



World Wide Webiverse
www.web3d.org

SIGGRAPH 2024

Anita Havele
Executive Director, Web3D Consortium
anita.havele@web3d.org

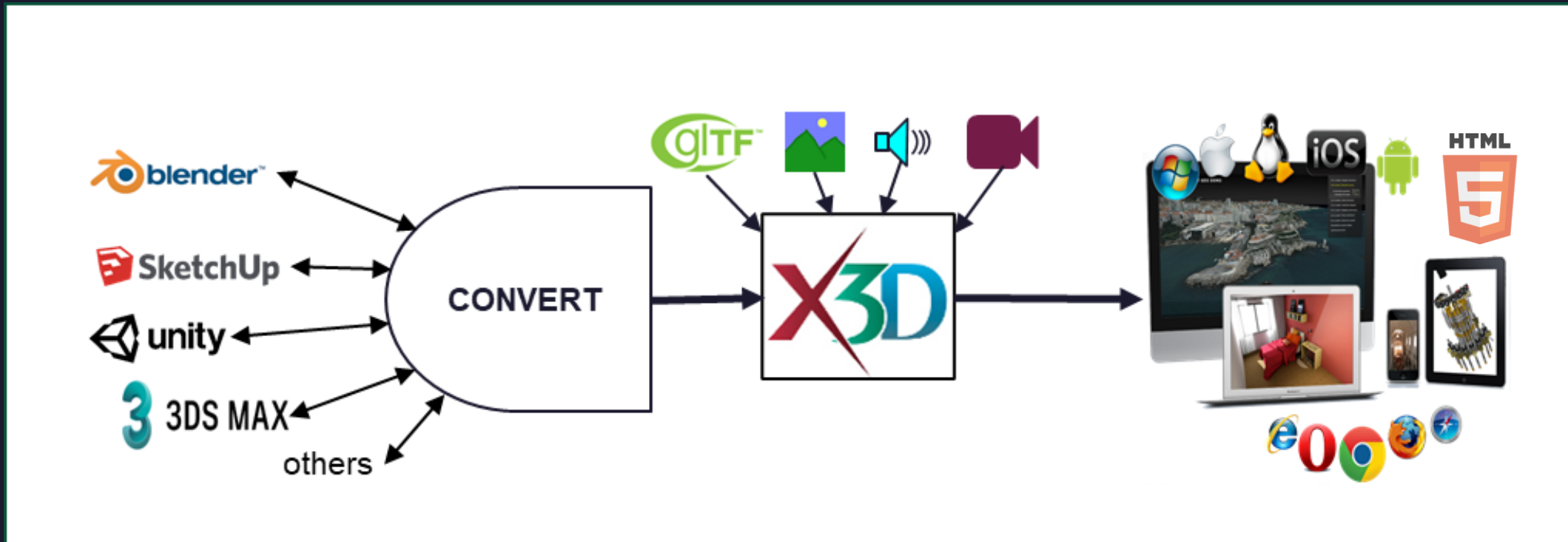
Nicholas Polys
President, Web3D Consortium
npolys@vt.edu

WWW + Web3D (Webiverse)

- *There is one Web :*
 - *composed of multiple URL-addressable and linked interactive experiences*
- *Similarly, there is one Metaverse:*
 - *composed of multiple addressable and linked interactive and spatial experiences called virtual worlds*

WWW + Web3D (Webiverse)

- *The Webiverse:*
- Designed for distributed clients to experience 3D worlds from across platforms and across applications ... across the Web



WWW + Web3D (Webiverse)

X3D Anywhere !

3D + VR + AR Capable
Runs on multiple devices
(Phones, tablets, desktops, CAVEs)

Used in multiple domains
(Medical, Geospatial, 3D printing/scanning,
CAD and more)

Interaction Animation Archivability Security

WWW + 3D Spatial data = Webiverse + Multi user experience = Open Interoperable
Metaverse



What do Web3D Standards have to offer:

Web3D based Immersive 3D ISO ratified standard

3D Presentation layer, bring data from multiple domains into one application

Multiple domain support (Geo, Medical, AR/VR, CAD...)

Converging with other industry standards

Fostering interoperability and adoption



Web3D.org

content

with



The logo for the Web3D Consortium is displayed on a background of a network graph with nodes and connecting lines. The text 'web|3D' is in a large, bold, blue font, with a vertical line separating 'web' and '3D'. Below this, the word 'CONSORTIUM' is written in a smaller, blue, all-caps font.

web|3D
CONSORTIUM

**The Web3D
Consortium
is building open,
interoperable, 3D
Immersive Worlds**

Today's Topics

Web3D Standards

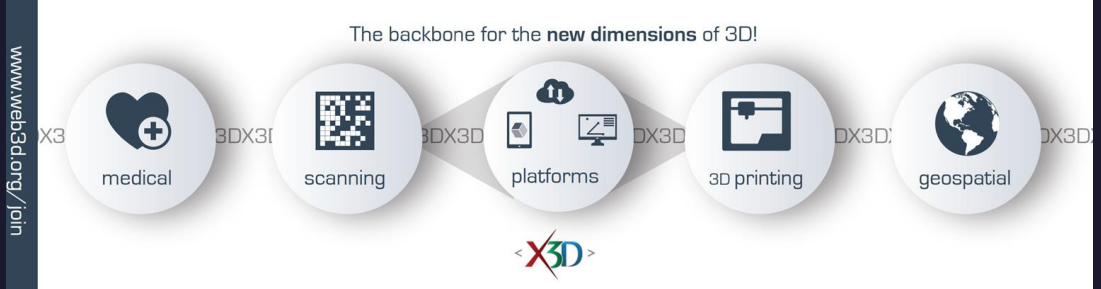
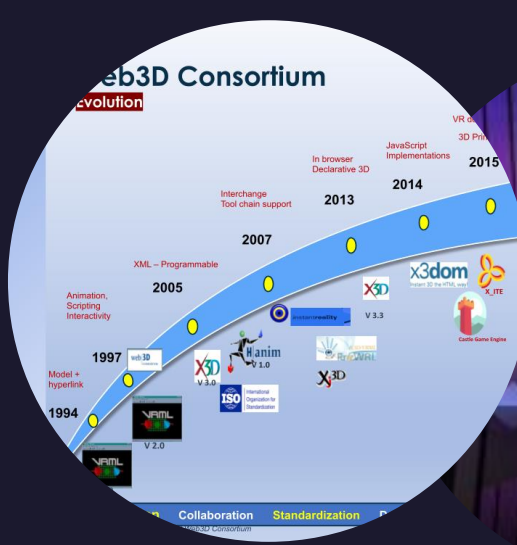
Web3D Evolution

Web3D Open-source implementations

Web3D Ecosystem

Web3D Member Use Cases

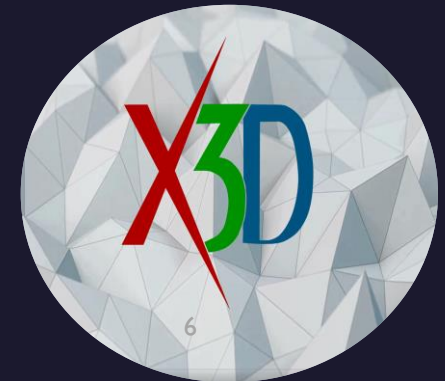
What next?



