

Virginia Tech

US Navy Workshop

December 6, 2019

Advanced Research Computing (ARC)
Center for Geospatial Information Technology (CGIT)

Topic Overview

Goal:

cover Virginia Tech's experience and outlook on 3D GIS & Facilities Management over the last 18 years and into the future

We will cover 3 topics:

- CGIT
- ARC
- Collaborations & Impact



Virginia Tech (VT): Ut Prosim

- A land-grant University serving the Public Good
- *Science* and the *Reproducibility* of Research is a core mission
- Investments in a broad spectrum of digital content **and access**:
 - **Capture (i.e. scanning)**
 - **Design**
 - **Simulation**
 - **Archival and sharing**
 - **Analytics**
- International Standards provide: **interoperability, accessibility, and durability**
 - the basis for a long-term strategy



CGIT

GIS Interoperability

Data Fusion, Analytics, and Web apps to solve real problems

Integrating:

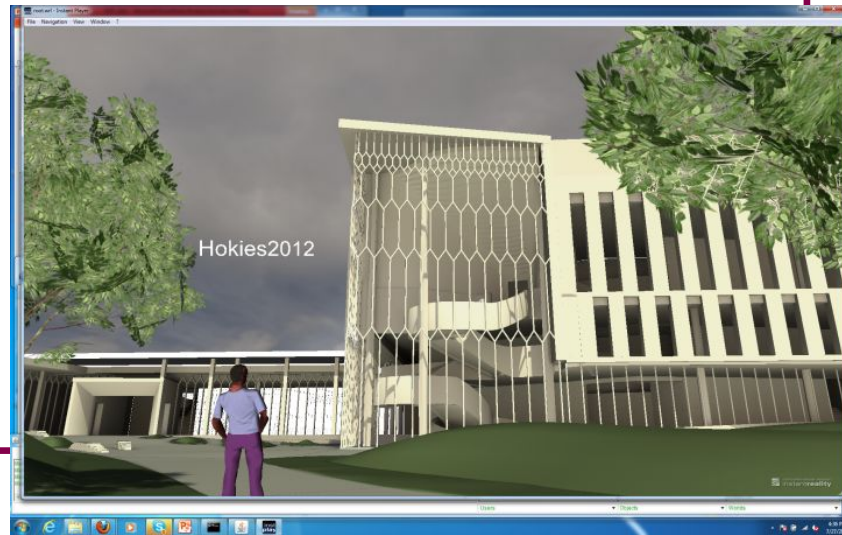
- Climate
- Tides
- Flooding
- Connectivity (Broadband)
- BIM

VT Advanced Research Computing

The screenshot shows a web browser window displaying the VT Advanced Research Computing website. The browser's address bar shows 'arc.vt.edu'. The website header features the Virginia Tech logo and the text 'Advanced Research Computing'. Below the header is a navigation bar with links for 'USER DASHBOARD', 'USER INFO', 'RESOURCES', 'ARC NEWS', 'ABOUT', 'SUBMIT A REQUEST', and 'VISUALIZATION'. The main content area is divided into several sections: 'LATEST CLUSTER NEWS' with a list of events (Oct 11 Hackathon, Torgersen, Huckleberry, Cascades, Dragonstooth, Newriver, Blueridge); 'RECENT POSTS' with a link to 'Quantifying opinion'; 'ARC NEWS' with three featured articles: 'WHAT CAN ARC DO FOR YOU?', 'NEW ARC CLUSTER : HUCKLEBERRY', and 'GAS-SURFACE INTERACTIONS ARE EVERYWHERE'; and a 'SIMPLE CALENDAR' for December 9, 2019, listing 'Deep Learning for Computer Vision' from 12:30 pm to 4:30 pm. The Windows taskbar at the bottom shows the time as 1:04 AM on 12/4/2019.



