Virtual/Augmented Reality (VR/AR) 101

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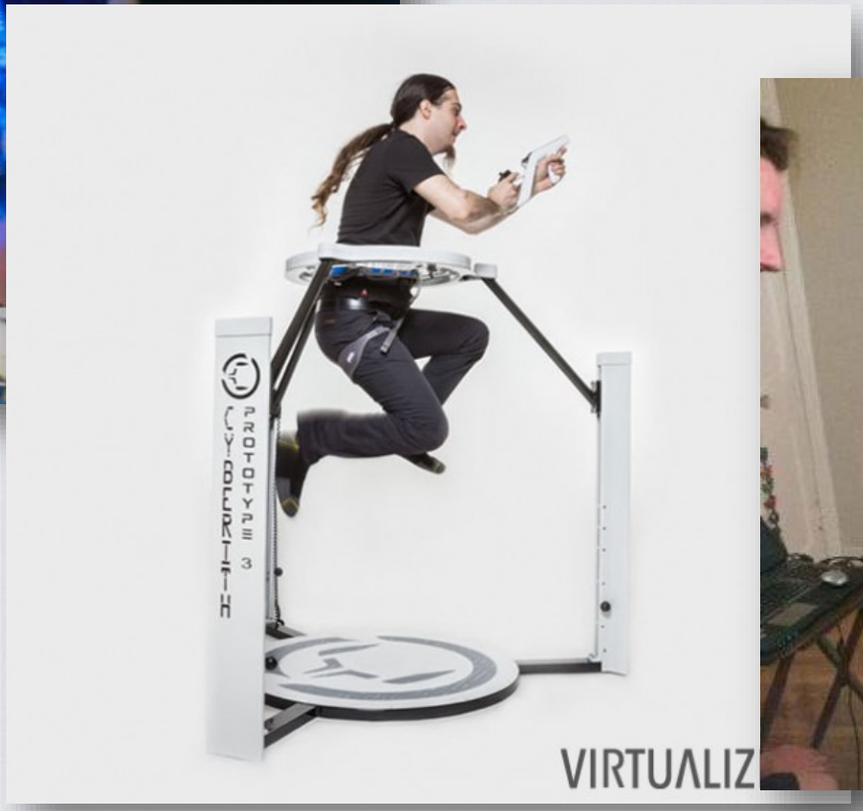