Who are we: The Web3D Consortium

www.web3d.org

- Not-for-profit Standards Development Organization (SDO), International, Member driven
 - **Community of Technologists and Enterprises**
- Providing Open International Standards (ISO) specifications for Real-Time Interactive 3D Graphics
Our Standards: X3D and HAnim
- Members dedicated to the portability, interoperability, and durability of interactive 3D content



Web3D® Consortium

Member funded; community driven; nonprofit organization



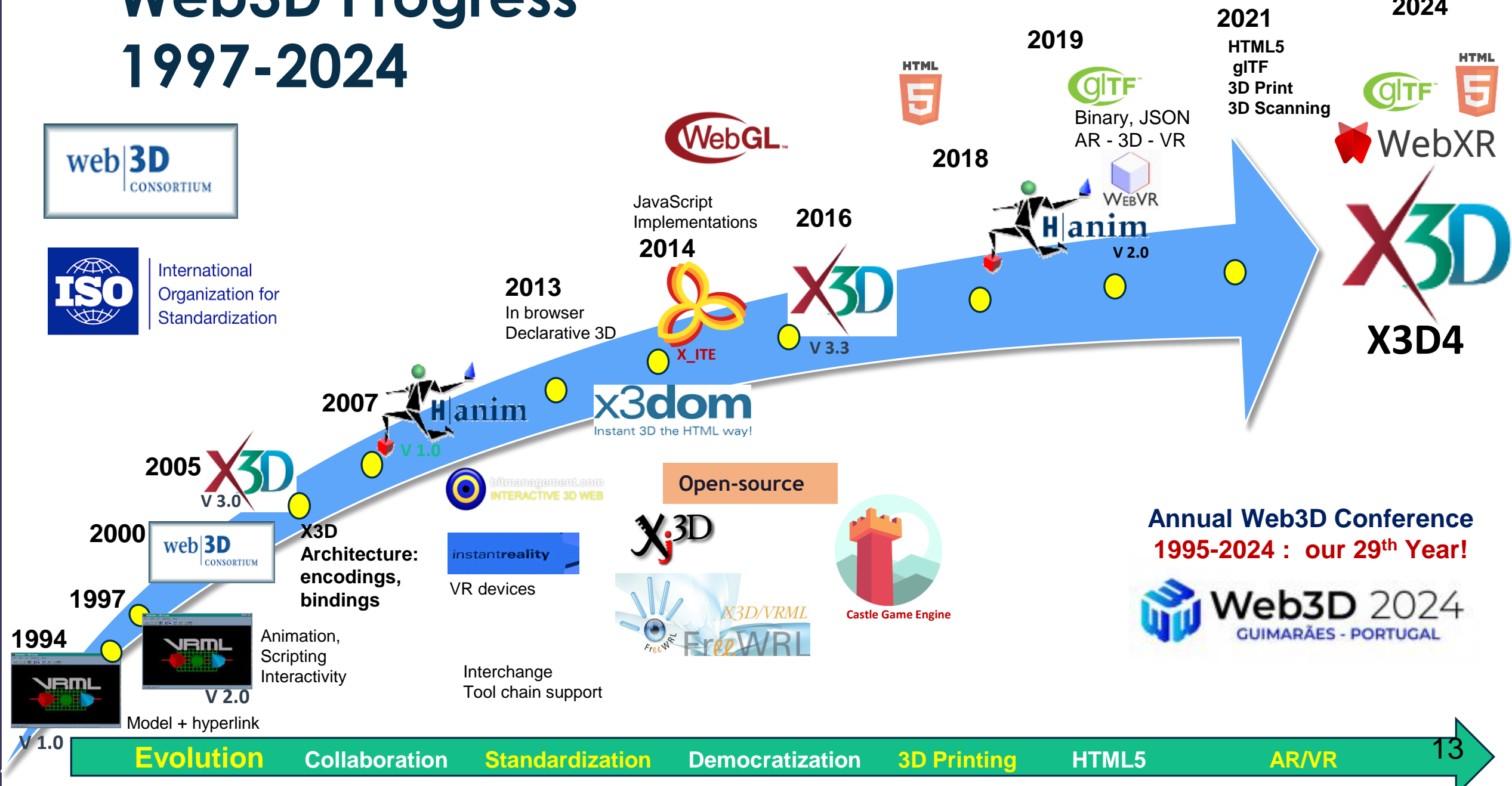
- Developing the royalty-free ISO specifications -
- X3D® and HAnim for interactive 3D Graphics on the Web



- Community of Technologists and Enterprises
- Members include Academia, Government, Industry, Research, and Professionals
- Several open-source implementations



Web3D Progress 1997-2024



1994
VRML V 1.0
Model + hyperlink

Animation,
Scripting
Interactivity

2000
web3D CONSORTIUM

X3D
Architecture:
encodings,
bindings

bitmanagement.com
INTERACTIVE 3D WEB

instantreality
VR devices

Open-source

x3D
X3D/VRML
FreeWRL

Castle Game Engine

Interchange
Tool chain support

2005
X3D V 3.0

2007
H|anim V 1.0

x3dom
Instant 3D the HTML way!

2013
In browser
Declarative 3D

X_ITE

2016
X3D V 3.3

JavaScript
Implementations
2014
WebGL

HTML 5

2018

H|anim V 2.0
WEBVR

2019

glTF Binary, JSON
AR - 3D - VR

2021

HTML5
glTF
3D Print
3D Scanning

WebXR

2024

X3D
X3D4

Annual Web3D Conference
1995-2024 : our 29th Year!

Web3D 2024
GUIMARÃES - PORTUGAL

Evolution Collaboration Standardization Democratization 3D Printing HTML5 AR/VR



X3D: Extensible By Design

- The ISO Standard scene graph pattern is adaptable across :
 - Graphic and data innovations
 - Formats (encodings)
 - Programming languages
 - Rendering libraries
 - Hardware





X3D: Extensible for Innovation

- @ 2000 : XML & binary
- @ 200x : Shader programming
- @ 200x : Virtual Reality (CAVEs, Headsets)
- @ 201x : WebGL
- @ 201x : Physically-Based Rendering (PBR)
- @ 2023 : WebXR
- @ 2024 : X3D4



X3D: Extensible Across the Generations

- Before broadband, before GPUs ... there was X3D!
- Now, running faster than ever!
- Mobile devices as an app or Web page
- Add color to 3D prints
- Rendering libraries from Mesa and POV-Ray,
DirectX, OpenGL, WebGL;
- WebGPU, Vulkan experiments ongoing



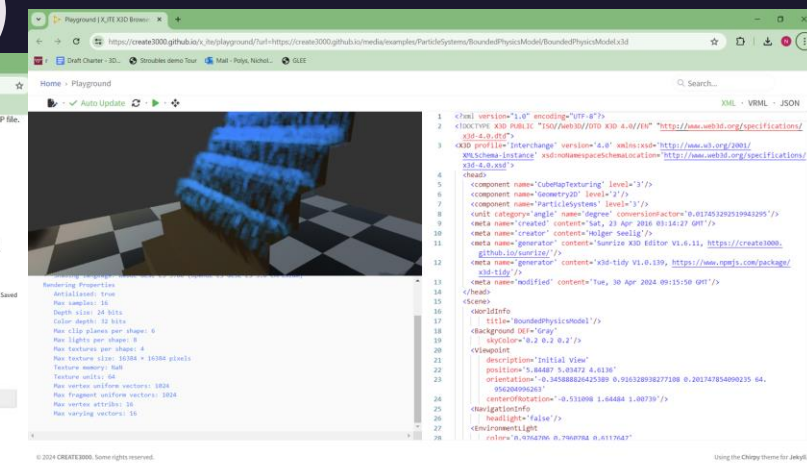
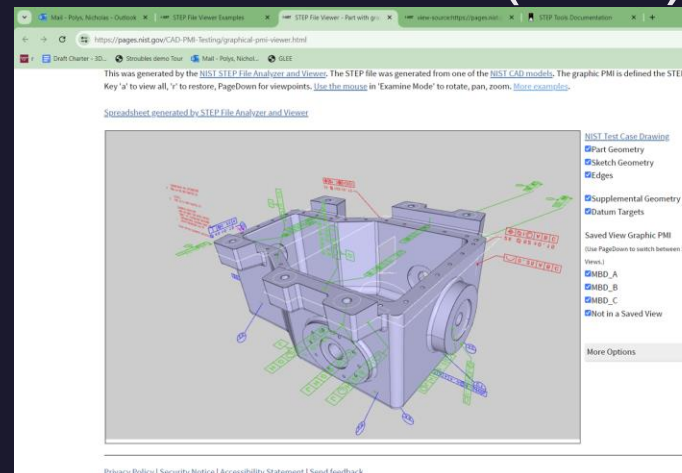
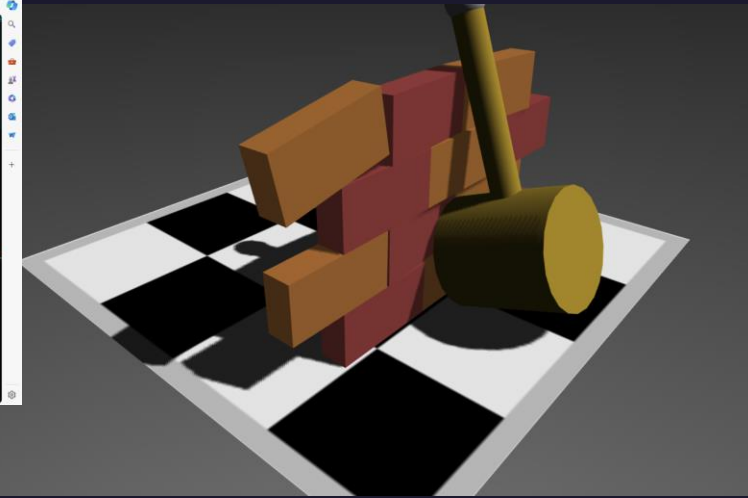
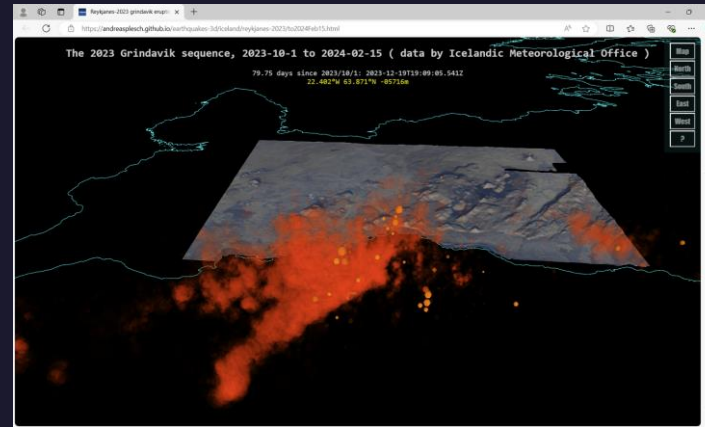