X3D Blacksburg



X3D Blacksburg

An ongoing collaborative to build a Mirror World / Digital Twin of our campus, town, and surround

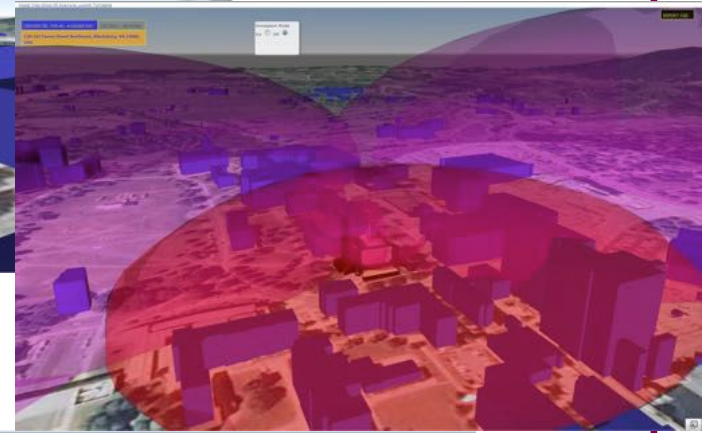
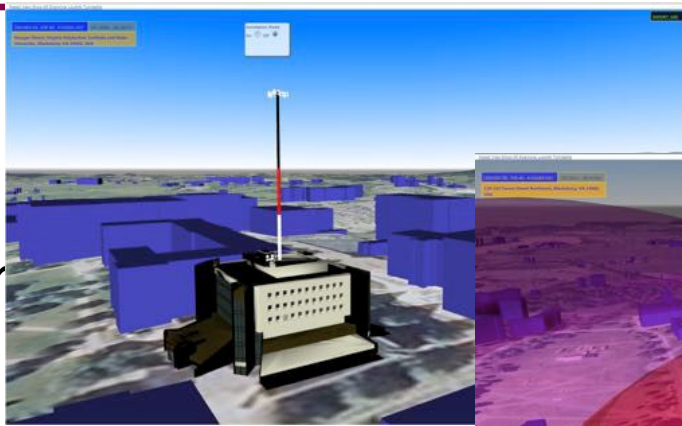
- Used lidar data to establish more accurate building elevations
- Used Lidar to provide tree locations, which were then populated with different 3D LOD models
- Videos
 - <https://vimeo.com/279335135>
 - <https://www.youtube.com/watch?v=Y5ViPrmJ848>

Online

X3D Blacksburg on GeoServer

X3D LODs

Binary X3D tiles



Annotations

Annotation ID	User Name/Tags	Address	Note	Image Link
1931-01-01	A:21	Grove, President's House, House	President's House	Grove (President's House)
1931-04-07				
1931-05-01				
1931-07-01				
1931-07-04				
1931-09-01				
1931-11-21				
1932-01-09				
1932-04-01				
1932-07-13				
1933-01-01				
1933-03-07				
1933-04-01				
1933-08-15				
1933-10-01				
1934-01-01				
1934-02-01				

Change Bounding Box

Manual BBox: Max X: 142958.86092, Max Y: 4119170.47058 OR Max X: 108505.11904, Max Y: 4124029.52937

Map Extent as BBox: B-1

Custom Request: `http://imagery02.esri.com/arcgis/rest/services/World_Imagery/MapServer/0/0/0?layers=0,1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45,46,47,48,49,50,51,52,53,54,55,56,57,58,59,60,61,62,63,64,65,66,67,68,69,70,71,72,73,74,75,76,77,78,79,80,81,82,83,84,85,86,87,88,89,90,91,92,93,94,95,96,97,98,99,100`

Apply BBox / Reset BBox

Apply BBox / Reset BBox

Apply Image Texture

Apply Custom URL

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Change Bounding Box

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Map Extent as BBox: B-2

Custom Request: `http://imagery02.esri.com/arcgis/rest/services/World_Imagery/MapServer/0/0/0?layers=0,1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45,46,47,48,49,50,51,52,53,54,55,56,57,58,59,60,61,62,63,64,65,66,67,68,69,70,71,72,73,74,75,76,77,78,79,80,81,82,83,84,85,86,87,88,89,90,91,92,93,94,95,96,97,98,99,100`

Apply BBox / Reset BBox

Apply BBox / Reset BBox

Apply Image Texture

Apply Custom URL

IIA

rt.ec



Watershed and Plantings

Topography and changes are essential for accurate flood models and hazard mitigation plans.

