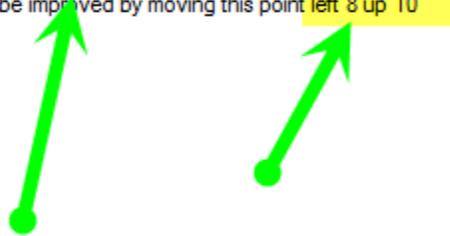


- k. From the above diagrams, you can easily see where I got the values for each of these boxes (hint, follow the red arrows)
- l. Now move around map, in no specific pattern and add more calibration points. I am finding that 6 points seems to be sweet spot for the better results. I choose not to add points in a rectangle pattern; I go randomly all over and always get as close to each corner, and a few in the middle areas, as I can. When you add at least 4 points, it will provide an "OK to Finish" button. Click on that. NOTE: it seems if you choose 7 or more points, the program will use a different type of calculation than if you choose < 7.
- m. At this point, the program will calculate and try to make sense of where you placed the points. Rarely will it indicate your done; every time I do it I need to move at least a few points. Note: If it says to move a point down 5000 (or similar) then you did not put the correct coordinates for that point at box "J" above. In this case, its best to delete that point and re-create it.
- n. Ex: It will say "Move point 1 left 3 and down 5" (see graphic below). You click on VIEW button on top menu and it again shows the map. Now move the mouse over each of the RED icons and it will popup to tell you which icon is Point 1. Since I always start putting calibration points in upper right and go clockwise, I know the upper right point is always point 1. When I LEFT click on that point, it opens a box where I hit the LEFT button 3 times and the DOWN button 5 times (as instructions directed). Then I hit OK and the red "X" in upper right corner of map to close the map. At this point, you repeat steps M & N until it does not tell you to move any points.

```

8:18:09 PM Calibration point 44.479680 -74.635347 5722 4351 NAD27 CONUS cor
8:18:09 PM Calibration point 44.615202 -74.848759 3075 1947 NAD27 CONUS cor
8:18:09 PM Calibration point 44.686887 -74.684525 5123 683 NAD27 CONUS com
8:18:09 PM Projection
8:18:09 PM Metres/pixel(mm 1b)=6.36769627889585
8:18:09 PM Average projection inaccuracy in original grid=7.5522
8:18:09 PM Largest inaccuracy at point 1 at 10477 267 8.1 10.9
8:18:09 PM Consistency will be improved by moving this point left 8 up 10

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- o. REPEAT: If a point is really far off (it says to move it down 25 or anything more than 10) then you did not put the correct coordinates for that point at box “J” above. Like step “N”, Go into VIEW and find that point. Right click on it and hit the DELETE button. Then put the cursor on the same (or perhaps close by) intersection of blue lines and hit the CENTER mouse button. This will add a new point to map; in effect replacing a poorly placed point.
- p. If you see the message in below graphic, you are NOT done yet. Notice it is reporting there remains an issue, as indicated with RED highlight, with point 6 (yellow highlight). Observe the green highlight. It shows a number larger than the 0.5 next to it. This shows an x,y pair, thus the Y value of point 6 needs tweaking to get both values below 1.0 I will click the VIEW command again and move point 6 UP 1 to try and fix and hope it is last adjustment needed.

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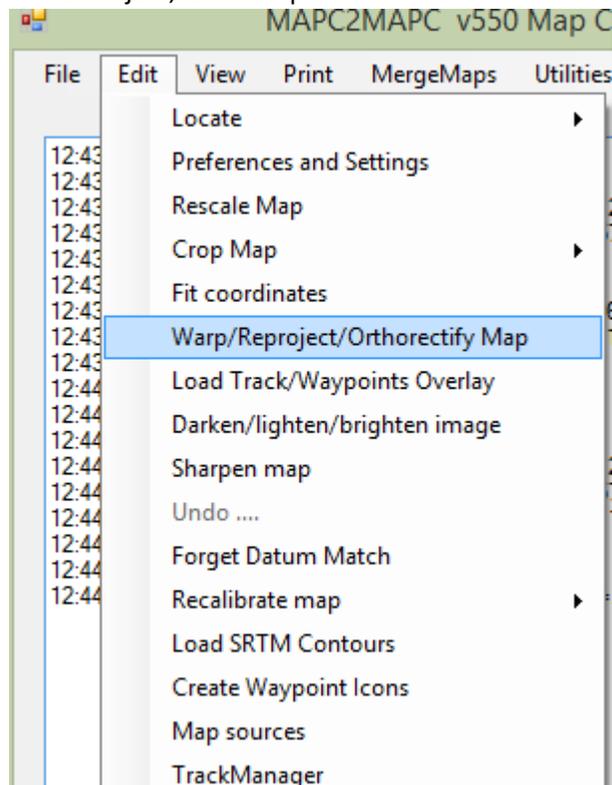
8:24:47 PM Calibration point 44.615176 -74.848323 3077 1930
8:24:47 PM Calibration point 44.686862 -74.684090 5127 693
8:24:47 PM Projection
8:24:47 PM Metres/pixel(mm 1b)=6.36843616045895
8:24:47 PM Average projection inaccuracy in original grid= 8227
8:24:47 PM Largest inaccuracy at point 6 at 73 4793 0.5 1.0
8:24:47 PM Consistency will be improved by moving this point