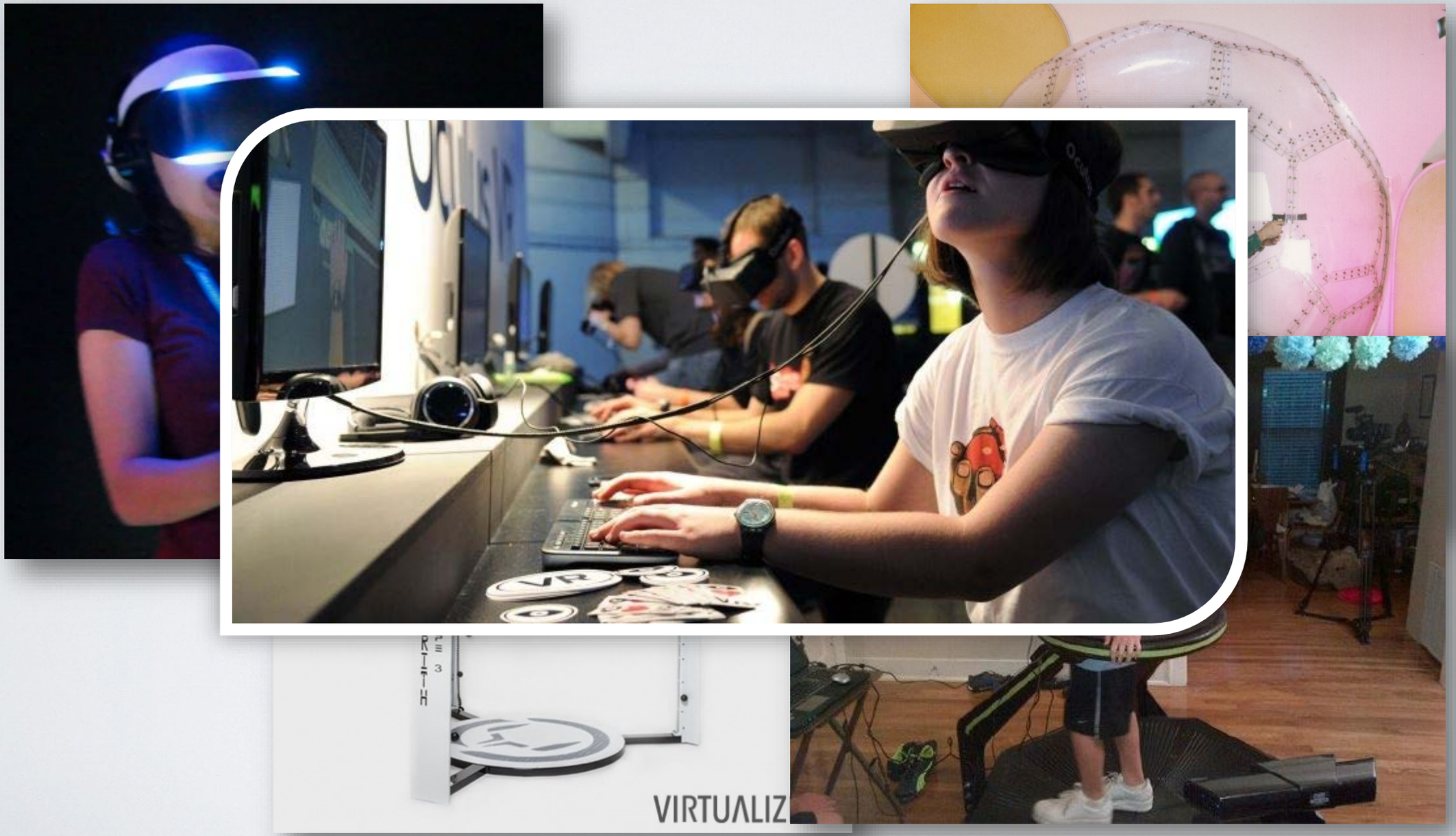
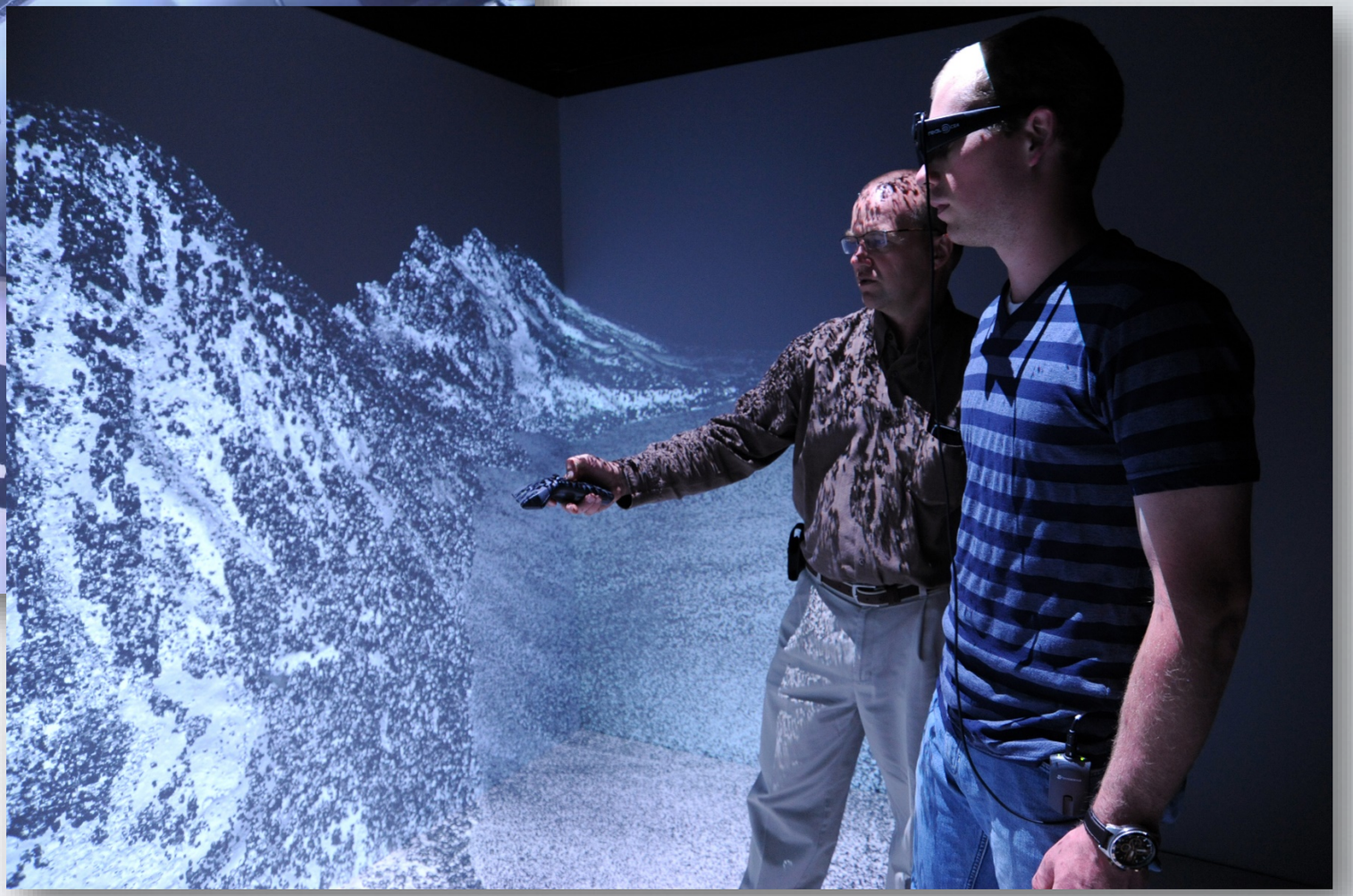
Virtual Reality