We have flown:

- Stroubles Creek (Stream Lab)
- Catawba Sustainability Center
- Dozens of other sites in Virginia, including agricultural experiment stations
- Videos : <https://www.youtube.com/watch?v=Y5ViPrmJ848>

Immersive, Multi-user 3D Blacksburg

Remote site visits



Remote site visits

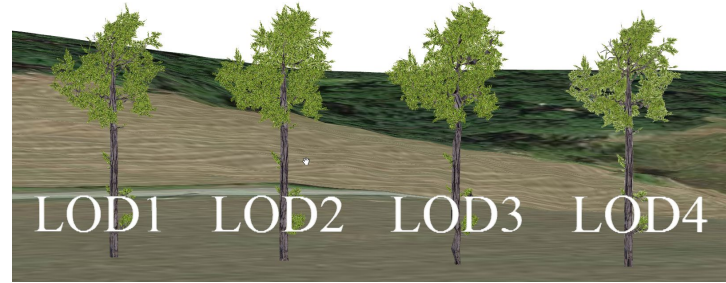
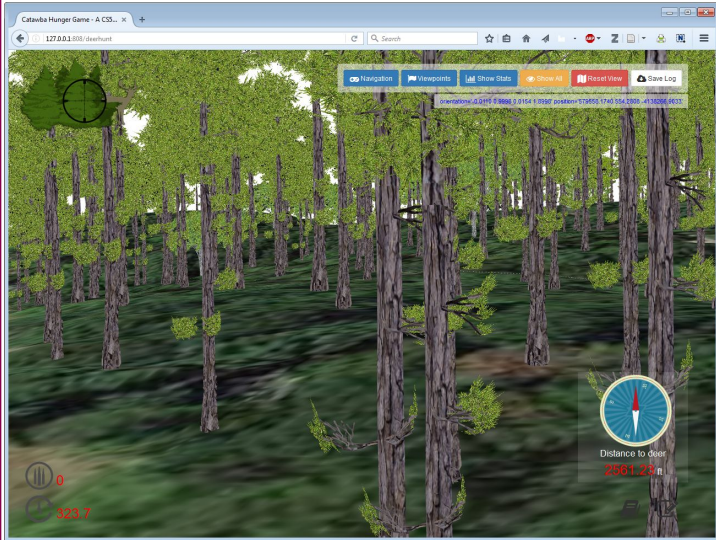


3D Blacksburg Collaborative Planning

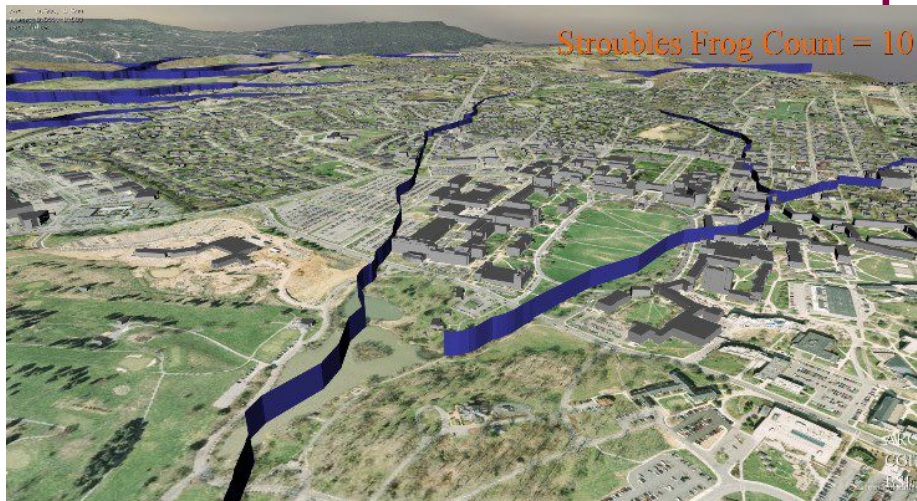
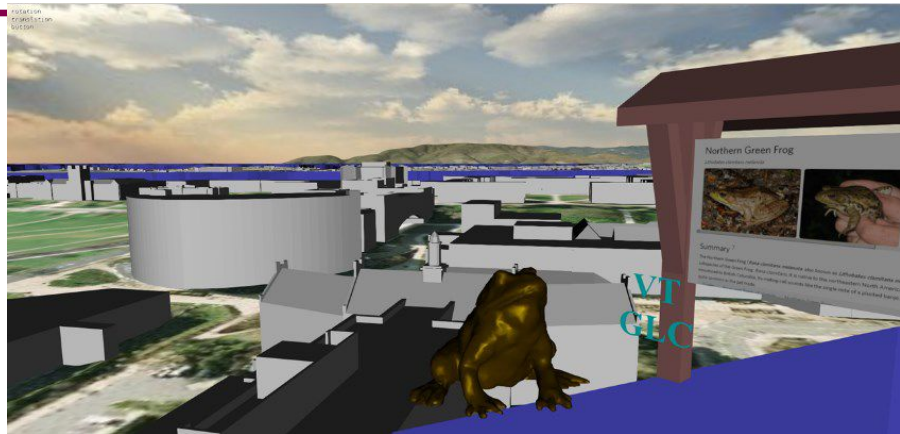