```

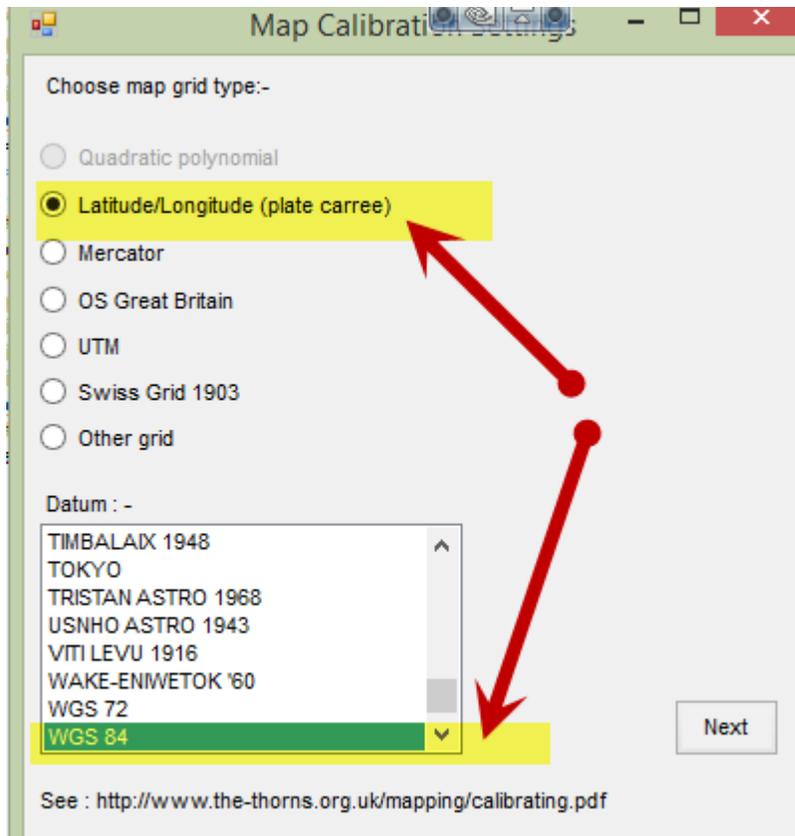
- q. When it finally shows the message like the green highlight below, you are done with “Geo Referencing” your .JPG NOTE: I have never tried to reduce the value highlighted in green below. I suppose you would need to move points around and repeat all the above. I have found GE review of most maps are great, but have never taken time to associate this number with quality of GE overlay.

```
3:31:09 PM Calibration point 44.615178 -74.848329 3077 1950
3:31:09 PM Calibration point 44.686862 -74.684090 5127 693
3:31:09 PM Projection
3:31:09 PM Metres/pixel(mm 1b)=6.36843640887132
3:31:09 PM Average projection inaccuracy in original grid=.7444
```