Virtual Reality



Virtual Reality

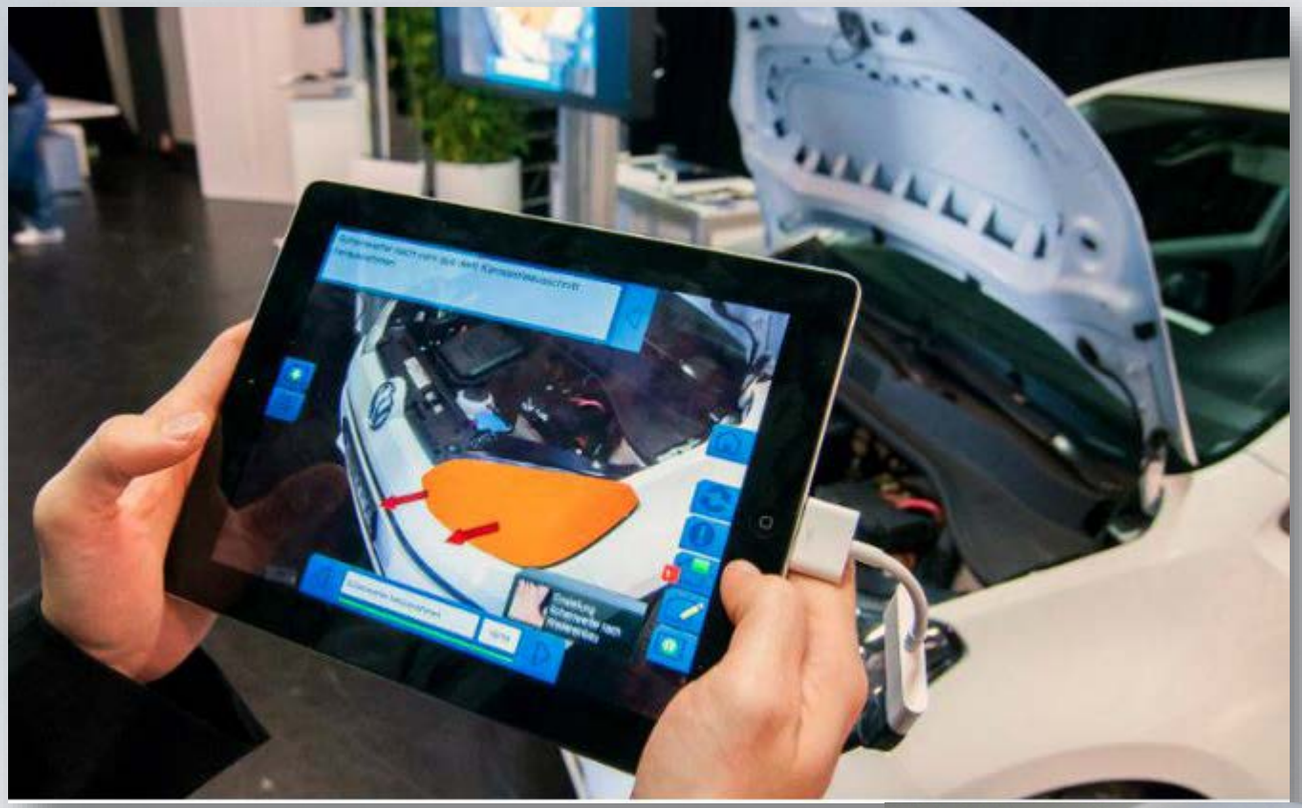


Images courtesy of Idaho National Labs and Case New Holland

Virtual Reality

Images courtesy of Idaho National Labs and Case New Holland

Augmented Reality



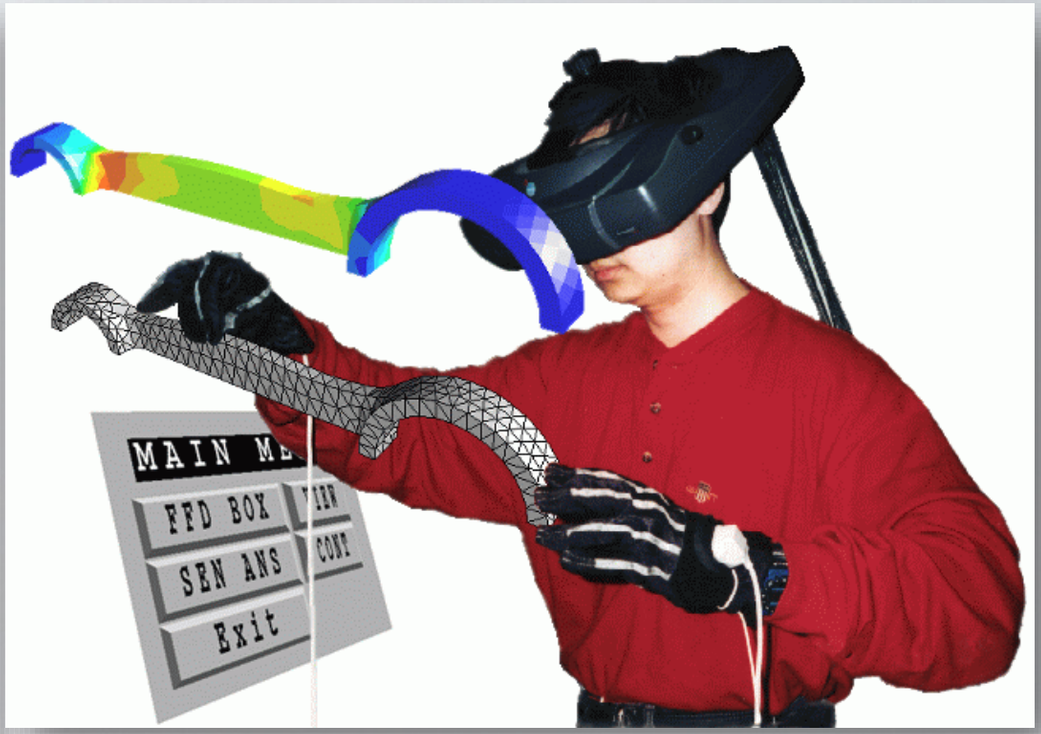