Web3D: Extensible 3D (X3D)

TIN, Imagery, Tree locations



Haitao Wang, Xiaoyu Chen, Nicholas Polys and Peter Sforza (2017). "A Web3D Forest Geo-Visualization and User Interface Evaluation". In Proceedings of the 22nd International Conference on 3D Web Technology (Web3D '17). ACM, New York, NY, USA.

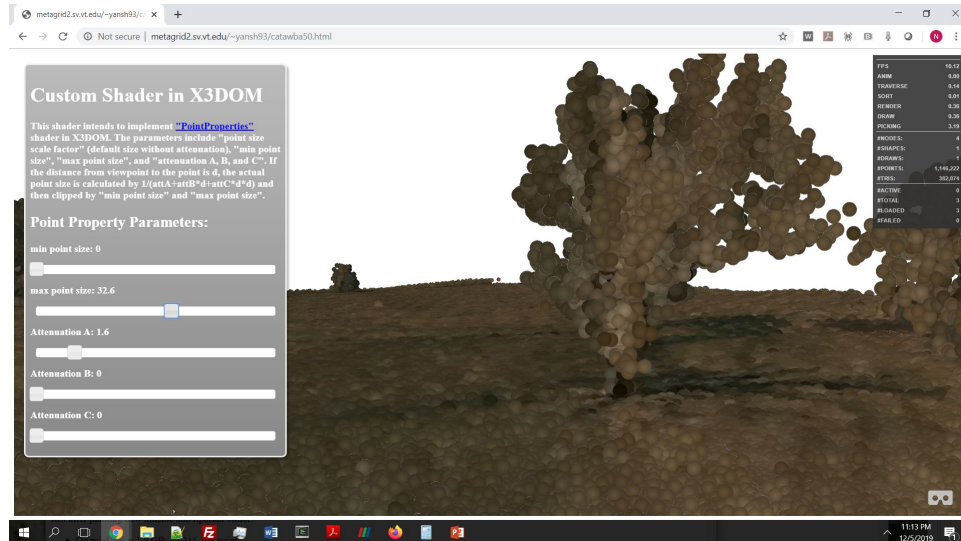
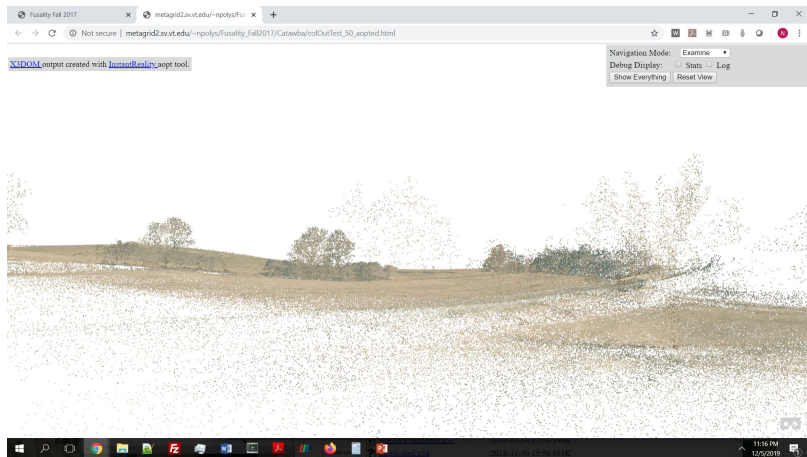