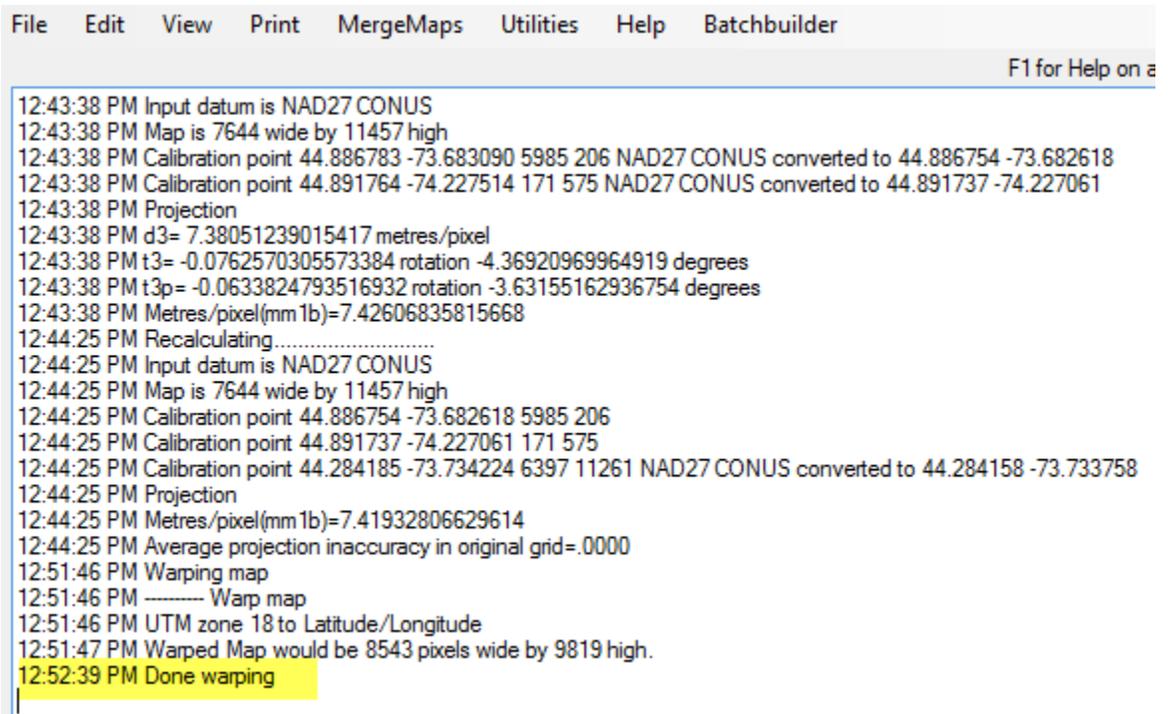
- r. At this point, we have Geo-Referenced a .JPG but only in the format the map was developed. I want to see this in Google Earth (GE), to confirm it is in correct location, then I want to convert to OruxMap format.
- s. If you accidentally hit FILE then EXIT you lose all your work. Everything you have done is in memory. Do NOT close the program !!!!
- t. To get into GE format, we need to:
 - i. “Re-Project” it. This is truly a superb tool in this program as you can re-project into many different programs/uses.
- u. To Re-Project, choose option like this:



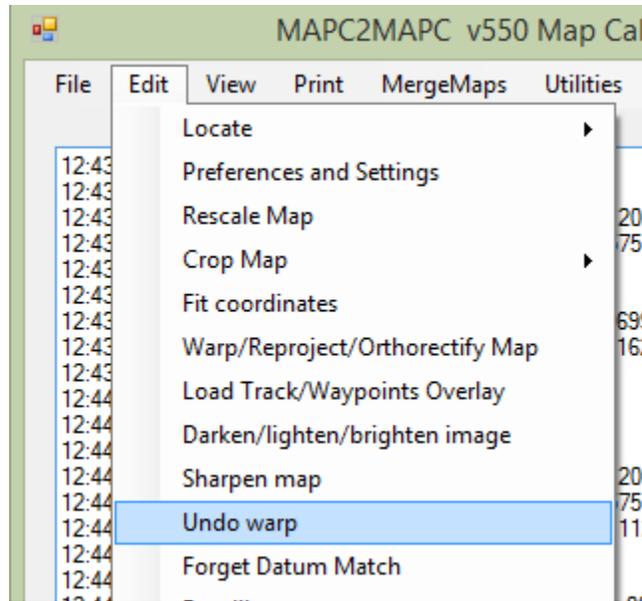
- v. Now choose the format that GE wants like this below:



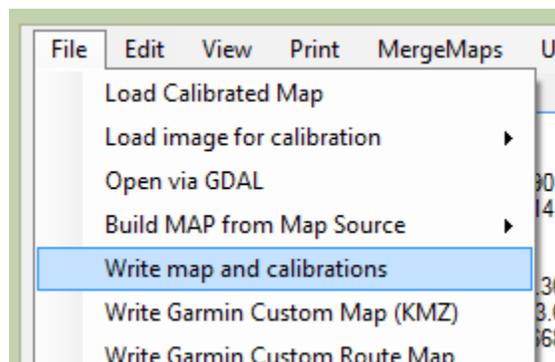
w. Choose these then hit NEXT button. You will see a screen like this below:



x. If you made a mistake in options, you can undo the warp per below:



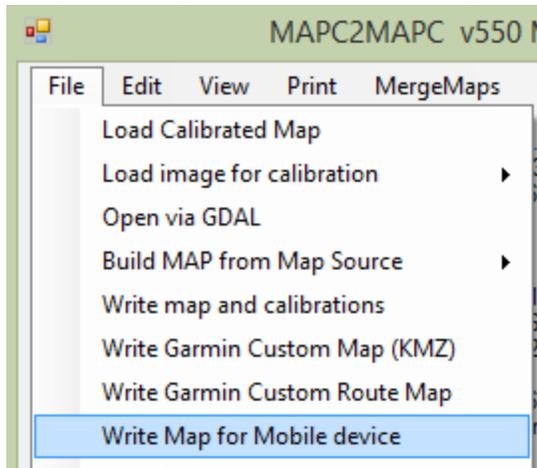
- y. Whats important to know here, is EVERYTHING you have done is in the memory of the program. Nothing is saved as of yet. If the program closes right now you lose all work and need to start over at step 1.
- z. The easiest way to save your work is to create a .KML.
- aa. Choose this setting below and it will take what is in memory and dump it to a .MAP and .KML files. It will ask you if its ok to overwrite; I always hit YES/OK to each prompt.



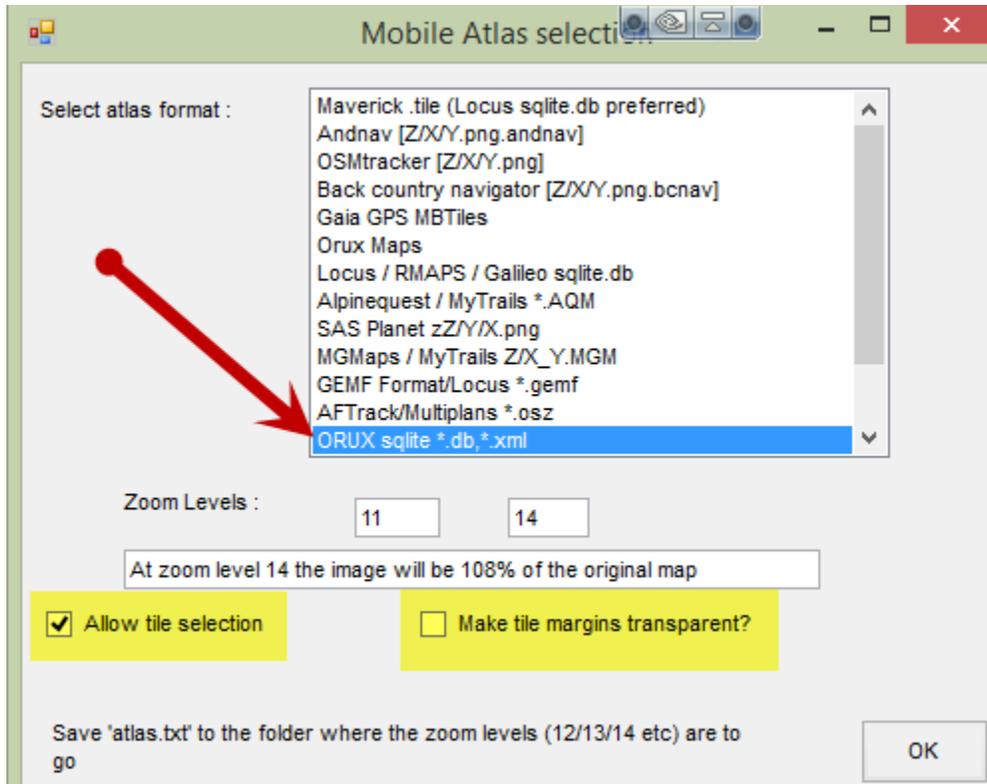
- bb. In the same folder as your .JPG, you will now see the .MAP, .KML and .P2G as well as your .JPG file. (I always save a copy of these files someplace else under a folder called (Final_KML).
- cc. If you have GE installed, double click on the .KML and it will open GE and zoom right to that specific area. You can zoom and look around to see the roads on the .JPG will very well overlay the roads shown in yellow on GE. If they don't overlay nicely, consider these options:
 - i. The paper map is not that precise to start with.
 - ii. The original scanning of paper map was sloppy.
 - iii. Did you do step "t" ? You must !

