ACC Pilot Project Work Plan

April 2008 - Final

The following plan is based on a draft provided by David Jupp in January 2008 (ACC_Pilot_DEM_Plan_Jan08.pdf) and developed in the plan in Chinese circulated by Hu Rongming and further from the added notes he sent to Li Rui plus discussions by email and the results of the data study reported in the associated document "Note_on_Russian_Topo_Maps.pdf". This is the plan that we will proceed with for the Pilot Project of the ACC Project in May 2008.

1   Objective

Apply 3S technology, using geographical and historical data bases, remote sensing images at various scales, historical and recent photographs, GPS information, data integration, 3D visualisation and fly-through in the the Jiangwozi study area, locating ancient relics and integrating historical information so that it is available in real time and via the web to many people.

2   Collate Base 3S Data sets

Base data sets:

- GPS waypoints, tracks and routes (have these as part of Plank Road system that is in KML and will be accessed as part of the integrated system);
- SRTM data for the study area (have these data processed to include slope and curvature information). Used for both visual TIFFs (drape over terrain) and working data;
- Russian Topo Maps for the study area (now have this in Geographic coordinates and cut to study area plus visual TIFFs will be used as image drapes in Google Earth but there are issues that are discussed below in the Appendix);
- Photographs geolocated with location in the EXIF header using GPS tracks, waypoints or known places in Google Earth. Photographs will include both those taken during current and future visits as well as historical photographs.
- Other information. It is possible to obtain Spot5 data or Quickbird data but they are (very) expensive. At the moment the Hanzhon Quickbird data will be included to demonstrate integration of external image data with Google earth. The Google Earth background at the sites may be sufficient for a demonstration.

3 Establish an ancient cultural relic sites information system

In consultation with Hanzhong Museum, who will provide the basic information on Plank Roads, history and related information, select representative sites for research. Using ARCGIS, establish a GIS historical cultural data base. Information types and extent needs to be established soon to design the database structure. Photographs need to be geolocated and this can be done in Google Earth using RoboGEO or other software. Digitized historical photographs (or other digital pictures) need to have known or reasoned geographical location to be included. Photographs can be managed using Picasa2 or Thumbs Studio or a range of other web based Photo management systems.

4 Establish sites, site information and visualisation in Google Earth

1. Bring the study area point locations from GPS information into Google Earth using MapEdit, GPSBabel, GPX files. Edit KML files to include important information. Base GPS data should be managed in a spreadsheet (for multiple access and interaction by many users) and mirrored in the ARCGIS information base. Routes and tracks will also be managed in a similar way and edited using MapEdit via GPX files (including non-GPS generated tracks and routes). GPX is more flexible and accessible than SHP and software exists to convert between these data types.

2. In Google Earth, annotate and create places with GPS2GE to bring historical GIS information into Google Earth. Information will be of two types, (i) that immediately accessible through Google Earth information windows and (ii) that accessible from web links in the information boxes. Photographs will be geolocated but stored on a web server as will the TIFF images that can be opened and draped on the terrain. This will enable the KMZ files to be very small and able to be sent by email. Thumbs can be included in the html information box.

3. By opening up the places, use SketchUp software to establish ancient Plank Road or historical relic site 3D model components. These are envisaged to be segments of "Plank Roads" of the four major types that can be positioned, oriented, scaled and replicated to the locations of known sites and (with some indication of uncertainty) sites believed to be Plank Road locations. Post-Stations can also have 3D icons as can fortifications at the "gates" or "passes". This should be discussed with Hanzhong Museum staff members who have already built analogue models.

5 Establish fly-through and other visualisation

Under ARCSCENE, use GPS data to compute points and establish a route or generate a flythrough in Google Earth itself. This can be done using two models, one based on

manual control and the other automatic. Flythroughs can be made available across the web as part of a Shu Road historical route information system.

6 Field Work

Plank Roads did not occur along the complete track. They were a technology to allow travellers to pass selected ravines and gorges. In between the roads were normal roads of the time. The objective of field work is to work with Hanzhong Museum and Zhangliang Miao staff to establish the most obvious and clearest relic areas between Jiangkou and Jiangwozi. They can be photographed, located with GPS, measured and issues resolved such as which side of the river they occur, what type of Plank road they would have been etc. This will improve the placement and reality of the Plank Road 3D models. At the time the heights in selected high elevation areas can be checked to resolve issues with the Russian Topo maps.

7 Demonstration to Hanzhong Museum and web serving

The data needs to be accessible as a small KMZ file able to be emailed and made available on web sites. It will be demonstrated to Hanzhong Museum and the recipient list will be their decision. The capacity to add material and make changes to the KML information is important as well and Museum Staff will be trained to be able to manage the data – possibly through an interface rather than to the KML. Although the full database for this exercise will be managed in ARCGIS, the base data and routes to entering new data into the KML will be accessible to and modifications able to be done by the Hanzhong Museum staff who are to be suitably trained.

8 Future Activities

The present exercise is a pilot project. The idea of an information system for the Shu Roads serving historical research, education and a Shu Road Tourist Trail has been well received in Hanzhong and discussed with other groups. However, to enable such a plan to go ahead, there will need to be cooperation between the museum and tourism groups and agencies that can undertake the geographic information development for such a wide area. Some promising options are emerging for this to occur. Nevertheless, we hope that by demonstrating a significant capacity for direct participation in the data management and system development at the source of knowledge (such as people at the Museums and historical sites), the future project can maintain that aspect to the web-based participative aspect to the benefit of all involved.

9 Appendix: Data problems and DEM resolution issues

The original plan included the following steps:

(i) Establish DEM for the study area using the available data to construct a fine scale (eg 20-30m gridcell size) digital elevation model, to achieve the ability to visualise in 3D at the "person" scale. Specific steps as follows:

(1) Using 1:10,000 Russian Topographic maps (TIF files) as the base data, cut out the study area, convert to Geographical (WGS-84) coordinates and use Arcmap to digitise and build DEM using methods similar to those currently used at Yangling to generate DEM data from Topographic maps.
(2) DEM data fusion is planned to be accomplished using something similar to using "Data Management Tools>Raster>Mosaic to new Raster" tool to bring SRTM data and (1) to establish the DEM through fusion and create the higher resolution DEM. However, this step is a research area and will be discussed and thought out as part of the initial work.

This part of the work is on hold and the above plan is based only on SRTM data (Google Earth terrain data is unmodified SRTM data). The reasons are two:

1. Firstly, the terrain in this area has very high relief and the contours are very dense and complex. The digitsing task will be very heavy. There may be other options for better line maps but they are very expensive and may still need manual digitising along contours;

2. Secondly, David Jupp carried out an initial investigation of the accuracy and consistency of the Terrain heights from GPS, Google Earth, SRTM and the Russian Topographic maps. This is described in the document "Note_on_Russian_Topo_Maps.pdf" which is available with this plan. Basically, GPS, SRTM and Google Earth are all consistent in height information and Datum. However, there is a significant issue in terrain areas above 1000m with the Russian Topographic maps that needs to be resolved. It may be datum differences but this needs to be established before a lot of work is done digitising data.

However, the work planned to establish a finer DEM is very important. The SRTM data will be interesting but likely too coarse for future needs. It is also an important area for research as well and should not be dropped entirely. Rather it should be a next phase for the work if the first stage is successful. I believe the Russian maps can provide a DEM with about 20m grid size and also provide information on previous modern roads that were closer to original roads since they did not use tunnels. The rivers, streamlines and gullies are also well marked as are spot heights and cultural features. They register very well with GPS data and with other maps in (x,y) so they are worth persevering with.