3-D VIRTUAL REALITY DATABASE OF THE CHICXULUB IMPACT STRUCTURE AND NEW INTERPRETATIONS WITHIN.

Gary L. Kinsland[1], Christoph W. Borst[2], Arun P. Indugula[3], Adam M. Guichard[3], Vijay B. Baiyya[2], Christopher M. Best[2] and Manuel Hurtado Cardador[4], [1]Energy Institute and Department of Geology, PO Box 44530, University of Louisiana at Lafayette, Lafayette, LA, 70504, glkinsland@louisiana.edu, [2]Center for Advanced computer Studies, University of Louisiana at Lafayette, [3]Formerly at the Center for Advanced Computer Studies, University of Louisiana at Lafayette, [4]Instituto Mexicano del Petroleo, Mexico D.F., Mexico.

Introduction: We have created a 3D Virtual Reality (3DVR) system ([1], [2]) into which we are inserting and within which we are interpreting data from the Chicxulub Impact Structure (CIS). Our goal is to create a 3DVR database and interpretation system containing all available data of the CIS and to perform a holistic interpretation of the data within this. Presently our database contains gravity data, topography derived from the gravity database, Shuttle Radar Topography Mission (SRTM) topography and GPS profile data. We are planning to add at least magnetic data, seismic data, well data and electromagnetic data as well as various satellite images of the surface.

Within our system we are able to: 1) move freely in three dimensions within the data, 2) change scales, 3) change displayed datasets, 4) simultaneously view multiple segments of the volume from different positions, at different scales and populated by different data sets (3D volumetric windows), 5) place interpretive markers to correlate/highlight features, 6) display these markers on all data sets for immediate correlation between datasets and 7) collaborate within the 3DVR volume in real-time with another viewer at a remote location.

Advantage of 3DVR: One of us, Kinsland, has been interpreting CIS gravity and topography data for over 10 years ([3], [4], and [5]) to better understand the structures of the buried CIS. He is responsible for the interpretations within the present 3DVR system. He readily acknowledges that the ability to move amongst the data so as to immediately view the data from the very best perspective to make an interpretation has allowed him to recognize and interpret features much more rapidly and accurately. Even though Figure 1 is here not in true 3DVR it still illustrates how easily data features are recognized and interpreted. The topographic representation used and the ability to view the data from this particular perspective make it clear that the surface over the CIS contains several nearly concentric topographic valleys as previously posited ([3], [4], [5]).

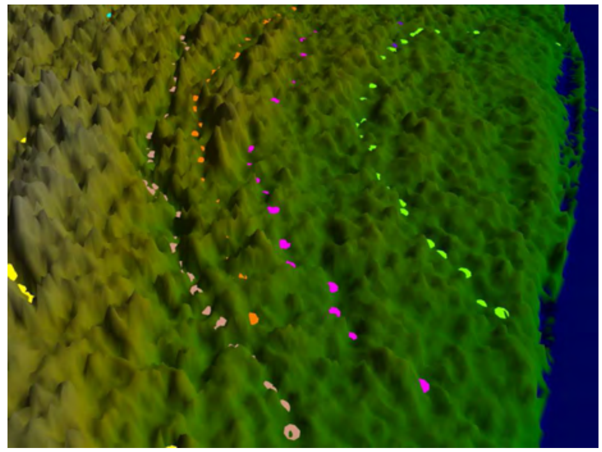

Figure 1. View of a portion of the SRTM topography data over the CIS as rendered within our system. This view is from a point roughly above the eastern side of the CIS. See Figure 2 for a full definition of the colored interpretive points.

Interpretation: Figure 2 is a larger scale view of the SRTM data showing the marked points at this time in our ongoing interpretation of the data. Several of the interpreted features have been previously recognized in other data, e.g., moat, inner troughs one and two, the minor cenote ring and the outer trough [3]. We first recognized the valley marked in orange, inner trough 3, in the GPS topographic profile collected in 2002 on the highway between Merida and Valladolid. Once we were able to view the SRTM data with the superimposed GPS profile in 3DVR, inner trough three became “obvious”. The feature interpreted in light blue is one of a set of several “fine scale” features recognized only within the 3DVR SRTM data imagery. Interpretation of these features is ongoing; however, portions of the orange, inner trough three, and the yellow, outer trough consisting of a “chain of pits (perhaps cenotes)” may be concentric with the light blue feature.