- iv. Back at step “n” the program made a bad calculation ?
- v. One way to get an overlay to fit “better” is to manipulate the .JPG yourself right in GE. You won’t find a simple shifting of map to improve position, that is what step “t” is all about. If you are reading this, you need to stretch/rotate/adjust the map on GE. There is lots of help about how to do this in GE (hint: hold the shift key down when you move any grip and it will maintain the x,y ratio.) If you do this, you must save this in GE as a .KML. Then go back into Mapc2Mapc program and pull down FILE – “Load Calibrated Map” since you manipulated the map outside of this program.
- dd. At this point, you have a saved Geo-referenced map (files per step z).
- ee. The last step is to convert into a format that OruxMaps likes.
- ff. Step 2 of this process is now complete.

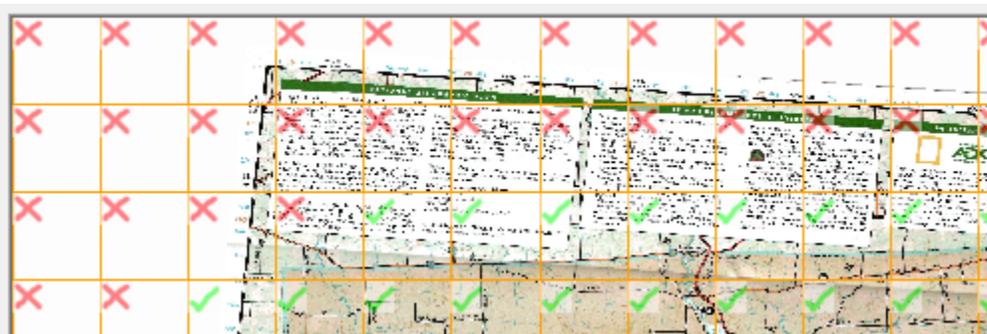
3. OruxMaps likes a specific format. Choose option to create this as below:



- a. Now choose like below. I always want the TILE selection so I can strip off some tiles that I don’t want. I don’t know what the “transparent” option does. Then hit OK.

