

TouchTable & TerrainTable

Showstoppers at the ESRI User Conferences

At the last two ESRI International User Conferences held in San Diego, much attention has been focused both by attendees and by the media on TouchTable technology and products. These have been developed by Applied Minds Inc. (AMI), a small and innovative high-technology company from California. In collaboration with AMI, Northrop Grumman, one of the giants of the American defence and aerospace industries, has also developed the TerrainTable, a three dimensional table display system that makes use of the TouchTable technology.

by Gordon Petrie



(a) The TouchTable TT84 with its 84 inch (213cm) diagonal table is equipped with a matt-white powder-coated aluminium display surface that responds to hand (or finger) movement and pressure. The TT84 sits on a tubular steel frame equipped with levellers. This particular example also features two 50 inch (127cm) diagonal touch-sensitive plasma displays mounted on stands in a vertical position alongside the main table.



(b) The TouchTable TT45 has a 45 inch (114cm) diagonal high-brightness flat-panel LCD display screen which is mounted on a mobile (wheeled) stand. This stand has an electric lift mechanism that allows the TT45 to be set to the desired height and angle.

(Source: Applied Minds Inc.)

TouchTable - 2004

A predecessor to Applied Mind's TouchTable was first shown at the 2004 International User Conference. It comprises a flat, touch-sensitive white screen laid out in a horizontal position and mounted on a sturdy aluminium honey-comb table with a steel frame. It allows users to view and manipulate geospatial (image and map) data that is projected down from a powerful computer-controlled colour LCD projector situated directly above the powder-coated surface of the table-cum-screen. The dimensions of the screen are 67 x 50 inches (1.7 x 1.27m) giving a diagonal size of 84 inches (2.13m). The overhead projector sits in a horizontal position and projects its 1,600 x 1,200 pixel image downwards via a mirror onto the table-cum-screen. The projected images can then be controlled by users through the use of their fingers touching the table surface in various ways. The positions of the fingers are determined by sensors placed at the side of the table and interpreted by the TouchTable soft-

ware. To pan across the image, the user moves a single finger across the screen surface. If the user wishes to increase the magnification of the projected image (to zoom-in), he touches the surface of the display table with two fingers, one from each hand, and spreads them apart. If he wishes to decrease the magnification and increase the area covered by the projected image (to zoom out), then he places his two fingers on the display table and moves them towards each other. On the TT84 table, pressing down on a single specific point on the surface brings up all the stored information about that particular point. A menu is also projected down together with the high quality graphical image. If a group is in discussion around the table, it is possible to re-position and re-orient this menu by touching the side of the screen so that it is

placed directly in front of a particular user. It is then possible for him to access the software tools and applications that are provided by the system. Taking a simple example, the user can use the tools to draw lines or to colourize areas. These drawn features are projected down and superimposed semi-transparently over the primary display image of the terrain. Using all the available tools, the TT84 acts as a group conference table where all the participants can discuss and analyze all the features present on the image and their inter-relation. From the ensuing discussion and visual analysis, they can reach a consensus and come to some decision or plan. TouchTables are controlled by AMI's TouchShare software, which runs within the Microsoft Windows environment. AMI's additional TouchShow module drives the interactive, auxiliary, touch-enabled



The TouchTable TT84 is seen here being operated by a group standing around its horizontal display surface during a consultation in a boardroom. The two auxiliary vertical plasma display screens can be seen mounted on stands at the back of the main horizontal display surface. (Source: Applied Minds Inc.)

displays. Other modules allow access to multiple data sources. As shown at the ESRI User Conference, the TouchTables made use of ESRI's ArcGlobe software, which forms part of the ArcGIS family of products.

