Enabling Geographic Support in Virtual Reality Modeling with GeoVRML

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The Virtual Reality Modeling Language (VRML) is an ISO standard for representing three-dimensional (3-D) data that are transmitted over the World Wide Web. Various plug-in products are available for Internet browsers, such as the Internet Explorer and Netscape Communicator, to display VRML content and to allow users to interact with these data.

GeoVRML is an official working group of the Web3D Consortium, the body that controls the VRML standard. The drive behind GeoVRML was seeded at the Carto Birds of a Feather (BOF) at the SIGGRAPH'97 conference, with the group being officially formed in February of 1998 after a successful workshop on geographic issues at the VRML'98 conference. The group is chaired by Lee Iverson of SRI International.

The GeoVRML working group aims to develop methods and tools for the representation of geographical data in VRML. A number of complex issues will have to be solved, including how to:

- Support data in various geospatial coordinate systems;
- Represent large quantities of terrain and other related data;
- Manage multiple levels of detail of these data; and
- Deal with the limitations of VRML's single-precision floating point support.

The group's efforts are ongoing; to date, four publically available deliverables have been produced.

The GeoTransform Package
A Java package with routines for performing efficient and accurate conversions between a number of geographic coordinate systems (based upon the SEDRIS Conversions API).

Custom VRML Nodes
A number of new Java-based nodes have been written to extend VRML's base functionality. These include the QuadLOD node, which provides a quad-tree based level of detail and loads higher resolution data only when needed; the GeoTile node, which enables the representation and selection of multiple terrain datasets and cultural features; and the GeoCoordinate node, which enables points to be specified in a VRML file using a number of geographic coordinate systems, such as geodetic or Universal Transverse Mercator.

The tsmApi Library
The Tile Set Manager API is a C library that provides support for generating large, rich, multi-resolution, tiled terrain data in VRML97. Full source code is available in addition to precompiled distributions for a number of platforms including Irix, Solaris, and Linux.

Documents The group has produced a RFC for integrating geographic support into VRML as well as a proposal for introducing double precision floating point support to better represent geographic coordinates.

Greg Leaver and Don Brutzman at the Naval Postgraduate School in Monterey, California, have used some of these materials to produce a VRML simulation of the Monterey Bay National Marine Sanctuary (see cover figure [included below]).
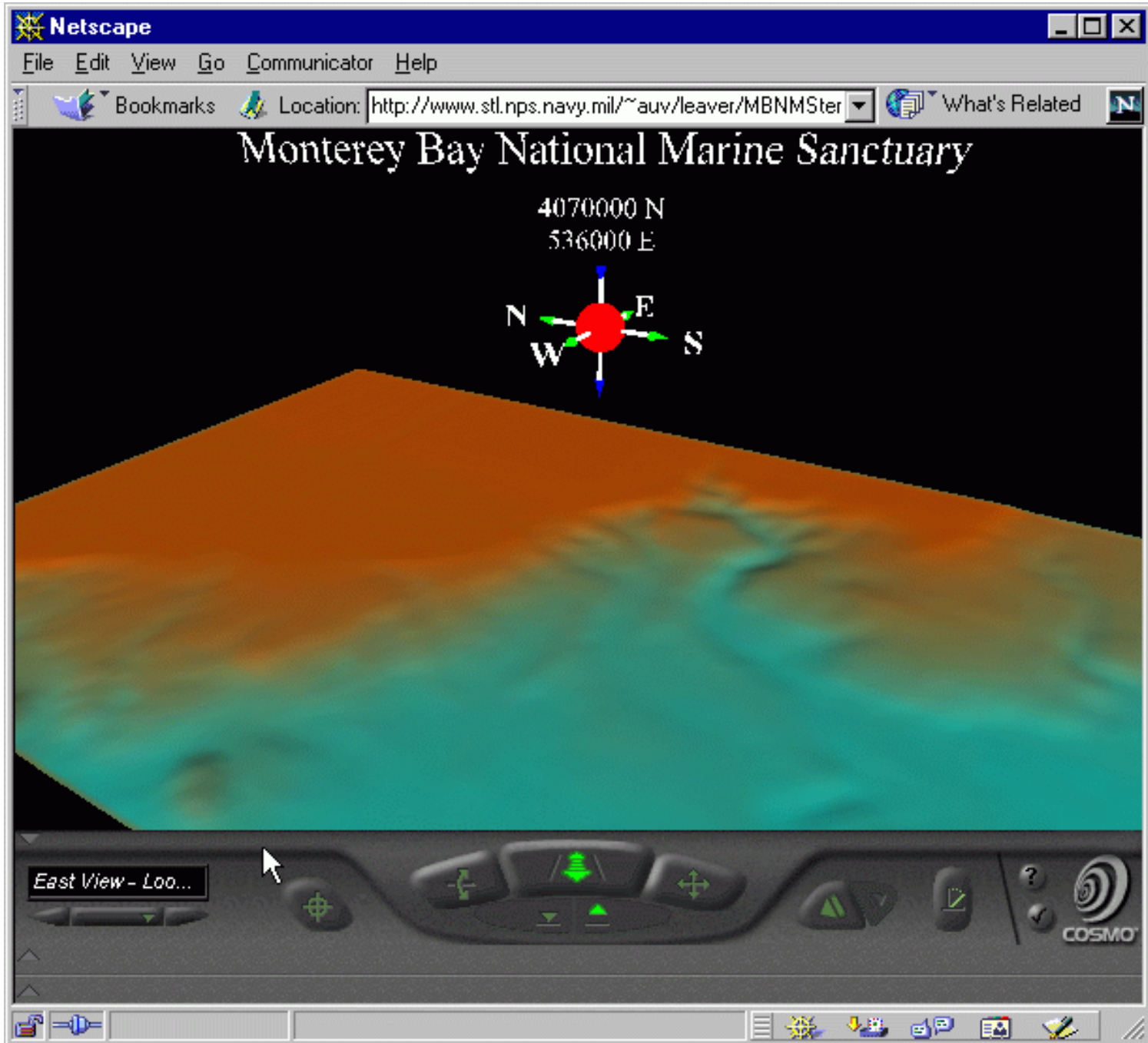
VRML is currently experiencing a period of evolution. The next generation of the VRML specification, referred to as X3D, is proposed to be integrated tightly with XML (eXtensible Markup Language) and address many of the limitations of VRML97. It is worth noting that the GeoVRML working group's proposal for the inclusion of double-precision floating point support in X3D was adopted and is now featured as a core requirement in the X3D Requirements Document.

A further interesting development is that the Web3D Consortium have announced that they will make the full source code for one or more VRML/X3D browsers available to the general public. The availability of this code base presents us with the promise of a stable platform to build support for geographic data that can be viewed over the Web by anyone with a PC and a standard VRML plug-in.

For further information, please refer to the GeoVRML Working Group home page at
http://www.ai.sri.com/geovrml.

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