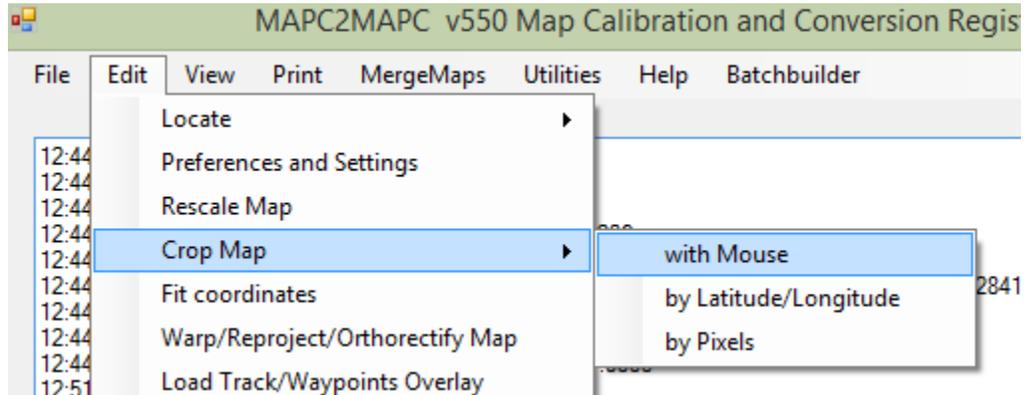


- b. Now for EACH of the zoom levels you use, you need to select each cell for inclusion or not. This is very intuitive. Just click once in each box to either include it (green check) or exclude it (red check). As shown below, I exclude the areas of .JPG where it gives instructions. This is not useful in my phone so I don't want to see it. Hit OK when done.
- c. Again, in the same folder as your .JPG, you will see a new folder created with suffix "_Atlas". This contains the OruxMaps compatible files. You can rename this folder as you wish.

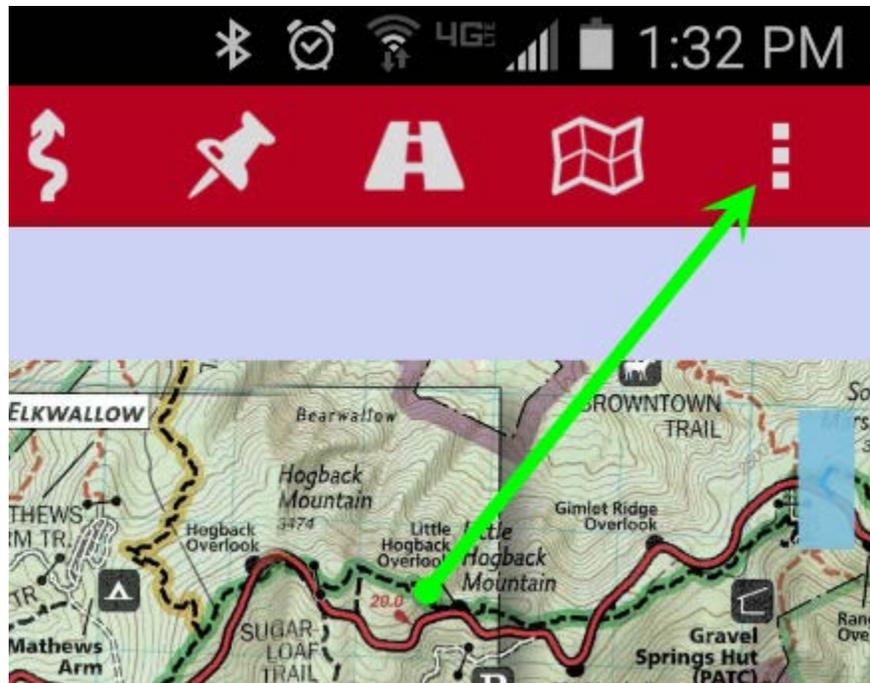


- d. We are otherwise done with the MAPC2MapC program, but there are a few important things to be aware of.
 - i. **Problem 10.** My .JPG has huge instruction areas or otherwise stuff I don't want/need to see in my phone GPS (OruxMaps). In this situation you can "CROP" your Geo-Referenced map. You select a square/rectangle area and the program will recreate a new .JPG with just the selected area. Be very careful