X3D: Extensible for the Web

- Interoperable (X3D + HTML5 + glTF + WebGL)
- Portable across mobile, Web, WebXR and Immersive platforms
- Multiple encodings: XML, VRML, Binary, JSON
- Multiple language APIs:
 - Java, JavaScript, Python, C, C++, C#
- 3D CMS and data-driven worlds since 1998 !

X3D: Extensible Across Applications

- Volume rendering
- Geospatial
- Rigid Body Physics
- HANIM
- Distributed Interactive Simulation (DIS)
- CAD, NURBS
- Particle Systems
- ...



Extensible for Convergence

Web, industry and standards bodies have been collaborating for a foundation for open interoperable enterprise 3D solutions



... and many more!

www.web3D.org/liaisons

X3D4 (ISO/IEC 2024)

- Specifies harmonization with other standards:
 - **gITF**
 - **WebAudio**
 - **MPEG**
 - **MIDI**
 - **HTML + DOM**
 - **DICOM**



Metaverse Standards Forum

3D Web Interoperability WG

- Use Cases -> Requirements
- Standards review & Gap Analysis
- Projects
 - Linked spatial experiences
 - Functional Profiles for Metaverse content
 - 3D UserAgent
 - Consistency of Experience



NEW RELEASES!

Four different open-source engines released for SIGGRAPH!

Chock-Full-O-Features and formats ~!



X3DOM.org : Javascript Engine - New Release 1.8.3

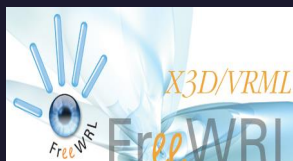


X_ITE Javascript Engine - New Release 10.0.5



Castle Game Engine

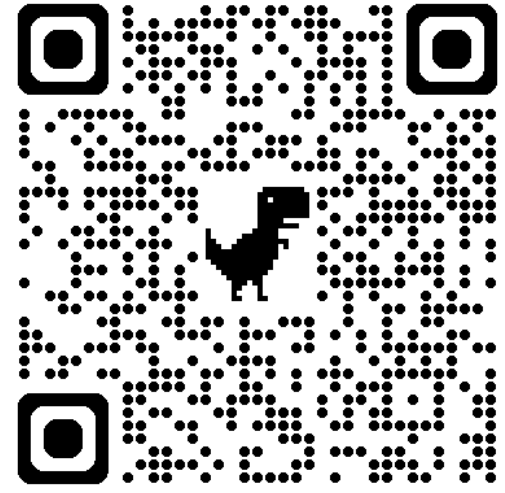
Castle Game Engine



FreeWRL 6.1



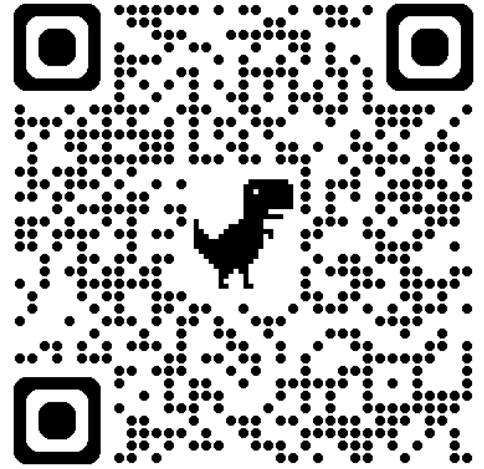
X3DOM.org



- JavaScript WebGL platform for X3D + HTML
- 1.8.3 release includes WebXR support
- Support for:
 - X3D Geospatial support (multiple projections)
 - Proposed [HTML profile](#)
 - glTF support
 - Sandbox in-browser editor



X_ITE

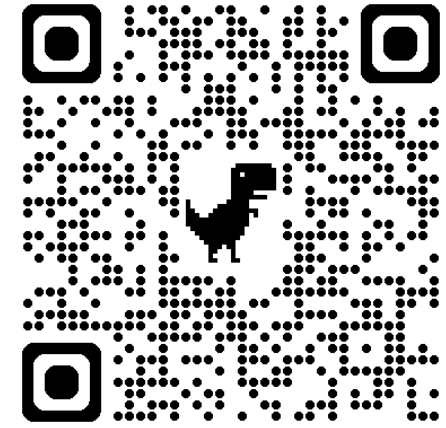


- JavaScript WebGL platform for X3D + HTML
- New release 10.0.5 !
- Recent Features
 - glTF, GLB: all extensions supported
 - Playground in-browser editor w/ syntax highlighting
 - Sunrize Editor w/ tooltips & material, texture, and audio preview
 - Full support for: VRML, STL, OBJ, PLY, SVG

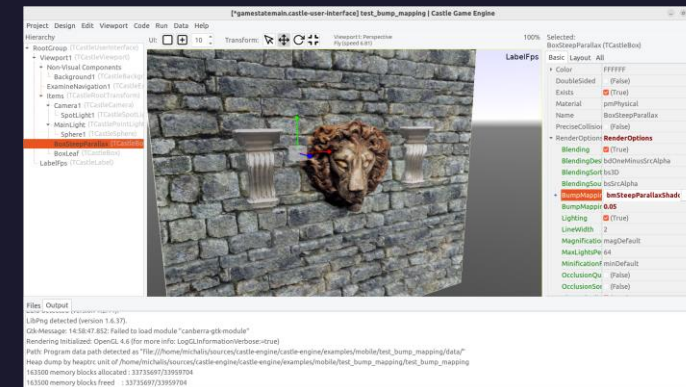


Castle Game Engine

Castle Engine



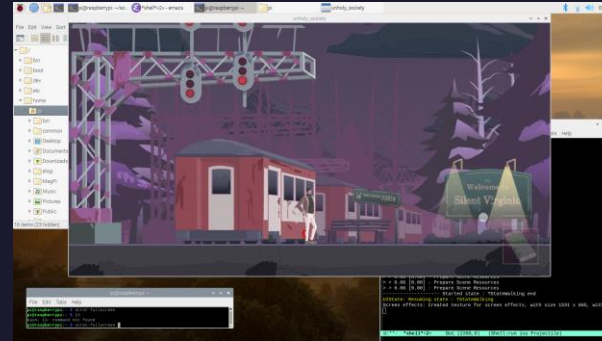
- Open source game editor and engine
 - Cross-platform (desktop, mobile, console) 3D and 2D game engine
 - Powerful visual editor.
 - Support for glTF, X3D, VRML, Spine, and *more*
 - Fast clean code using modern Pascal
 - Free and open-source