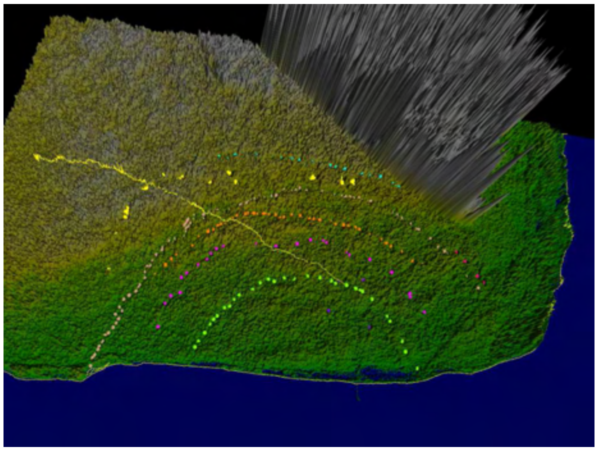

Figure 2. View of the SRTM topography data over the CIS from a point above and slightly north of the center of the CIS. Interpretive point colors: light brown – Moat [3], fuchsia – inner trough two [3], green – inner trough one [3], orange – inner trough three (first recognized in the GPS profile which is the yellow curve extending from Merida in the lower right center of the image toward the southeast to Valladolid, red (four points right of center) – minor cenote ring [3], yellow – outer trough [3], light blue – one of many fine-scale topographic valleys evident within our system, scattered dark blue points around Merida - isolated cenotes. Note: the light blue and portions of the orange and yellow marked features appear to result from nearly concentric features but do not share a center with the other interpreted features. The diameter of the light brown valley is roughly 180 km.

Figure 3 shows the correlation with the gravity data of the features interpreted from the SRTM data. In the 3DVR system the interpreter can toggle back and forth between data sets or view portions of the volume as one data set and other portions as another with or without the interpretation superimposed on the data.

We are interpreting the topographic and gravity data sets as proxies for the buried structure [4]. Variations in buried density result in the gravity variability. Fractures propagated up from structural features of the buried CIS into the Cenozoic carbonate cover are conduits for groundwater and result in karstic features e.g., cenotes and valleys.

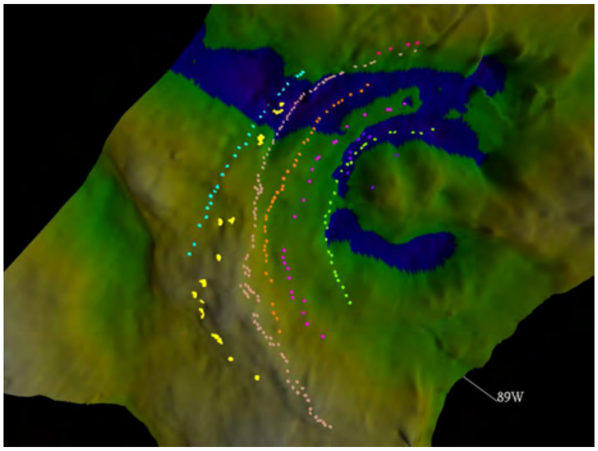

Figure 3. With the click of an icon in the 3DVR system the displayed data become gravity data with the points previously interpreted from the SRTM data superimposed. The correlations between the features in the SRTM data and the gravity data are immediately clear.

Conclusions: We have created a 3DVR data interpretation system and are populating it with data from the CIS. Interpretation of the data which is underway has more clearly identified previously recognized features and is finding new features. These features, when integrated with other data sets, will lead to new understanding of the buried CIS.

References: [1] Borst C. W. and Kinsland G. L. (2005) *Trans. GCAGS, 55*, 23-24. [2] Borst C. W. et al. (2006) *Trans. GCAGS, 56*, 87-100. [3] Pope K. O. et. al. (1996) *Geology,24*, 527-530. [4] Kinsland G. L. et al. (2000) *GRL*, 27, 1223-1226. [5] Kinsland G. L. et al. (2005) *GSA Sp. Paper 384*, 141-146.