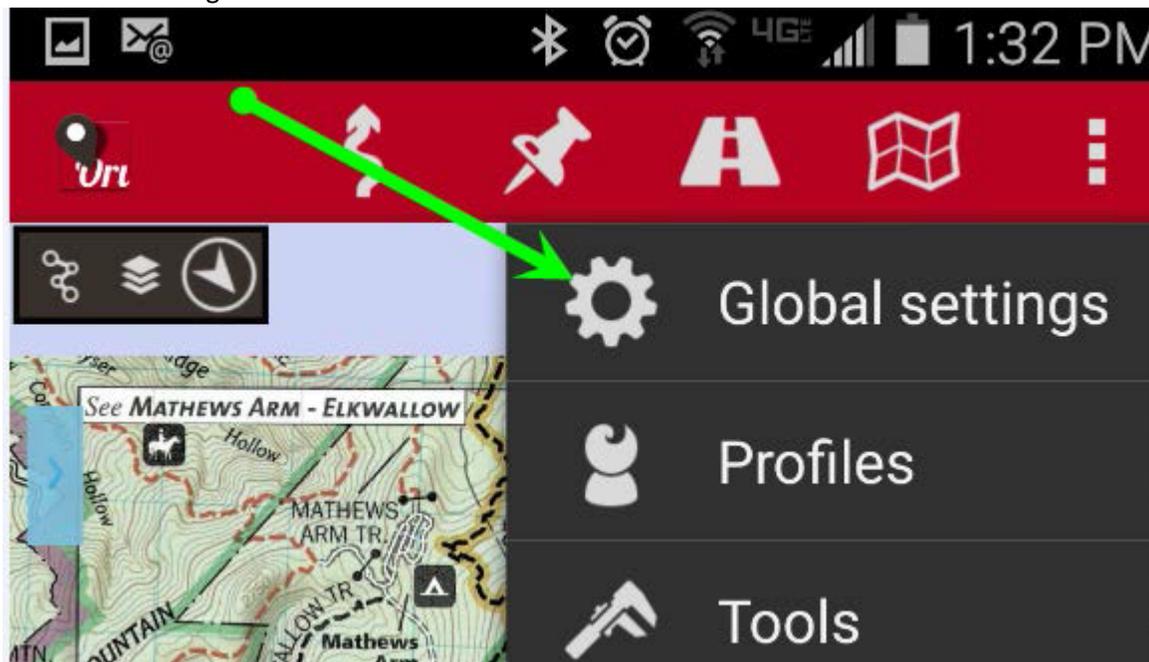
about naming the new Cropped map something different because if you overwrite, you must rescan you map to restore the full map. Here is the how to CROP map.