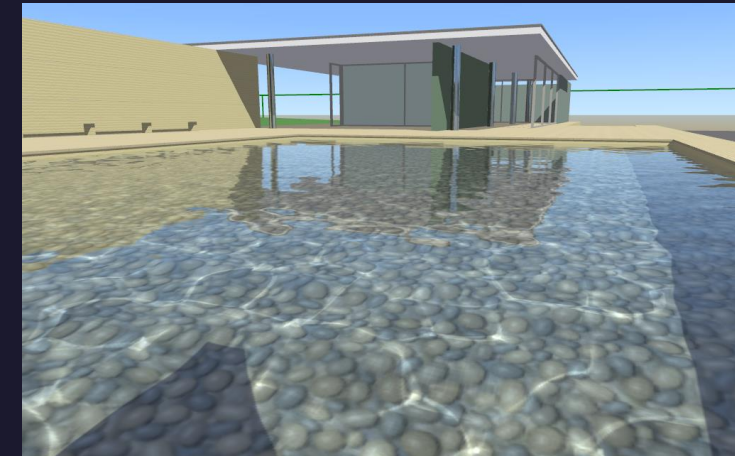
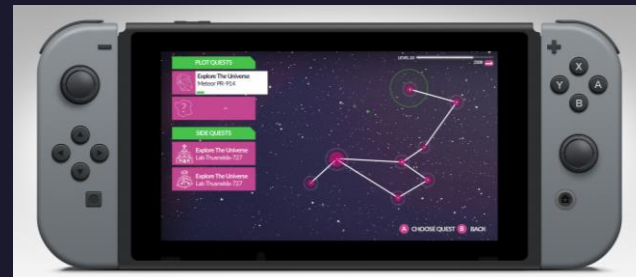


Castle Game Engine

Castle Engine



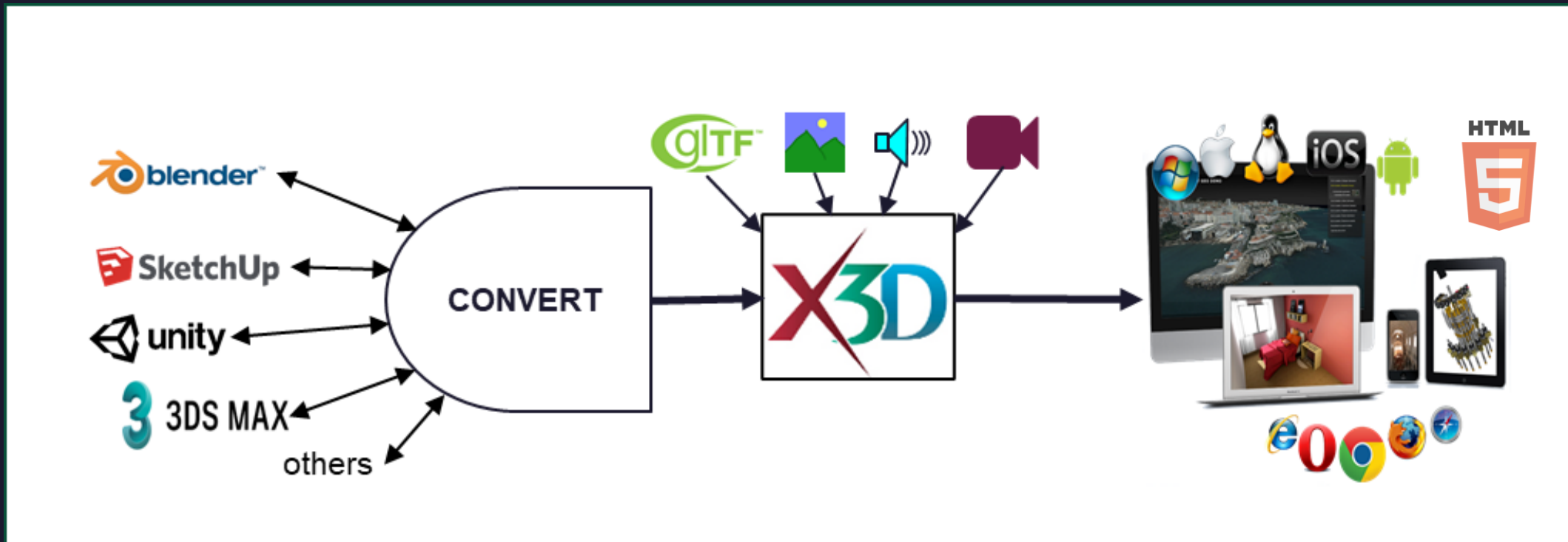
- glTF (editor w SktchFab integration) + X3D
- Physics, composable shader effects, shadows, mirrors, physically based rendering, bump mapping, gamma correction
- Target any platform (desktop: Windows, Linux, macOS, FreeBSD, Raspberry Pi, mobile: Android, iOS, console: Nintendo Switch).
- WebGL (WASM) and Oculus (VR) coming soon.
- IDE integration, Patreon



X3D Ecosystem Special Interest Group

Tool Testing, Tracking, Advocacy

Call for Participation: <https://www.web3d.org/working-groups/x3d-ecosystem>



Examples: Member Use Cases



Dr. Nicholas Polys

Domain: Virtual Reality



Mike McCann

Domain: Geospatial



Casey Gomez

Domain: Geospatial



Member Use Cases



Chris Lane

Domain: Medical



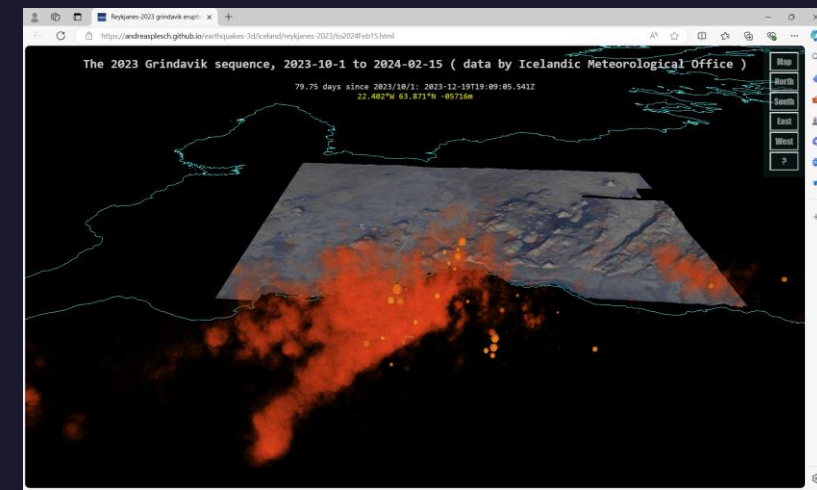
Dr. Johannes Behr

Domain: Industrial Metaverse



Member Highlights

- Interactive X3DOM mashups for scientific visualization; created by Dr. Andreas Plesch (X3D Geospatial + Volume + D3 + gITF):
 - USGS earthquake Vis – live query Ridgecrest, CA : [demo](#)
 - Grindavik seismicity, 93 days. Oct. 2023 to Jan. 2024 [video](#) ; [demo](#)
 - Grindavik seismicity, last 48 hr query: [demo](#)
 - Mars: Percy Landing location [demo](#)
 - [Data mashup demo](#)