Augmented Reality

Vehicle Simulators

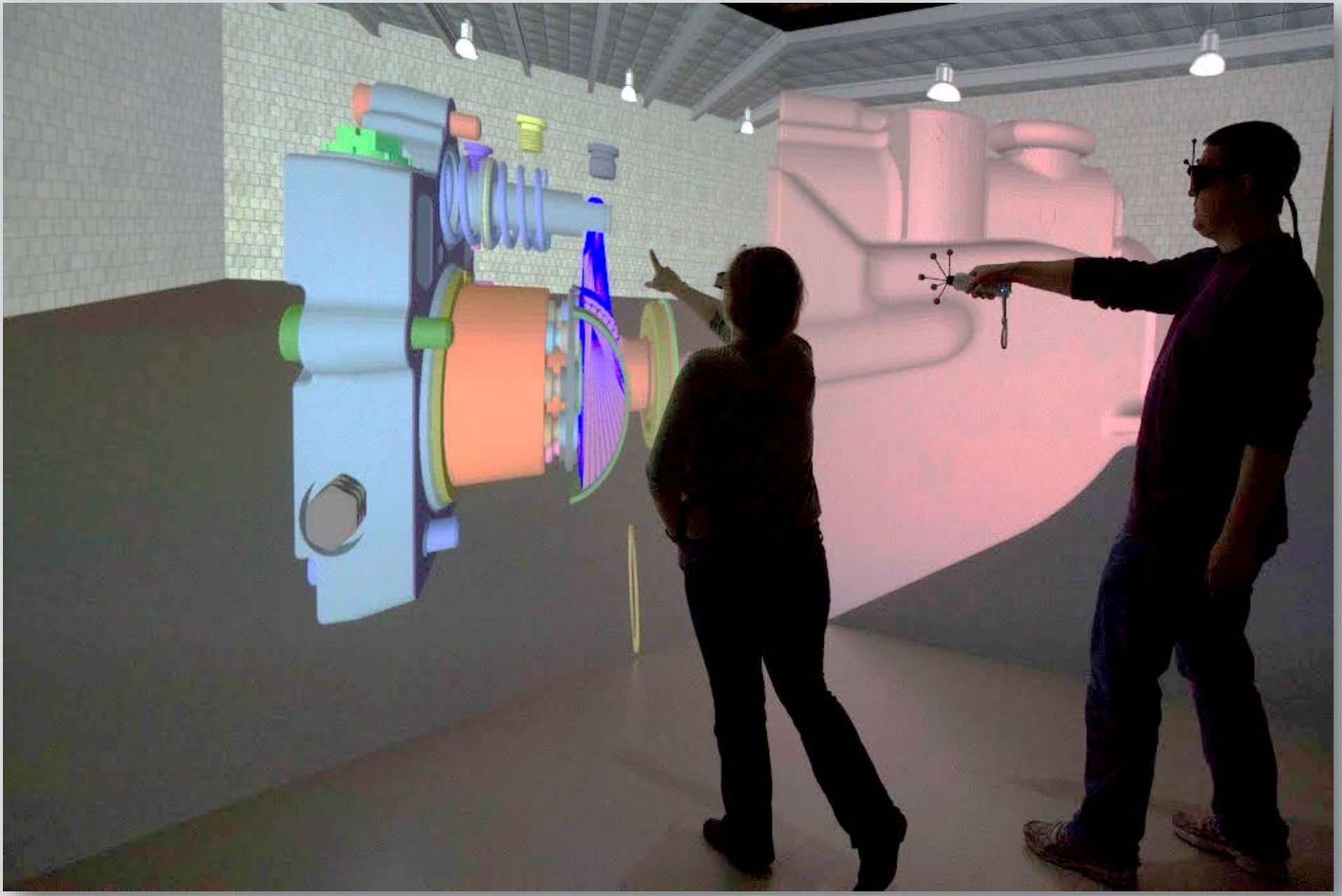
The Time cover of virtual reality shows Oculus Rift creator floating above a beach.

The Time cover of virtual reality shows Oculus Rift creator floating above a beach.

