# The development of the new ESNW Passive Stereo Facility and the Rise of "Presence"

*Martin J. Turner and Mary McDerby*
*Research Support Services, Manchester Computing, University of Manchester*

### *When is 'a belief being somewhere' equal to a 'presence'?*

An Access Grid node system – termed by some as 'video conferencing on steroids' – is slowly becoming a common sight with hundreds of nodes now installed within the US, Europe and Australasia. These range from large lecture theatre nodes to small personal office nodes as well as the more traditional meeting room environment. Each node has many cameras, microphones and multiple screens, to enable the users within the meeting to 'believe' to an extent that they are in a similar shared environment. The participants should not notice the technology as an inconvenience, only as giving and presenting an added advantage to the users. The University of Manchester has been chosen to run the Access Grid Support Centre which is pioneering new techniques and middleware to extend this shared virtual work space. This belief that you as a user are sharing a common space, as well as being integrated completely within the meeting even if you are hundreds of miles apart, is a key feature to its success.

Previously in 1999, the University of Manchester developed and built one of the first large scale Virtual Environment Centres (VEC) within the UK academic community, called the Visualization Immersive Projection Laboratory (VIPL). The VIPL consists of a 7m curved screen, covering at the optimal position a 125 degree field of view, displaying three projected and blended computer generated images allowing, for example, high resolution architectural walkthroughs, full-scale engineering diagrams, computational fluid dynamic analysis and extensive medical visualizations. An auditorium style arena allows for an audience of up to about 30 to have a joint experience of the virtual environment so that they can both share and then discuss in an informed manner the scientific data displayed. The current system uses three Infinite Reality 3 graphics pipes on a multi-processor SGI shared memory cluster, running some specifically in-house designed software as well as a range of commercial products. Recent use by Earth Sciences researchers (Figure 1) have incorporated full user motion tracking and 3D control using floating virtual menus to display, modify and analyse gigabyte data sets as well as in the next stage of use to collaboratively link with other VECs at different universities.

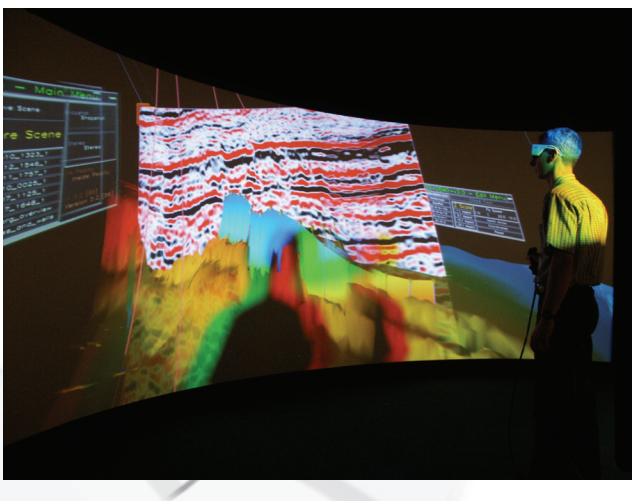

Figure 1: Earth Sciences in the VIPL.

VECs have now been used for wide-screen presentation of numerous types of data. The number of centres within UK based research environments, both universities and other commercial organisations, has rapidly increased in the last few years and is expected to continue as costs reduce. All these centres have an aim to try and create a high level of a term called 'presence', where a user or group of users, believe they are inside the data they are interacting with. From experiences within VECs two of the most important cues of 'presence' include maintaining items as believable real-sized objects and the inclusion of stereoscopic vision to stop the image appearing flat and remote.

The belief that you are in the same working environment and an increased level of 'presence' is effectively a shared aim of the Access Grid and the VEC designer. When the e-Science North West Centre (ESNW) proposed the building of a new large Access Grid meeting space, the opportunity was taken to incorporate a VEC within the same space, both increasing the facilities available, and saving construction costs as a joint build, as well as eventually being able to exploit the features from each system to benefit the other.

## *A New Centre - Early Launch and a Greet-and-Meet Session*

The ESNW Passive Stereo Facility adds functionality to the current design of a core Access Grid node. The current node consists of an 8m flat screen illuminated by three projectors including surround sound as well as three fixed cameras with multiple microphones. The two main additions required to incorporate the features of a VEC are a dedicated computer rendering engine in the form of a small PC based cluster and the addition of a complete stereoscopic display system. The cluster was designed using one master computer, that controls three slave computers. Each machine is identical incorporating; dual Xeon 3.06GHz processors, nVidia QuadroFX 3400 graphics cards, 1GB memory.