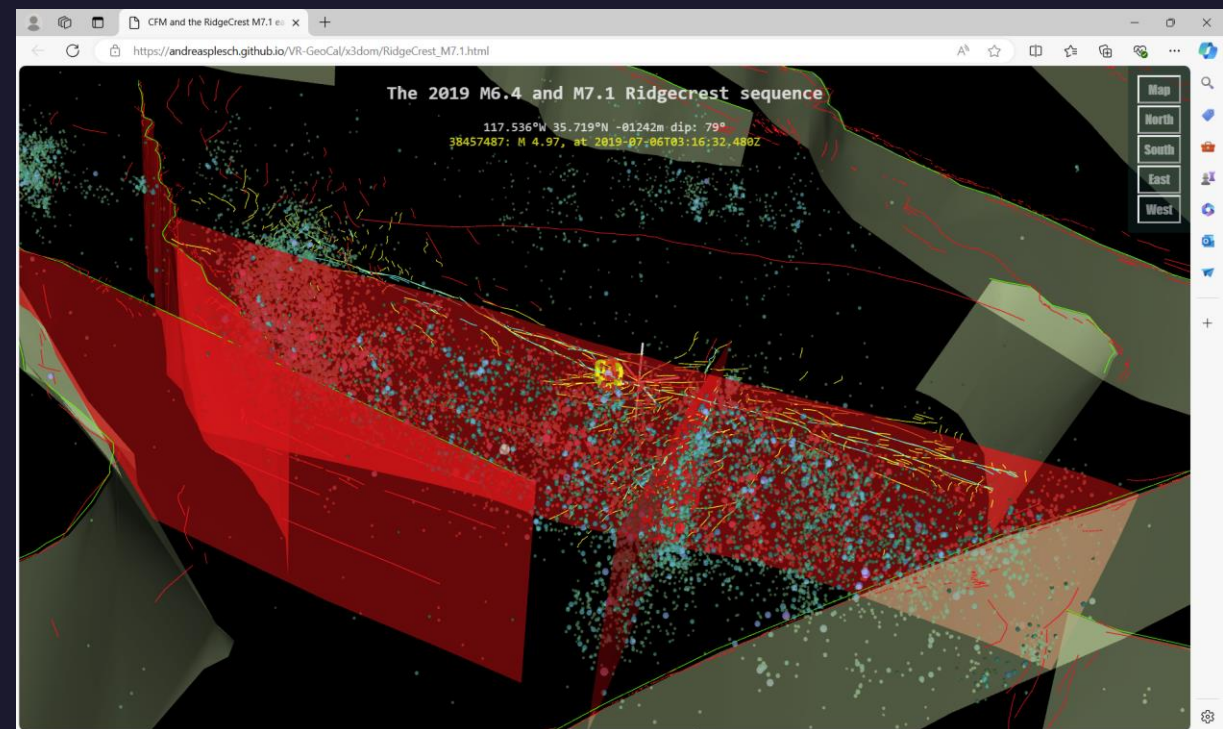
- **X3DOM: Volume rendering w X3D + glTF**

- **Live query of USGS Data**

- **NASA Perseverance data**



X	Y	el. az.:
4590878.30	4354494.53	1093297.92 -2569.90 199.54
clicked point, true distance from last [m]:		
4590878.37	1093298.13	-2569.90 0.68
4590878.88	1093297.65	-2569.92 1.62
4590878.49	1093296.07	-2569.92 16.14
4590884.12	1093311.30	-2570.02 14.32
4590881.86	1093297.14	-2569.88 21.62
4590879.10	1093318.59	-2570.00 1.27
4590879.72	1093319.72	-2569.98 15.68
4590878.56	1093304.88	-2569.91 65.94
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4590883.29	1093184.13	-2567.93 48.52

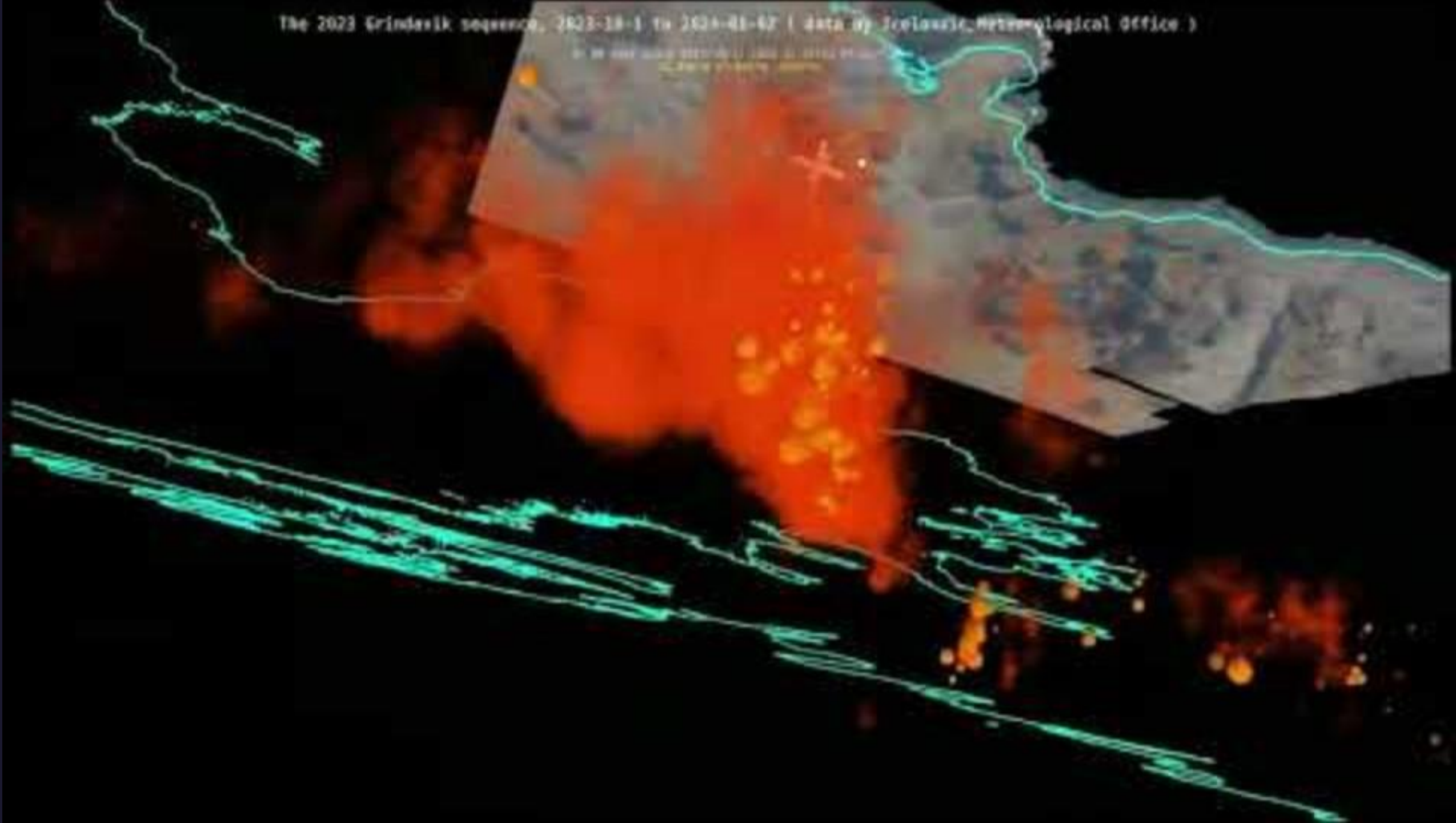


The 2019 M6.4 and M7.1 Ridgecrest sequence

117.536°W 35.719°N -01242m dip: 79°
38457487: M 4.97, at 2019-07-06T03:16:32.480Z

The 2023 Grindavik sequence, 2023-10-1 to 2023-11-07 (data by Icelandic Meteorological Office)

© 2023 Icelandic Meteorological Office



Virginia Tech

Nicholas F. Polys, PhD
Immersive Cartography

2023-2024 Highlights :