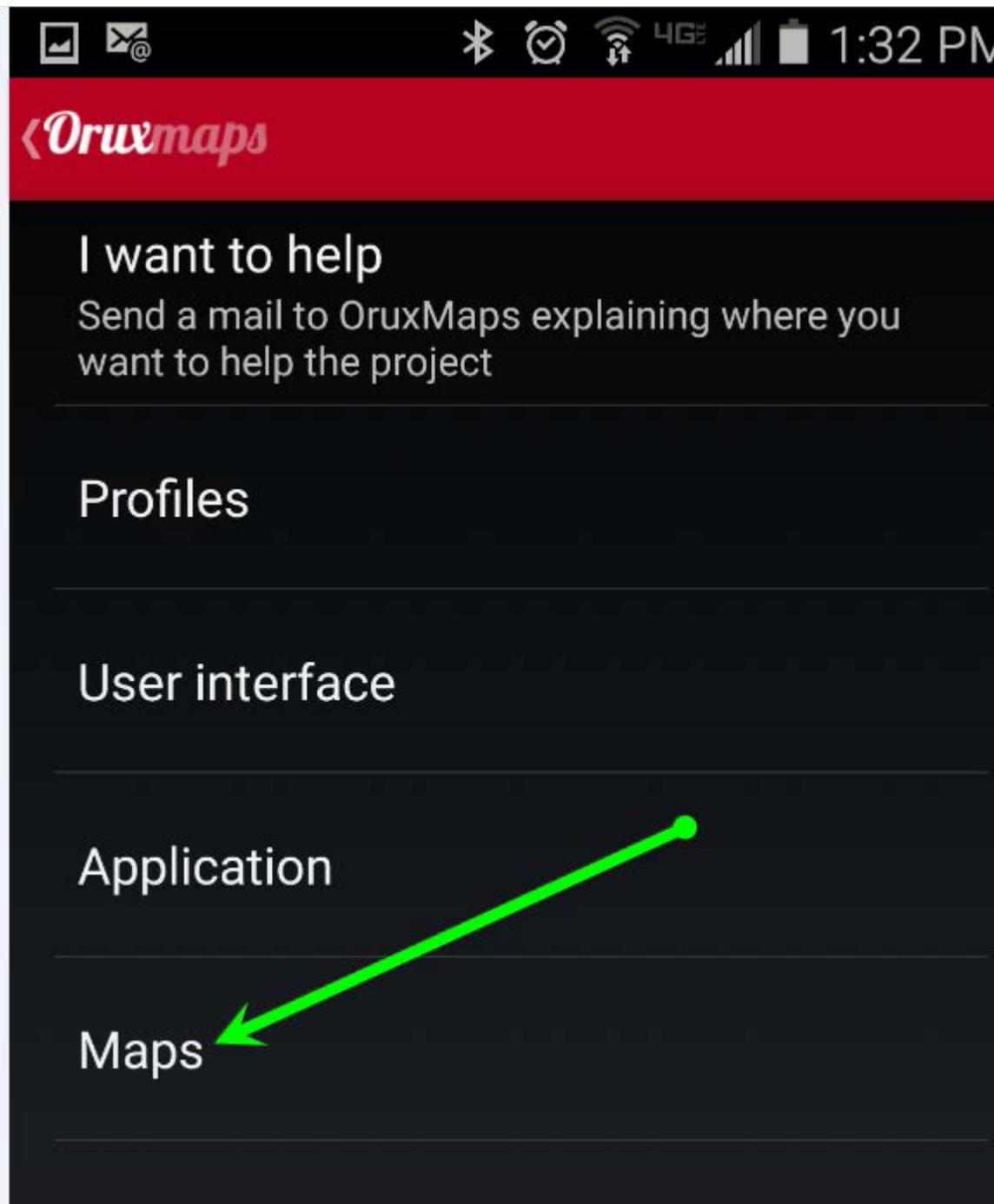
1. You select upper left corner with LEFT click and lower right corner with RIGHT click.
 - ii. **Problem 11.** The important (to you) hiking area is right at the intersection of 3 maps. Thus to see the area, you need to jump between 3 maps. A simple solution is to MERGE those 3 maps. You might consider CROPPING a section of each of these 3 maps and MERGING the 3 cropped maps. To MERGE maps (2 at a time), just select the MERGEMAPS option on main menu bar. Again, after you CROP or MERGE, you must repeat steps 2y and step 3.
4. Finally I organize my files on my main computer so I have a logical place to save/retrieve/backup the OruxMaps files. I created this folder under my Documents: Orux_Send_to_Phone\MyMaps So when I want to add maps to my phone, I plug my Android phone into USB cable and connect other end to my computer. When File Explorer opens, I delete ALL the files from the MapFiles folder on the phone and copy all files from my Orux_Send_to_Phone\MyMaps folder. When Oruxmaps runs the next time, I will auto-rebuild the entire database to include all the maps I just added.
 - a. Where are the MAPS stored in OruxMaps ?
 - i. Open OruxMaps program on Android phone.
 - ii. Click on the icon in upper right corner as below:



iii. Now click on the gear.



iv. Now click on MAPS



- v. Here is the location, in MY phone, where the MAP files are located.



Maps directory:

Where the offline maps are stored.

(/storage/extSdCard/Orux_Stuff/Toms_Maps/)

DEM files directory:

Where you have your .HGT or .HDR files.

(/storage/sdcard0/oruxmaps/dem/)

KML overlay settings

- vi. Also observe the last line "KML overlay". That is the folder where you save the routes you plan to hike. Ex: In GE, you add one of your .KML files. Then DRAW a path on top (using GE tools) then save that path as a .KML or .KMZ Then copy those files to the KML Overlay folder as above. The Oruxmaps program has an option to open the overlay while looking at a map.

REFERENCES:

Mapc2mapC: www.the-thorns.org.uk

OruxMaps: <http://www.oruxmaps.com/>

END OF REPORT