Each PC outputs two different images, one for the left eye and the other for the right eye, therefore each slave machine covers one third of the screen with two overlapping images. This means three pairs of projectors are required (each projector is a Christie LX32) giving a DLP (Digital Light Processor) pixel resolution for the complete screen of 3072x768, although expandable via anti-aliasing to a higher resolution depending on software use. Stereoscopic viewing (Figure 2) is achieved using linear polarization to separate the left and right eye views. Alternative matching polarising filters are placed between the projectors and equivalent light weight polarizing filters are worn by the viewers.

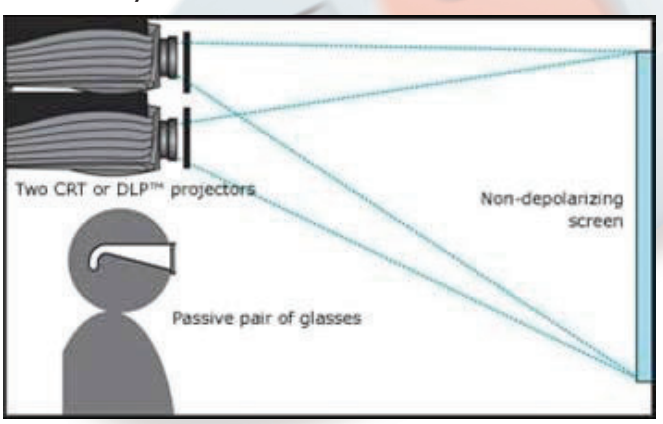


Figure 2: Stereoscopic Viewing.

For experimental purposes the new ESNW Passive Stereo Facility is built using alternative techniques to the original VIPL. The former uses a cluster PC system, passive edge-abutted stereo projection and a flat screen model, whereas the latter uses shared memory, active blended stereo projection and a curved screen model allowing for varied user evaluation studies.

The complete system can easily switch between the two main modes of Access Grid environment and VEC scientific visualization; and although the environments during a presentation can be mixed, the two systems should be considered as augmented to each other and not closely integrated. On the first Thursday in March 2005 the ESNW held a public 'Greet-and-Meet' session, demonstrating two of the main scientific visualization software platforms; AVS/Express and Amira (Mercury), Figure 3. These two products aim to display similar scientific visualizations, but have alternative methods for carrying out the image rendering over multiple PCs. Amira launches a set of software daemons, one on each of the slave computers that incorporates a full data model and rendering engine at each slave node requiring the complete data-set to be transferred before any visualization can occur. MultiPipe AVS/Express has been developed in-house under contract for KGT and AVS and runs rendering modules at each slave computer, where the master computer then transmits intelligently OpenGL commands to the slaves. Again, this choice allows for comparison of performances and the ability to create new improved rendering design modes for any future system. A forthcoming article of *CSAR Focus* will consider the development of the MultiPipe AVS/Express and the Parallel System Toolkit that are currently being integrated for high performance visualizations over many processors.

## *New Experimental Augmented Project*

VECs are unfortunately neither portable nor cheap. A new programme (SAGE Stereoscopic Access Grid Environment) incorporates the specification and construction of cheaper stereoscopic projection units incorporating novel stereoscopic video encoders for a variety of user groups.

The project involves two phases; the first being the construction of software and hardware to be incorporated with current high-end Access Grid nodes, specifically in its initial stage at the University of Manchester and the University of Southampton. Incorporated with this will be the developmental build and specification for a portable system that has minimal outlay costs for new users; estimated at under £10,000. The second phase of the project is the use of software recording systems based around a light-weight portal for storage, distribution and analysis of these stereoscopic performances.

Informal pre-workshop and more formal workshop demonstrations are planned to promote these ideas to a local audience and through the Access Grid and wiki web sites as a global forum. A set of initial user groups

have indicated desires to raise capital and resources independently to incorporate stereoscopic units within a network and include; the Centre for Creative Technology at De Montfort University, archaeological researchers at the University of Southampton, Material Sciences and Earth Sciences at the University of Manchester.