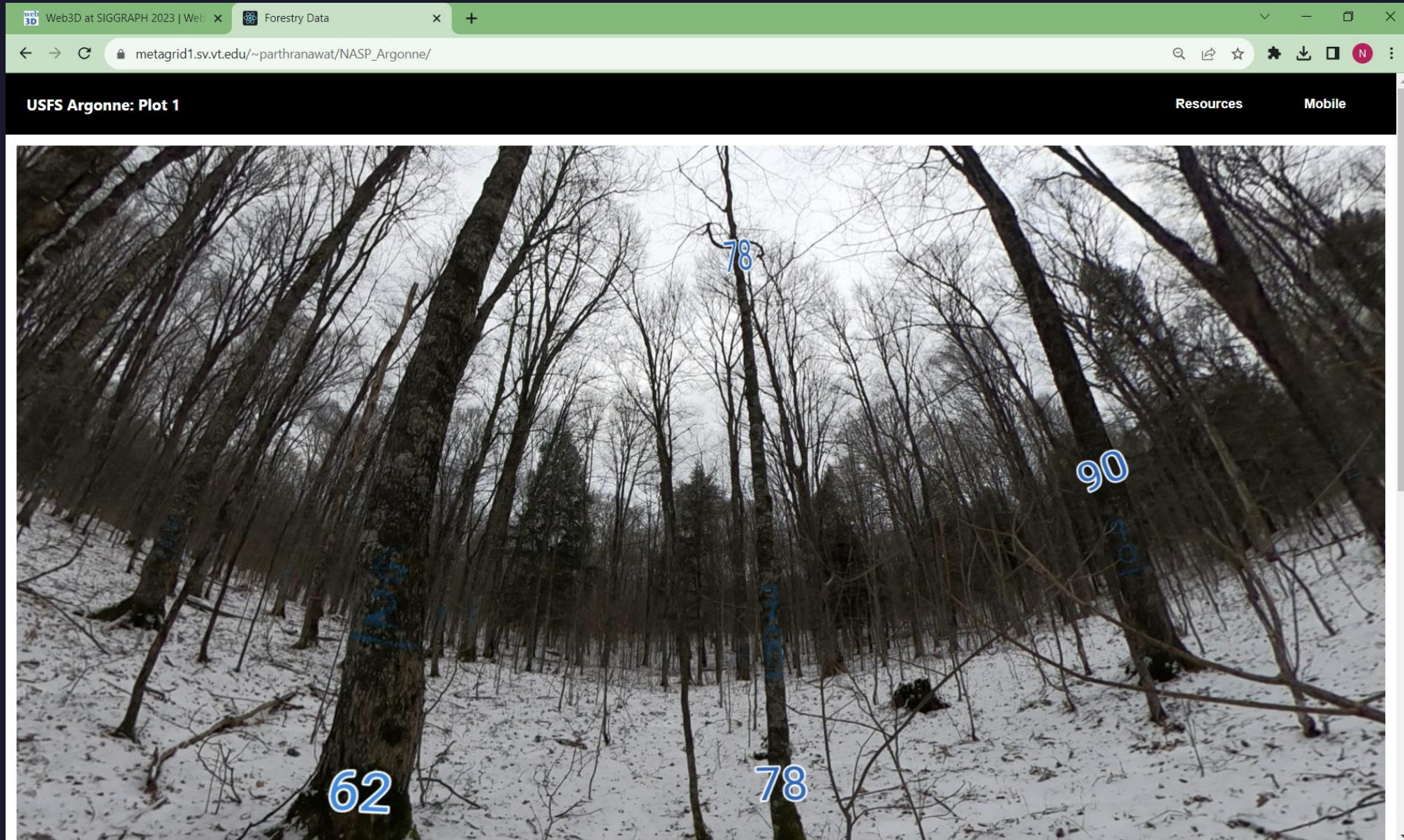
Virtual Field Trips:

- **USDA Professional Forestry Training**
- **Construction Safety and Liability Management**



- USDA Professional Forestry Training:

Plot data
360photos
X3DOM
Maps
Videos
+ React



Forestry Data- Jefferson

Plots Resources Mobile



Tree #	Species	Class	DBH	Crown Class	Logs	Bolts	Height
1	Mockernut Hickory	AGS	18	Codominant	1.5	0	65
2	Red Maple	AGS	13.2	Intermediate	1	0	55
3	Mockernut Hickory	AGS	17.9	Codominant	2	0	70
4	Red Maple	AGS	15	Intermediate	0.5	0	50
5	Scarlet Oak	AGS	32.9	Codominant	1	0	70
6	Mockernut Hickory	AGS	9.5	intermediate	0	3	45
7	Chestnut Oak	AGS	25.5	Codominant	1	0	75
8	Scarlet Oak	AGS	12.5	Intermediate	1	0	65
9	Scarlet Oak	AGS	24	Codominant	1.5	0	80
10	Scarlet Oak	AGS	23	Codominant	0.5	0	75