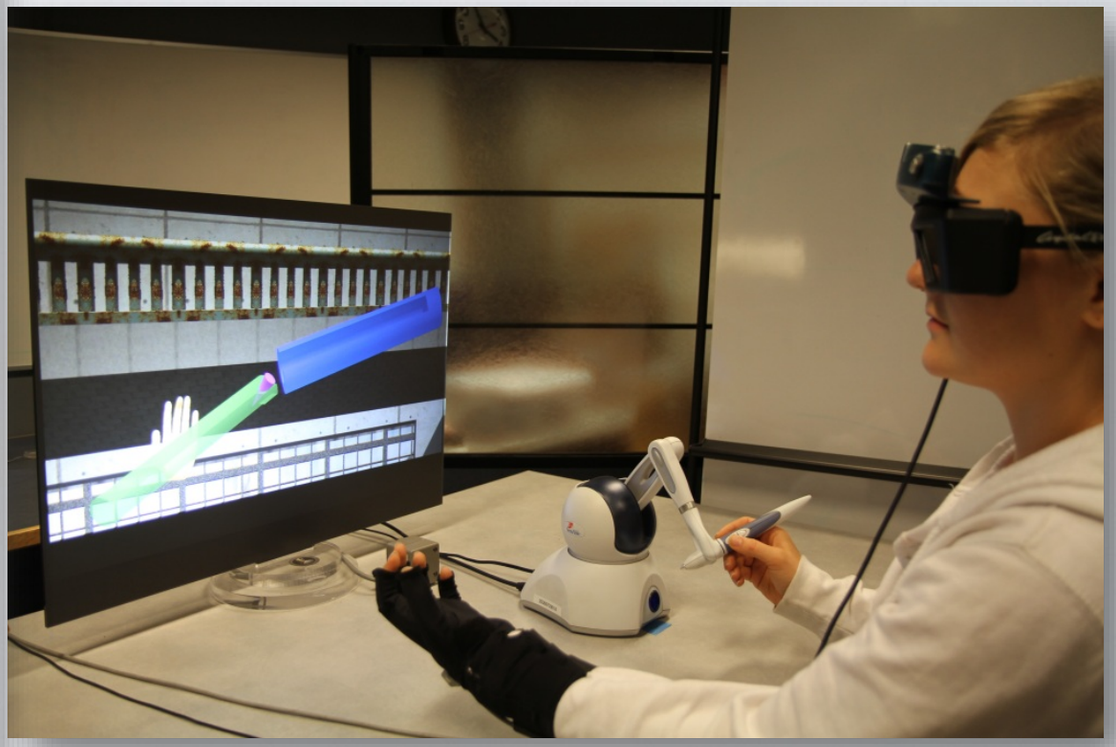
Virtual Reality Applications Center



Virtual Reality Applications Center



Virtual Reality Applications Center



VR/AR 101

- What it is
- How it works
- Why should you care

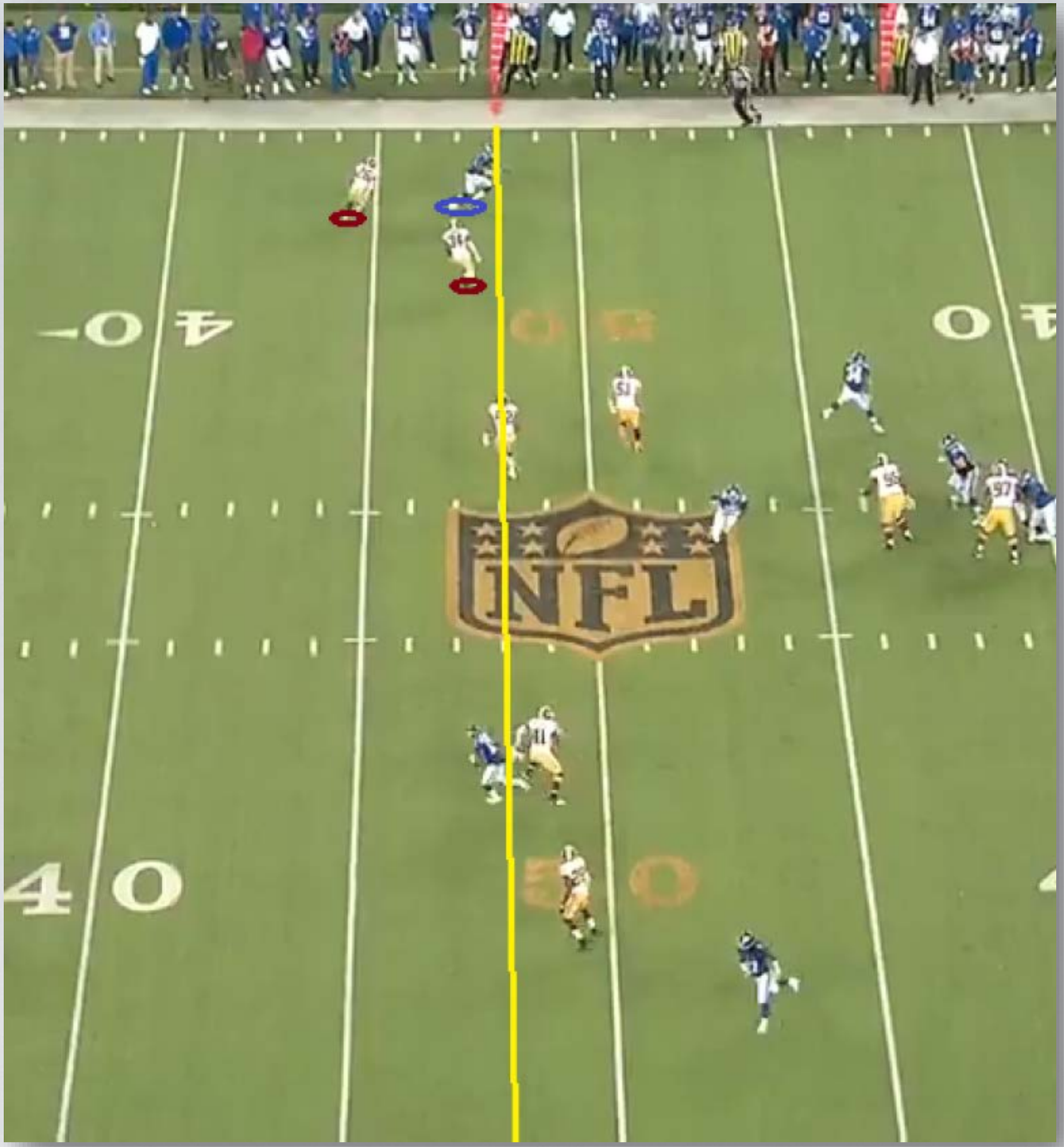
Virtual Reality

A medium composed of interactive computer simulations that sense the participant's position and actions and replace or augment the feedback to one or more senses,
giving the feeling of being mentally immersed or present in the simulation.

