

ALGORITHMS FOR RUN TIME TERRAIN DEFORMATION

STATUS REPORT

SBIR Phase II Contract FA8650-05-C-6537 Topic AF04-064 April 8, 2006
Prepared for AFRL/HEAE, Air Force Research Laboratory
Attn: Steve Stephens, 6030 South Kent Street, Mesa, AZ 85212-6061
Tel: (480) 988-6561 ext. 146 e-mail: steve.stephens@mesa.afmc.af.mil

Prepared by Computer Graphics Systems Development Corp.
Attn: Roy Latham, 2483 Old Middlefield Way #140, Mtn. View CA 94043
Tel: 650-903-4922 Fax: 650-967-5252 e-mail: rwl@cgsd.com SkypeID: rlatham001

Project Abstract

The goals of Phase II are to develop and implement algorithms for a real time mission rehearsal simulation which will deform the terrain database to match target data. A correction function $c(x,y)$ that is added to every vertex in view. The correction function must (1) adjust the terrain surface to meet the specified features, (2) appear smooth and continuous so that the adjustments appear natural, and (3) do not distort aspects of the database that must be preserved. The implementation is to be in C++ and compatible with Open Scene Graph. The code will be placed in the public domain in keeping with an open source philosophy.

ALL DATA CONTAINED IN THIS REPORT IS PROPRIETARY TO CGSD CORPORATION AND MAY NOT BE DISCLOSED OUTSIDE OF THE US GOVERNMENT WITHOUT PERMISSION OF CGSD.

• *Previously Completed Work*

The Phase II contract was signed on April 8, 2005 and work started immediately. ▪ A kickoff meeting was held in May '05, and the program plans were reviewed. ▪ Don Burns, one of the originators of Open Scene Graph was added to the project team. ▪ Completed the first draft PDL that links to OSG and deals with database layers and tiles. ▪ The SHAPE file input software was written and debugged. An algorithm to find the shape of the object contact to the terrain was devised and programmed, with the terrain modified abruptly. ▪ The comprehensive algorithm for real time terrain modification was completed and documented. ▪ The correction function and recursive subdivision algorithms have been implemented and demonstrated.

• *Work Accomplished This Reporting Period*

The draft of the paper proposed for the IMAGE Society Conference was submitted this month. A copy of the paper is being forwarded alone with this report. We would appreciate any comments. There will be another revision before the paper is made final.

The software effort this month was mainly devoted to testing and debugging the insertion and subdivision code. We used a public domain Delaunay triangulation routine as part of our code. It turned out that this routine had a subtle bug that appeared during our testing, and produced a lot

of grief before it was tracked down. I temporary fix was developed, and the author of the Delaunay routine was notified. Our code is now working correctly.

Completion of the debugging allowed generating short animated sequences that illustrate the dynamic terrain modification process. The animations show the terrain being gradually deformed until it matches the target data. The smooth shaded imagery is at

<http://www.andesengineering.com/CGSD/filled.mpg>

and the corresponding wire frame sequence is here:

<http://www.andesengineering.com/CGSD/wire.mpg>

The wireframe version shows the adaptive subdivision of the terrain to ensure that the contours always appear smooth.

An important part of our project is documentation of the code base to allow users to adapt the code for use in other real time environments. We also have the goal of ensuring that the code can be successfully used and modified by users in the Open Scene Graph environment. Aside from comments in the code, our documentation plan includes recording and transcribing into document form a series of lectures on OSG and the dynamic terrain module.

We did some preparation for that this past month, acquiring a digital voice recorder and some transcription software. The Sony ICD-MX20 digital voice recorder holds about 11 hours of recording on a 256M memory stick. The main recording session is planned for mid-May.

• [Summary of Status](#)

The project is on schedule. The status of tasks is summarized below:

ID	Description	04/06
Task 1	Research & verify the timeliness of the full-scale Algorithm/technique	100%
Task 2	Verify the accuracy of the full-scale algorithm or technique	100%
Task 3	Design, code and test the full-scale algorithm	70%
Task 4	Develop a web site for the release of open source code	65%
Task 5	Examine the compatibility of the open source code with the existing IG hardware	40%
Task 6	Demonstrate the prototype	20%
Task 7	Write Interim Report(s)	48%
Task 8	Write Final Report and Summary Report	0%

• [Problems](#)

No significant problems or information that might impact schedule have been encountered in this reporting period.

- **Interim Results**

The draft IMAGE Society paper is attached.

- **Recommendations and Proposals**

There are no recommendations or proposals as a result of efforts in this reporting period.

- **Summary of Future Plans**

Code clean up and documentation will continue. The next phase of implementation is for line and areal targets. A documentation effort is planned to start in mid-May.