### *Use and Availability*

Regular training courses, specific development consultancy and demonstration sessions are available via the Research Support Services group, at Manchester Computing. These sessions cover both the Amira and the AVS scientific visualization software tools, as well as on the practical use of the VIPL and the ESNW Passive Centre facilities.

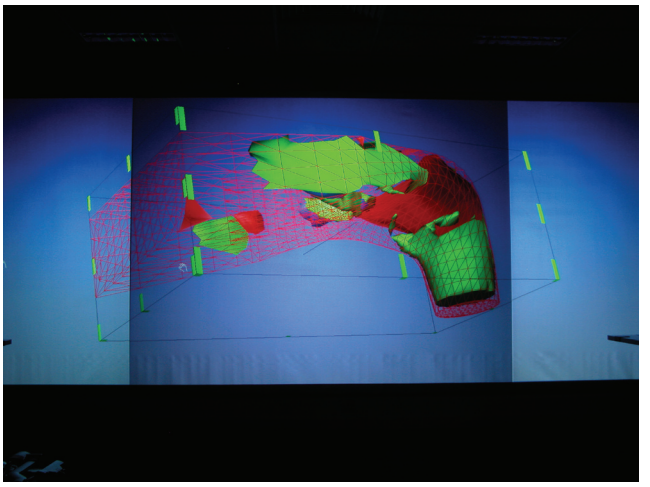

Figure 3: ESNW Passive Stereo Facility.

# The Celebration of UK Engineering Research and Innovation


***Ms Joanna Leng***

***HPC Consultant, Manchester Computing, University of Manchester***


Last November an international review of UK engineering research was conducted. The exercise was organised by EPSRC in partnership with The Royal Academy of Engineering (http://ire2004.org.uk). This was the latest in a series of reviews of engineering held by EPSRC and the year of planning and preparation that made it possible has been shown to be worthwhile, see the reviewers' report http://www.epsrc.ac.uk/ResearchFunding/Programmes/Engineering/ReviewsAndConsultations/InternationalReviewReport.htm.

The review was conducted by an international panel of 26 experts and lasted one week. During this time subsets of the panel visited forty academic sites across the country. The showcase of the review was an exhibition which allowed the panel to see the breadth of research from universities not visited. CSAR participated at this exhibition with Mike Pettipher, Joanna Leng and Lee Margetts demonstrating engineering related work.

The exhibition was a large, unique, one day event held at Excel in the London Docklands. Over 200 groups contributed and were divided into 12 integrated themes. CSAR was part of the Underpinning Technologies theme. For some time the CSAR team have been working with Professor Ian Smith to develop parallel numerical libraries for engineers. The results of these libraries were analysed and validated through a visualization system that allowed users to directly manipulate and explore the data. The group used a portable virtual reality system to display these visualization images at the exhibition. The system had a large, bright screen and used stereo projection so that when a visitor stood in front of the system they felt immersed in the scene.

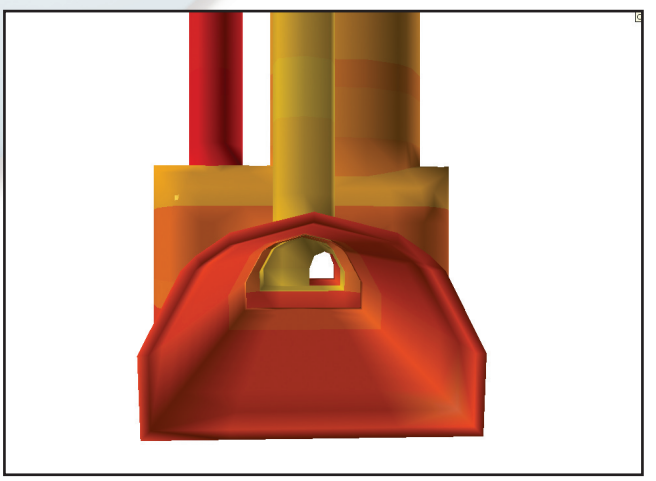

Figure 1: This is the start of the journey through the CERN tunnel.

Many of the visitors particularly enjoyed flying through the CERN tunnel. The stereo effect made many duck to avoid the "walls" of the tunnel.