Scaling to 6 ecosystems and dozens of plots with

X3DOM + React

Paper: Web3D'21





- **Construction Safety and Liability Management**



Scene 3 Fog

View Scene

Mobile





WebXR Elements >> 1

HTC Vive Stereo effect Headset

position: 0.00 1.60 0.00

rotation: 0.00 0.00 0.00

Right controller

position: 0.50 1.50 -1.00

rotation: 0.00 0.00 0.00

select button

squeeze button

Reset pose Exit immersive

Console Issues

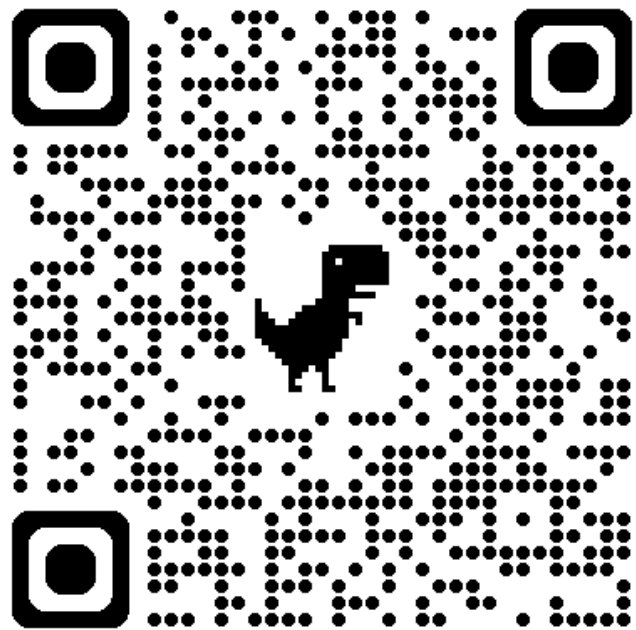
top Filter 2 hidden

Default levels 1 Issue: 1

>

*Paper in
ACM SIGGRAPH
Web3D 2023!*

*360 videos
X3D
X3DOM
+ React*



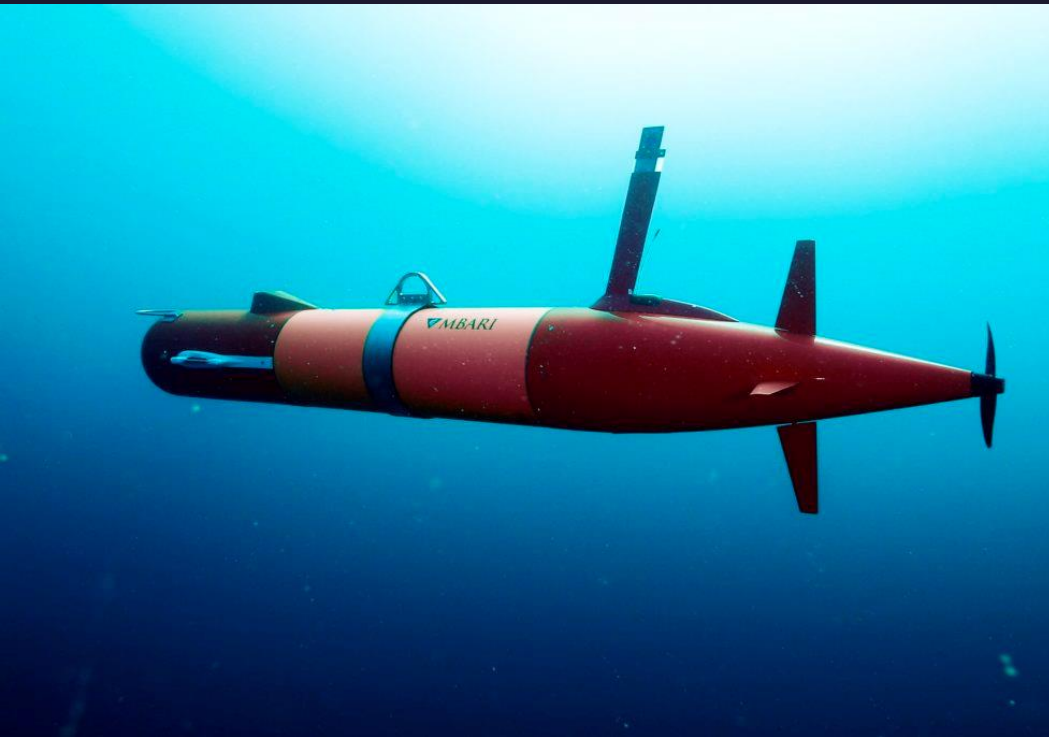
MBARI – Mike McCann

Monterey Bay Aquarium Research Institute

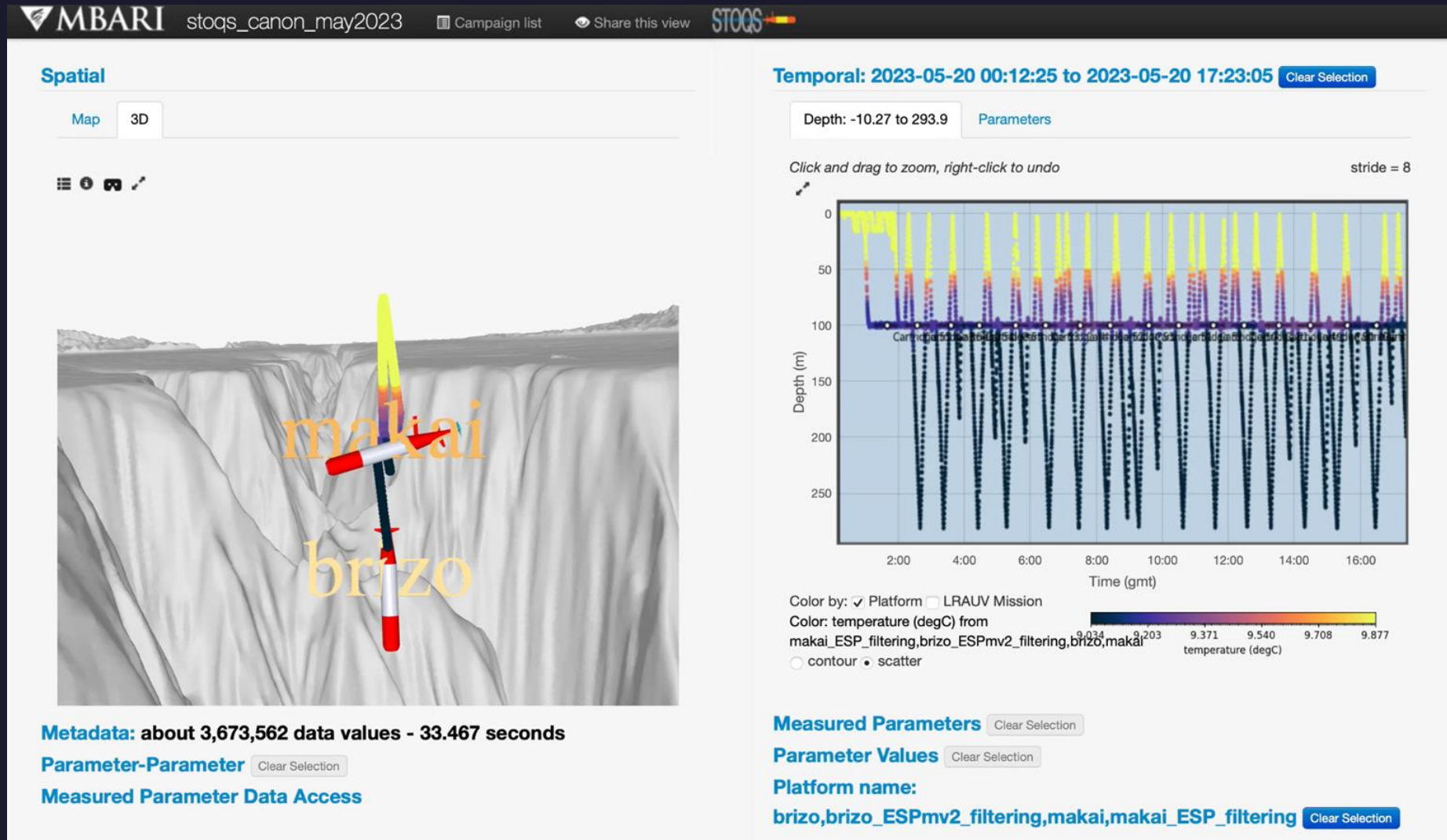
3D Oceanographic Data Visualization with

STOQS, an open source web application using X3DOM

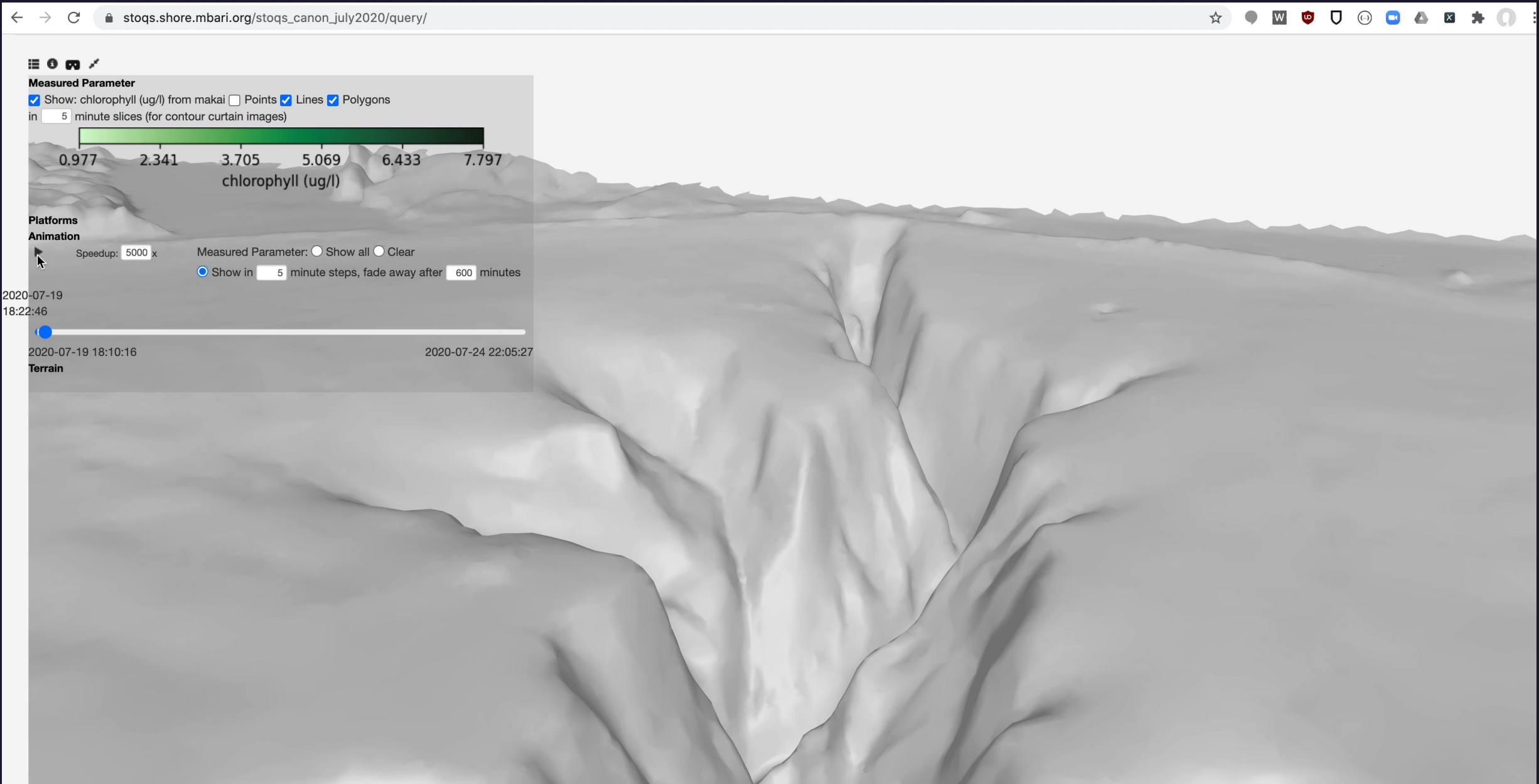
Robots collect a lot of data...



Humans need to understand it...



3 Dimensional moving fluid with life growing in it...



Web3D Community 🎉

A variety of groups to connect you with others around the world

- Geospatial, Medical, 3D Printing and Scanning, UserExperience
- Plus listerves and git

Future work

- NEW!
 - Open Special Interest Group: X3D Ecosystem
- ... (what are your needs?)