Sherman, W. R., Craig, A. B. 2003. Understanding Virtual Reality: Interface, Application, and Design, Morgan Kaufmann Publishing.

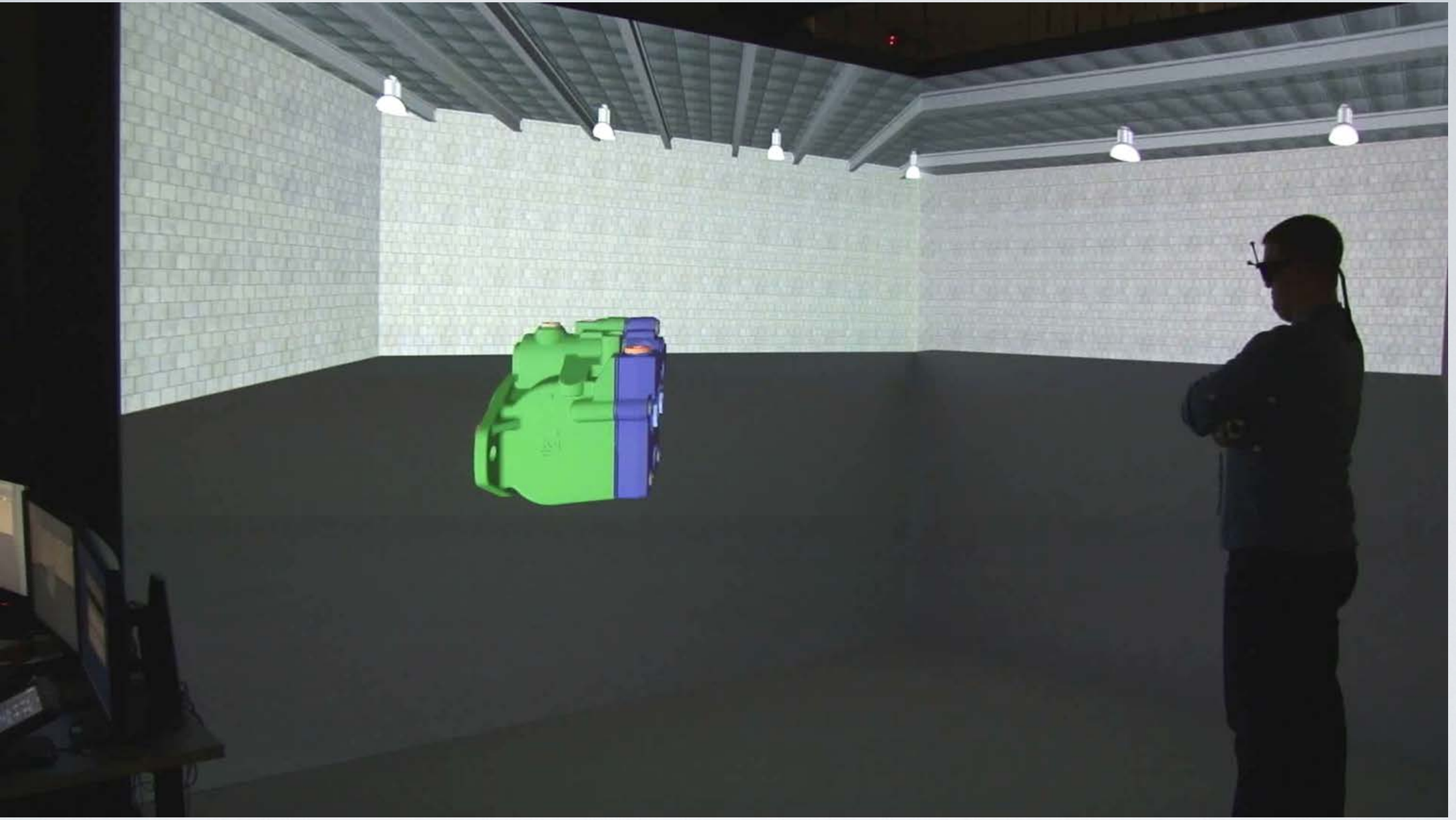
Augmented Reality

A technology that superimposes a computer-generated image on a user's view of the real world, thus providing a composite view.


NFL

VR Characteristics

- Variable scale
- Human control of the view
- Ability to naturally interact with the computer images



