Java3D Graphics of Satellite Data: Nighttime Lights
FY 2004 Proposal to the NOAA HPCC Program

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Proposal Theme: **HPCC Technology Transfer**

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Java3D Graphics of Satellite Data: Nighttime Lights

Proposal for FY 2004 HPCC Funding

Prepared by: Chris Elvidge and Christopher Moore

Executive Summary:

The goal of this proposal is to package and make minor changes to visualization routines developed under HPCC funding (*Construction of Complex 3D Virtual Worlds*, funded in FY1999, and *Continuous VRML output from regional circulation models: a rapid model diagnostic, analysis, and educational tool*, funded in FY2001), so that they can be used for creating interactive 3-D renderings of high-resolution satellite data at NGDC.

Problem Statement:

The Defense Meteorological Satellite Program (DMSP) current operates satellites in low-altitude polar orbits, recording nighttime visible-near infrared (VNIR) radiance. This system can detect lights from cities, towns, industrial sites, gas flares, and fires, as well as the lights from fishing boats. This global data set has been put together in a popular "Nighttime Lights of the World" poster, and custom data CD. It has also been rendered on Forecast System Laboratory's "Science on a Sphere" (

http://www.fsl.noaa.gov/fsl/sos). This immersive 3D rendering system involves a room installation, or a 30-foot-square exhibition installation to view the data, which is highly effective in large rooms and at conferences. However, the public cannot view this impressive data set locally, except as flat images.

Proposed Solution:

We propose to transfer visualization routines developed at PMEL to NGDC, leaving them with the ability to create and customize interactive, 3D virtual reality visualizations of high-resolution satellite data. With the creation of a Visualization Toolkit (VTK) based back-end, and a Java3D client to render the Nighttime Lights data, we will be able to render the data either as texture mapped interactive spheres (shown) for public interest, or as a spherical surface deformed by light intensity for analysis by satellite imagery researchers. Specific objectives include:

1. texture mapping applet for global-averaged light from cities, fires, and flares.

2. Topology-generating applet from light intensity

3. Animation of time-evolution data of visible-near infrared radiance data

4. Deploy web service for data dissemination

5. Create Java3D client to render textures, topology, and animations.

PMEL will package and make minor changes to visualization routines useful to NGDC, and travel to NGDC to work with NGDC scientists and programmers to assure full transfer of necessary technical expertise. At the end of this project, NGDC will have software useful to them for creating the visualizations they require and also will have the expertise required to maintain, modify, update and utilize the software for their purposes.
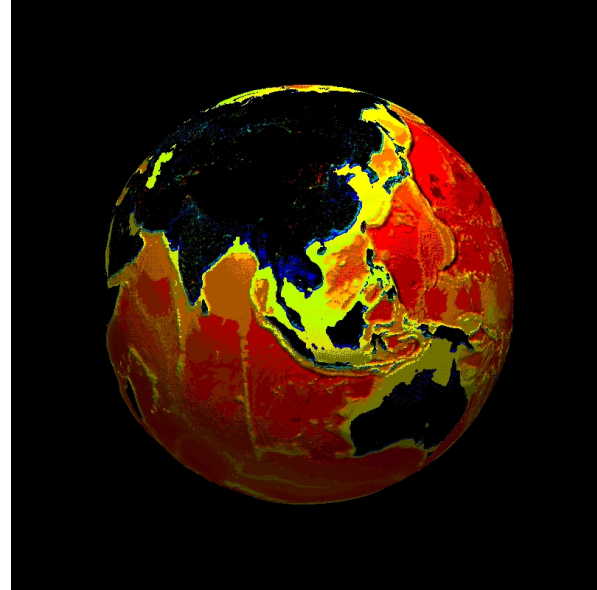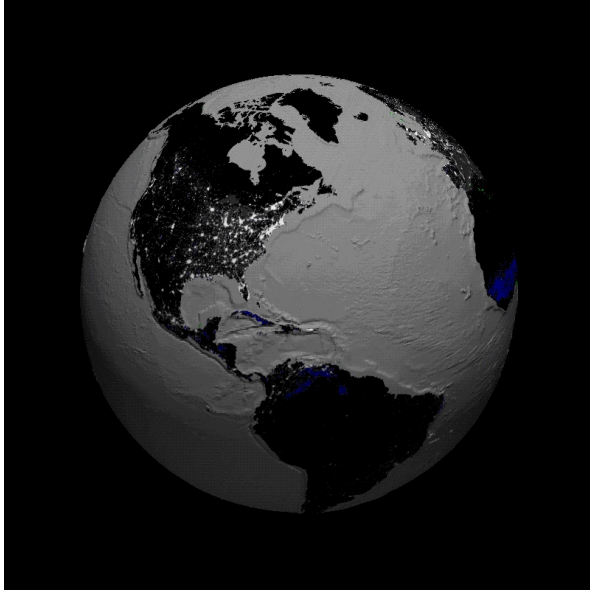
These test renderings are global topographic data (Etopo-5) deformations overlaid by the Nighttime Lights texture images showing city lights, fishing boat lights, and gas flares color-coded in white, green, and red.

Analysis:

NOAA's Pacific Marine Environmental Lab has been a leader in the field of Scientific Visualization for the past five years, including work on such diverse visualization platforms as the ImmersaDesk, vGeo, desktop- and browser-based renderers, and the Geowall (www.geowall.org). PMEL's HPCC sponsored "Road Tour" with the ImmersaDesk in FY 2002 resulted in a demonstration for President Bush's visit to Silver Spring, a hurricane presentation at the national Cable 2002 Conference, and successful transfer of visualization technology to several NOAA laboratories. In the past year, PMEL has purchased a Geowall, and has been involved in the national NSF funded Modeling Environments for Atmospheric Discovery (MEAD) project, including work on objective rendering of large, distributed data sets.

It both logical and cost effective to transfer this technology, rather than for others to reinvent it. Therefore we propose to transfer the appropriate visualization routines and technical expertise for creation of interactive 3-D renderings to NGDC for the serving of high resolution satellite data visualizations to diverse audiences.

Performance Measures:

Successful completion of this project would not only provide a web service of 3-D renderable objects and a Java3D client for the service, but it would also give the DMSP group the technical expertise to create Java3D applications for the presentation of their data in a server/renderer framework.

Milestones/Deliverables

- o Fully documented web presence for dissemination of 3-D rendered radiance data - Month 12

- o Java3D client for rending 3D topologies and animations - Month 12