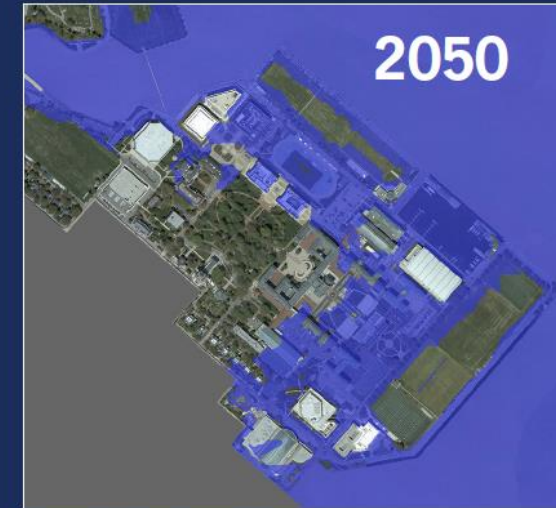
Versar – Casey Gomez

USNA X3D Annapolis Resilience Plan

- Web browsers
- Navy and Army
- Disparate Data Sources
- LiDAR, Imagery, GIS, CAD
- Georeferencing
- Survey Controls
- Geo & Local Transformation
- Tiling, Optimization
- UI Controls



Current 5-Year Storm Water Level: 3.7 feet



Projected 5-Year Storm Water Level: 5.6 feet



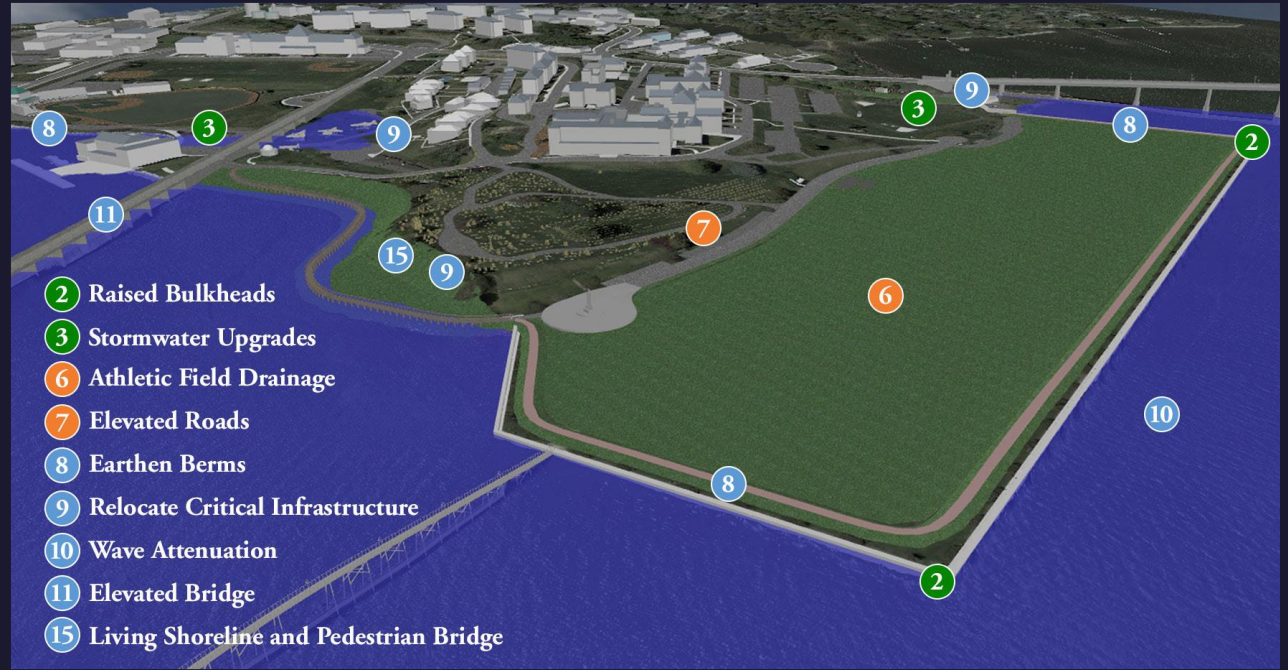
Projected 5-Year Storm Water Level: 6.3 feet



Projected 5-Year Storm Water Level: 8.1 feet



- Numerous interventions
- Numerous project phases



Versar

X3D Gulfport, MS

- Web browsers
- Navy and Marine Corps
- Data Collection
- Training Data
- LiDAR,
- Photogrammetry
- Survey Controls
- Geo Wrap
- Water Level
- Measuring Tool
- Movable Features
- UI Controls





X3D Annapolis & X3D Gulfport



US Naval Academy
Annapolis, Maryland
11 February, 2022

Elevation and Imagery

North Severn

- North Severn Features
- North Severn Buildings
- North Severn Vegetation

Lower Yard

- Lower Yard Features
- Lower Yard Buildings
- Lower Yard Vegetation
- Lower Yard Tunnels

Upper Yard

- Upper Yard Features
- Upper Yard Buildings
- Upper Yard Vegetation



Sea Level Scenario (*)

- Today | 2035 | 2050 | 2065 | 2100
- Show Nuisance Flooding
- Show 100-year Storm Water Level
- 2065 Sea Level Scenario with Adaptations

(*) Water levels shown in Mean Higher High Water

Project Phases

- Today
- Short-Term (2023-2027)
- Mid-Term (2027-2037)
- Long-Term (2037-2065)



Project Portfolio

Details +

Debug: Stats Log

Threedy.io

3DMD

Where are we now?

Open Web Based Immersive 3D (AR/VR) : Lots of different data from different domains, several solutions available but not necessarily interoperable or open

Improved user experience: Many proprietary headsets and devices

Improved Security: Very little awareness for Metaverse safety, Security, Privacy & Ethics

Interoperable standards: Identify where standards need to work together and where interoperability is need and possible

Corporate Cooperation: Leaders and from Industry, SDOs, User community need to unite



What is needed?

Open Web Based Immersive 3D

New standards for Improved multi user experiences

How will browsers support multi user experiences

Will we need a new browser?

Improved Privacy and Security

Improved interoperable standards

Corporate Cooperation



The Web is our platform:

X3D Anywhere !

3D + VR + AR Capable
Runs on multiple devices
(Phones, tablets, desktops, caves)

Used in multiple domains
(Medical, Geospatial, 3D printing/scanning,
CAD and more)

Interaction Animation Archivability Security

WWW + 3D Spatial data = Webiverse + Use experience = Open Interoperable
Metaverse



www.web3d.org/x3d/why-use-x3d

Web3D Standardization Process

Volunteers and Members work together on Standards

Domain Specific Web3D Working

Groups:



WG Sc24

X3D

Medical

Geospatial

Mixed Reality

Heritage

Semantics

Design Printing & Scanning

Web3D UX

www.web3d.org/working-groups

SDO Partnerships:



Web3D 2024

Web3D.SIGGRAPH.org

The screenshot shows a web browser window with the URL <https://web3d.siggraph.org>. The browser's address bar and tabs are visible at the top. The website's header includes a navigation menu with links for CONFERENCE, KEYNOTE SPEAKERS, PROGRAM, SUBMISSION, SPONSORS, and ABOUT. The main content area features the Web3D 2024 logo (a blue cube icon) and the text "Web3D 2024 GUIMARÃES - PORTUGAL". A large, stylized 3D cube icon is centered on the page. Below this, the text "Web3D 2024" is displayed in a large font. Three key details are presented with icons: a calendar icon for "September 25-27", a location pin icon for "CCG/ZGDV Guimarães, Portugal", and a document icon for "In-person and Online". Two call-to-action buttons are located at the bottom: a blue button labeled "PREVIOUS CONFERENCES" and an orange button labeled "REGISTRATION IS NOW OPEN". A small white circle with a downward arrow is visible in the bottom left corner of the page.

Join Our Global Community: Web3D.org !

The screenshot shows the homepage of the Web3D Consortium. At the top left is the logo "web|3D CONSORTIUM" with the tagline "Open Standards for Real-Time 3D Communication". To the right is a globe and a "Log in" button with a search bar. Below the header is a navigation menu with "HOME", "NEWS & EVENTS", "CREATE X3D", "PARTICIPATE", "STANDARDS", and "ABOUT". The main content area features a diagram illustrating the X3D workflow: various 3D software packages (Blender, SketchUp, Unity, 3DS MAX, and others) feed into a "CONVERT" process, which outputs X3D files. These files are then shown being accessed on various devices (laptop, tablet, smartphone) and operating systems (Windows, macOS, iOS, Android). To the right of the diagram, the text "X3D Means 3D Anywhere" is displayed. The browser's address bar shows "web3d.org" and the page title is "Web3D Consortium | Open Standards for Real-Time 3D Communication".