https://www.youtube.com/watch?v=BrvwaplZXIw

Asymmetric Interfaces for Bimanual Virtual Assembly with Haptics

https://www.youtube.com/watch?v=lL2Ha2Ymht4

To Make it Work

- Position Tracking Technology
- Display Technology
- Sensory Feedback

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Consumer Position Trackers

Wii

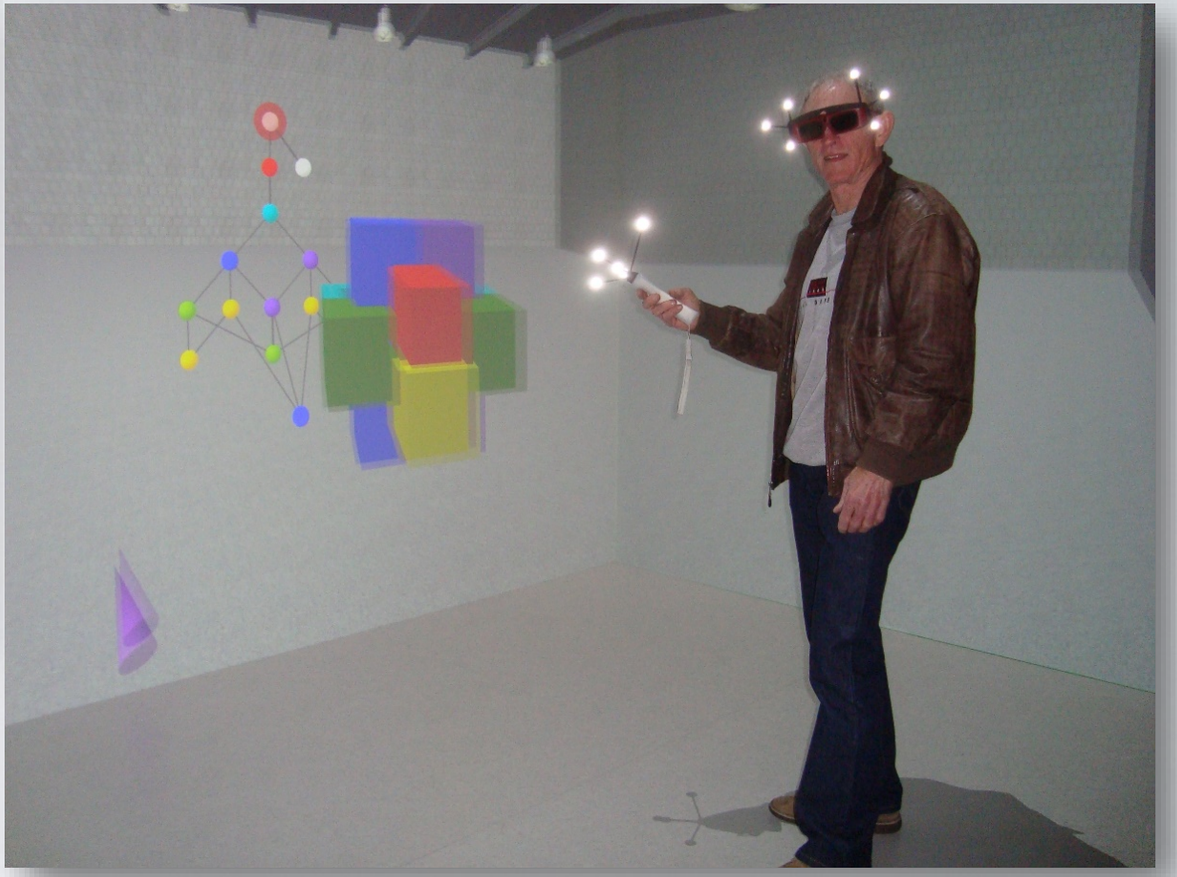
Consumer Position Trackers

Kinect

