3-D Modeling of Fort Stanton Cave using Maps, Lidar, Photogrammetry, and Gaming Engines

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3-D Cave Simulation Benefits

• Prevent damage: Allows personal “exploration” and trip planning without leaving footprints
• Map: Yields a portrayal of the cave several steps above traditional 2-D maps
• Scientific studies: Allows planning for scientific sampling and searching for hypotheses. Can inspect 3-D structural relationships.
• Public outreach: Allows access by those unable or not inclined to overcome the rigors of actual access. Conveys a good simulation of the caving experience.
Old Process: 2010-2016

For Reference only; Details not important

**Make Cave Map** → **Make 3-D Framework** → **Take Photos** → **Stitch Photos** → **Texture 3-D Walls** → **Add Avatar**

- **Compass**
- **Blender**
- **Digital Camera, Uniform Lighting, Tripod with Nodal Ninja, etc.**
- **Photoshop**
- **Blender**
- **Unity3D**

- **WALLS**
- **3DS Max**
- **Maya**
- **Hugin**
- **3DS Max**
- **Blender**

- **Survex**
- **SolidWorks**
- **Cyan URU**
- **Maya**
- **Cyan URU**
- **SolidWorks**

**Paper available from NCKRI, or email Ron at rjlipin@msn.com**

R. J. Lipinski, “Caver Quest 3-D Virtual Cave Simulation of Snowy River in Fort Stanton Cave”, National Cave and Karst Management Symposium, Carlsbad, NM, USA, November 7, 2013

Important points outlined in red

Lidar Point Cloud → Make 3-D Framework → Take Photos → Stitch Photos → Texture 3-D Walls → Add Avatar

Buecher Gen-V → Blender, MeshLab → Digital Camera → Photoshop → Blender

Lots of Photos → Photogrammetry → Point Cloud & Textured Mesh → Add Avatar

Metashape

Photogrammetry yields 10x larger file size

Many more; Google it

PC, Mac → Unity3D → Oculus Quest 2

VR Headset → Unreal
Generic Wall Texture

Trail to Main Gate
Photogrammetry Wall Texture

Trail to Main Gate
Photogrammetry (Todd Roberts)
Caver Quest for PC, Mac, Linux

• 8.4 miles modeled
• Historic Section and some of Snowy River
• www.FSCSP.org
Caver Trek for VR Headset (Quest 2)

Near Turtle Junction and some of New Section
Caver Quest PC Demo

Free download at: www.FSCSP.org

Bat flyby screenshot video (60 sec)
Turtle Junction (40 sec)
Pagoda Passage (30 sec)
Unlimited Access: FSCrocks!
Caver Quest PC Demo:
Bat flyby screenshot video (60 sec)
Caver Quest PC Demo:
Turtle Junction screenshot video (40 sec)
Caver Quest PC Demo: Pagoda Passage screenshot video (30 sec)
Caver Trek VR Headset Demo
Caver Trek VR Headset Demo: Priority 7 Landing screenshot video (1min 40 sec)
Credits

We wish to thank the BLM, Knutt Peterson, and FSCSP personnel for their support of this activity

Cyber-Producer: Ron Lipinski

Lead Photographers: Pete Lindsley and Todd Roberts

Caver Quest Photo and Lidar Assistants and Beta Testers:

Game Engine: Unity3D
Music: Soundrangers

Caver Quest, © 2010-2022, Ron Lipinski, Fort Stanton Cave Study Project.

Questions?