PointClouds and X3D Rendering

PointProperties in X3D 4.0

http://metagrid2.sv.vt.edu/~npolys/Fusality_Fall2017/home.html

<http://metagrid2.sv.vt.edu/~yansh93/catawba50.html>

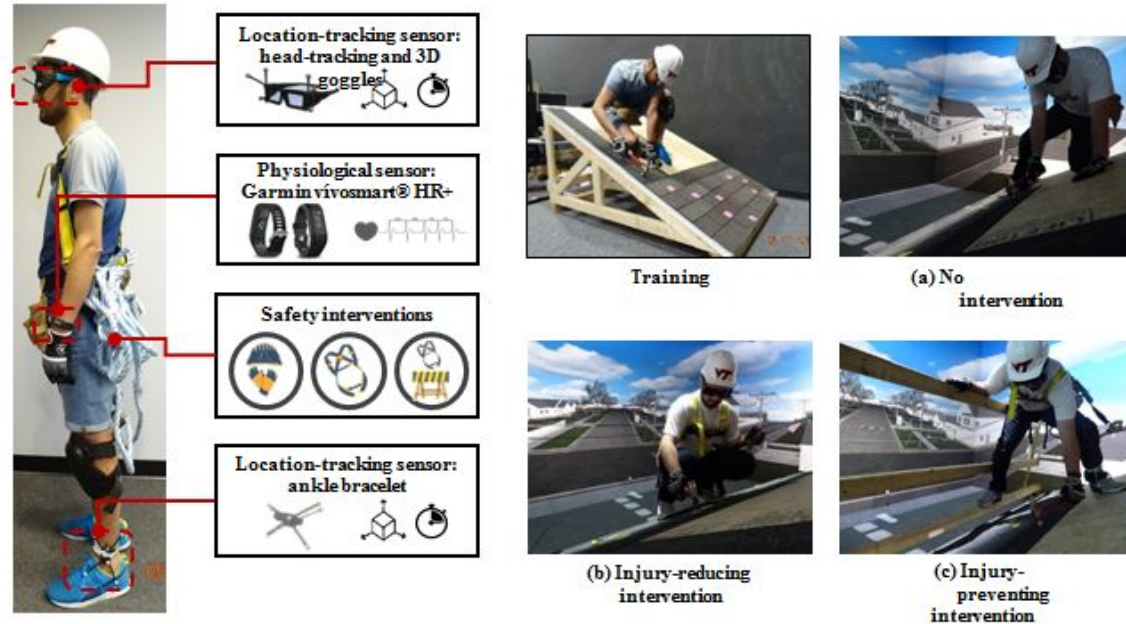


Training & Safety

•Sogand Hasanzadeh
PhD Dissertation

Latent Effects of Safety Interventions

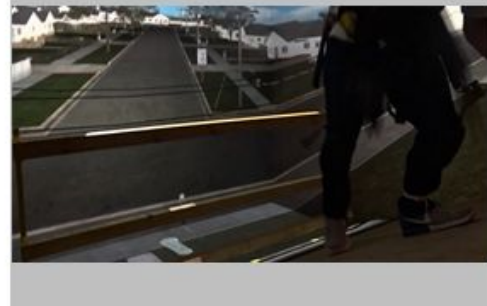
Sogand Hasanzadeh



Latent Effects of Safety Interventions



Sogand Hasanzadeh



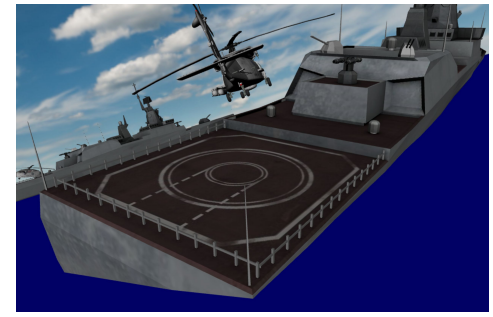
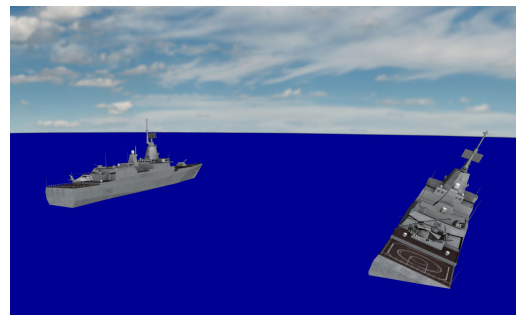
Latent Effects of Safety Interventions

