Duncan Lees, 2002

From 25th February to 11th March 2002, members of the Geomatics team of the Museum of London Archaeology Service (MoLAS) undertook an intensive topographic survey of the core area of Amheida Project. This work successfully demonstrated that in a relatively short timescale large areas of the site could be mapped in meticulous detail. Due to the "rescue" nature of most of the archaeological work undertaken by MoLAS, the Geomatics team is very experienced in producing highly accurate survey solutions and presenting the results of this work within extremely tight deadlines. However, it is a testament to the clear goals that the whole project team established before the survey began that all the available time was used constructively and that geomatic data was collected from the beginning of day one.

The geomatic objectives established prior to the survey commencing were:

1) To establish an accurate geodetic survey framework for the Amheida Project within which all work can be referenced
2) To produce an accurate 3D model of the terrain within the core settlement
3) To survey the surviving ground plan of the building walls in Area 1
4) To continue the survey of surviving walls into the other areas within the core settlement, if time permitted
5) To establish local grid systems within Buildings N3 and N4 in Area 1 to facilitate geophysical survey and excavation recording

To undertake this work the MoLAS team, comprising Duncan Lees (Principal Geomatics Officer), Jessica Cowley and David Mackie (Senior Geomatic Officers), utilized a combination of Global Positioning System (GPS) receivers and more traditional electronic optical instruments. All three members of the team rotated the individual survey tasks, some of which required the team to work in pairs; others necessitated a more solitary existence. The survey data was processed and interrogated using a number of specialist software packages, notably Trimble Geomatics Officer, Sokkia SDMap, AutoCad, and ESRI ArcView GIS.

The geodetic control network for the project was established using Trimble 4800 & 5700 GPS Total Station receivers. A 'Fast Static' (or 'Rapid Static') survey methodology was used to coordinate a number of permanent ground markers (PGMs) located at cardinal points around the project area. An initial PGM (IS100) was emplaced on the highest terrain within the project area, to the west of Area 2. The Trimble 4700 receiver was set up over this and served as the "base station" for the Fast Static survey, logging data from the GPS satellite constellation. Further GPS data was then collected simultaneously at the other PGMs around the project using the Trimble 5700 receiver. This second "rover" receiver collects data not only from the GPS satellite constellation but also from the base station via a radio link; thus enabling the accurate positioning of the rover's location with a much reduced occupation time. This data was post-processed to produce a millimetrically accurate 3D control network on the Universal Transverse Mercator (UTM) Zone 35 North coordinate system. All the subsequent survey work undertaken by the MoLAS team at Amheida, whether using GPS or optical technology, was referenced to this coordinate system.

Following the establishment of the control network, the Trimble GPS kit was used in Real Time Kinematic (RTK) mode to collect topographic data across the project area. Each day the 4700 receiver was set up over one of the PGMs to act as a base station which broadcast real time corrections to the 5700 rover; allowing the collection of sub-centimetrically accurate surveyed points within a few seconds. Using Trimble survey software loaded onto a hand held datalogger, the ground plans of buildings, walls, streets and other structures were surveyed with the GPS rover. Thousands of spot heights were also recorded enabling the MoLAS team to produce a Digital Elevation Model (DEM) of the project area, using the Spatial Analyst extension of the ESRI ArcView GIS software. Using the GPS receivers, well over half of the entire project area (circa 910 x 905m, an area of nearly 100 hectares) was surveyed; providing a DEM and contour map against which the ground plans of the surviving structures, the geophysical survey and future excavation results can be accurately articulated.

Concurrent with the GPS survey work, the two remaining members of the team were surveying the surviving ground plan of the impressive mudbrick structures that emerge from the sands across the site. Using a Sokkia total station and datalogger referenced to the UTM coordinated control network, all the wall lines in Area 1 were surveyed within 8 days. The remaining time was spent recording the structures within Areas 2, 3 and the cemetery area to the south of the settlement, with considerable success as the amazing extent and scale of the settlement began to unfold as more and more survey data was collected and collated.

The final task successfully completed by the MoLAS team was the establishment and emplacement of local arbitrary grid systems in Buildings N3 and N4. It was decided that for the geophysical survey and forthcoming excavation seasons a grid system aligned with the walls of these structures was most propitious. This system will minimize the number of planning sheets needed to cover the excavation area and allow the planning to be completed more easily than if the grid was not aligned to the building. The two buildings are on a different alignment and so two different grids were established, although no problems of overlap are envisaged, as the two structures are physically discrete and separated by a distance of some 100m. The transformation parameters that allow the local grid system emplaced in the buildings to be converted to the project UTM coordinate system were calculated to allow all the excavation and geophysical survey data to be compatible with the topographic survey.

The 2002 survey season was particularly successful as much more of the project area was covered than had originally been envisaged. However, there is much more that needs addressing from the geomatics perspective at Amheida in the coming seasons. It is hoped that the subsequent years will see the completion of the ground plan of the entire settlement; the excavations planned to commence in 2003 will need survey support as the work progresses; it would be useful to record many of the associated outlying structures and features that relate to the Amheida site as this would provide a stronger archaeological and topographic context for the central settlement. As an adjunct to the survey work on site, much other useful data can be sourced or collected for presentation and interrogation within the project GIS, such as background mapping, hydrological surveys and satellite imaging.