TouchTable - 2005

Further developments of the TouchTable were shown at the 2005 ESRI User Conference. The concept TouchTable shown in 2004 was replaced with a full production version of the TouchTable, called the TT84 (from the 84 inches diagonal measurement of the screen). The TT84 was supplemented by a completely new model - the TouchTable TT45. Instead of an overhead projector projecting its image down on to the horizontal table-cum-screen, the new TT45 model features a much smaller 39 x 22 inch (99 x 56cm) flat-panel LCD screen, giving a diagonal measurement of 45 inches (1.14 m). This screen is driven directly by the system's computer and displays an image that is 1,920 x 1,050 pixels in size.

The LCD display is mounted on a mobile (wheeled) frame that equipped with an electric lift mechanism. This gives the possibility for the TouchTable TT45 to be set to an appropriate height and at various angles between the horizontal and the vertical. This allows users to sit around and in front of the vertical screen in group sessions as well as being able to stand around the display screen when it is set in the horizontal position, as is done with the TT84 model.

TerrainTable - 2005

Essentially the TerrainTable is a 3D development of the TouchTable by Northrop Grumman Mission Systems, based in Reston, Virginia. The TerrainTable makes use of the TouchTable software and is aimed specifically at military, defence and intelligence applications. Instead of the flat 2D surface of TouchTables, the new

TerrainTable features a 3D physical model of the terrain covering an area of 52 x 40 inches (1.32 x 1.02m). The table surface consists of a flexible silicone material that can be stretched upwards in the vertical direction using a honeycomb matrix of vertically mounted steel pins or rods. Each individual rod is tipped by a small ball. The height of the rod at each individual position on the table is controlled by the elevation data contained in a digital terrain model (DTM) of the geographical area being covered. At the same time, the overhead projector projects the image of the terrain, together with the accompanying lines and symbols, down on to the curved surface of the table. When users view the model, they can readily see (and touch) the hills and valleys of the area appearing on the stretched and curved silicone surface. When the viewing or analysis of the model has been completed, the 3D surface can be flattened and re-set to display the surface of another area in a very short time – about 10 seconds.

Applications

The larger TouchTable (TT84) and the TerrainTable are designed for use in a large fixed facility such as the command centres used by military forces and home security

agencies concerned with mission planning and in the boardrooms of large companies. The smaller TouchTable (TT45) with its greater mobility and portability is seen as being more suitable for use by smaller groups working in small offices and in mobile command centres. A picture showing a TouchTable TT45 table mounted in a Hummer military vehicle that is being used as a mobile command vehicle appears on the TouchTable Web site listed below.

Pricing & Availability

The ballpark pricing for the TouchTable TT84 is less than U.S. \$200,000, while that for the TouchTable TT45 is less than U.S.\$100,000. The two products are manufactured and supported by the TouchTable Business Unit of Applied Minds Inc., which is based in Pasadena, California. Northrop Grumman Mission Systems is a Value Added Re-seller (VAR) focused on government customers. The TouchTable TT84 has been delivered to customers since the late fall of 2004, while deliveries of the new TT45 model began in the fall of 2005. The TerrainTable is owned and sold by Northrop Grumman. The TerrainTable has undergone several generations of design iterations and is now available commercially.



Donald C. Winter (left), President of Northrop Grumman Mission Systems (NGMS), demonstrates the display surface of a TouchTable system to Robert Bishop, President & CEO of Silicon Graphics Inc. (SGI), at the NGMS Advanced Concepts Demonstration Lab in Reston, Virginia. The two companies are cooperating in the development of advanced visualization technologies for government and intelligence agencies - with SGI supplying the powerful computers needed to handle in real time the huge data sets that are being used in terrain visualization. (Image courtesy of Northrop Grumman Corporation)

Professor G. Petrie (g.petrie@geog.gla.ac.uk) is Emeritus Professor in the Department of Geographical & Earth Sciences, University of Glasgow. More detailed information on the TouchTable products can be obtained on the Web site of AMI's TouchTable Business Unit: www.touchtable.com/. Further information is given on the relevant pages:

- (i) www.ms.northropgrumman.com/touchtable/ and
- (ii) www.ms.northropgrumman.com/images/TerrainTable_FS.pdf - of the Web site of Northrop Grumman Mission Systems.