Sogand Hasanzadeh



Simulation

Helicopter landing dynamics at sea



Virginia Tech @VTEngineering team uses #X3D to visualize and test multiple control algorithms for ship and aircraft maneuvers, working to improve safety and increase insight. **Cornel Sultan, Keren Chen, Nicholas Polys Virginia Tech**

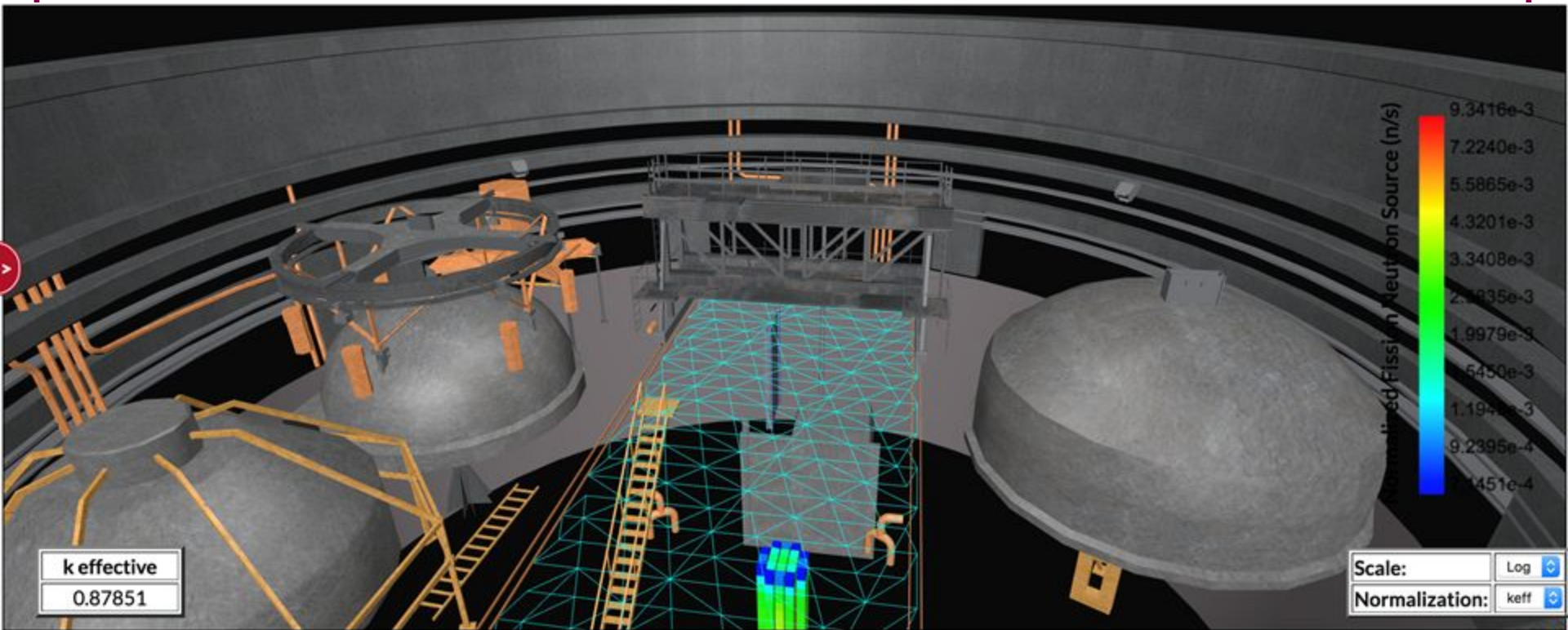


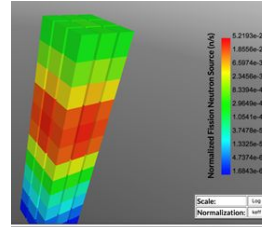
- **VRS-RAPID** is a collaborative, interactive, and 3D virtual-reality **web-application** for real-time simulation of nuclear systems
- Users connect to VRS-RAPID to collaborate **on modeling and simulation** of e.g., nuclear reactors
- Valuable tool for nuclear industry operators and regulators, educators and students, and continuing and professional training



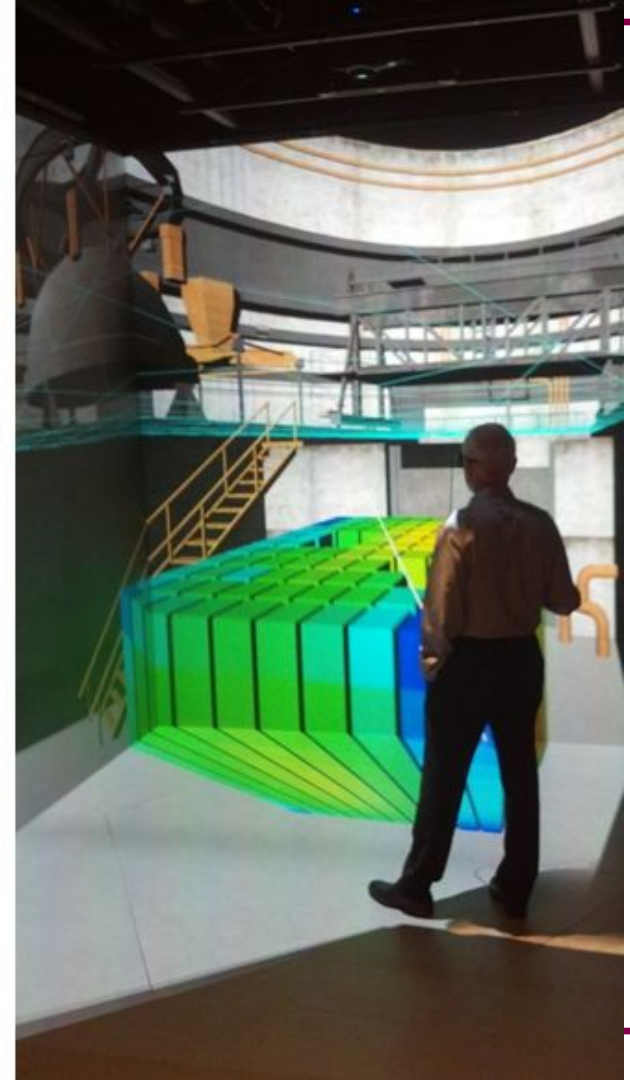
VRS
Rapid







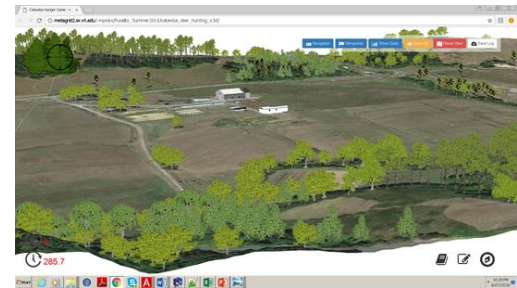
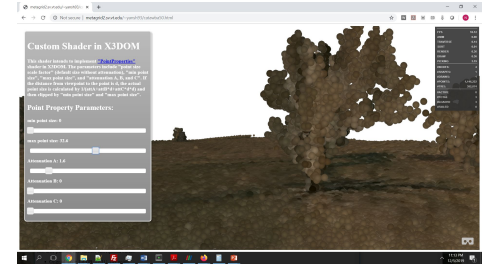
- - Producing X3D enables the delivery of results to other platforms, such as immersive Virtual Reality
- - For example, VRS output data can be loaded in the 26.7 million stereo pixel HyperCube in the VT Visionarium Lab
- - Head tracking and embodied interaction at the human scale creates a highly immersive experience supporting spatial understanding
- - Using projection VR, users can see each other and themselves in the space



HTML5 + X3D

Using SRC 3D Compression

- 1) 440K points = 23MB.ply , 21MB.x3d
- 2) Compressed.X3D = 3.4 MB
- 3) Interaction through Web and WebVR
 - 50-60 fps on laptop
- 4) Gltf Inlining also demonstrated



Take-Aways

- X3D and open standards leadership helps Virginia Tech fulfill its mission everyday
- X3D supports interoperable data, unlocking value across the enterprise, application stovepipes, and hardware platforms
- X3D is durable, providing a data strategy longer than silicon valley life-cycles

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