Optical Tracking

depth map

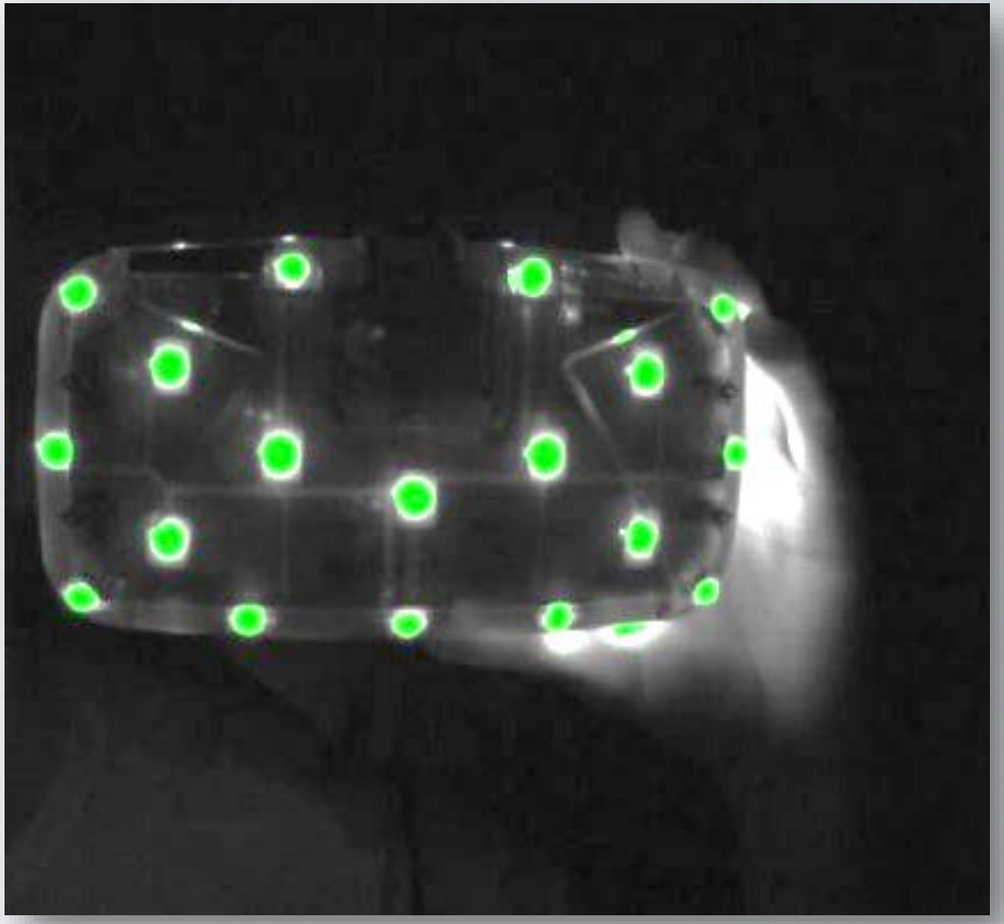
Optical Tracking retroreflective balls



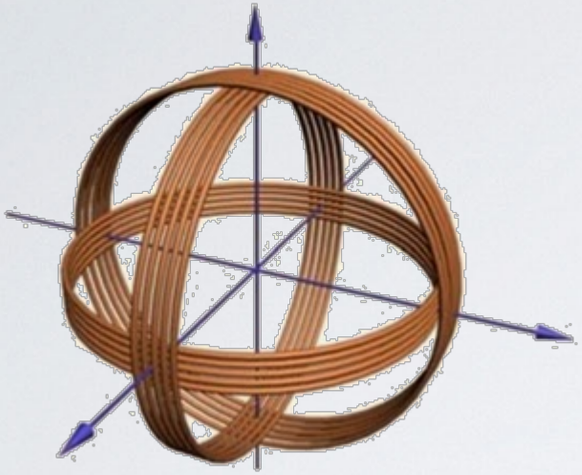
Optical Tracking
active LEDs

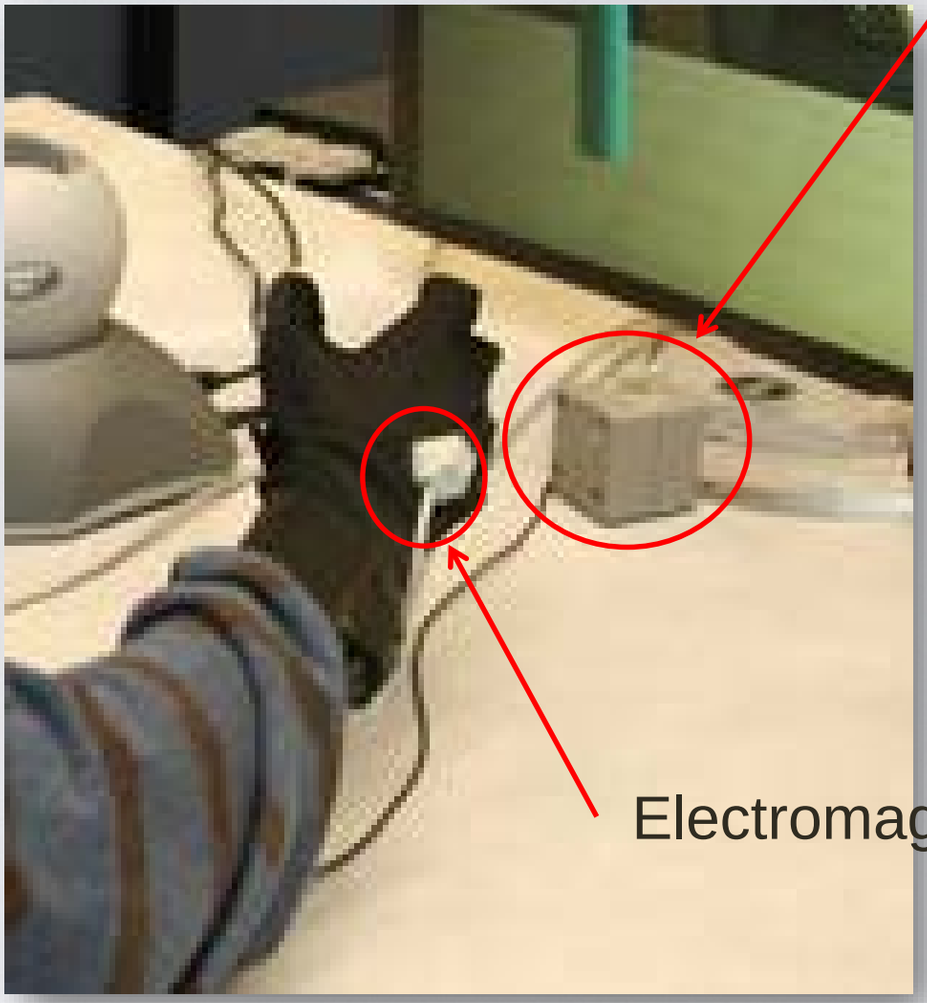
Oculus Rift HMD

Infrared LEDs embedded in the headset

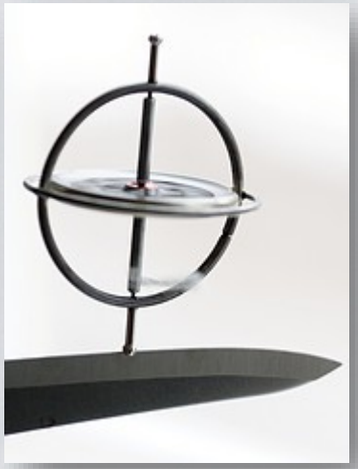


Magnetic Tracking





Inertial Tracking



Acoustic Tracking

Brain Computer Interface

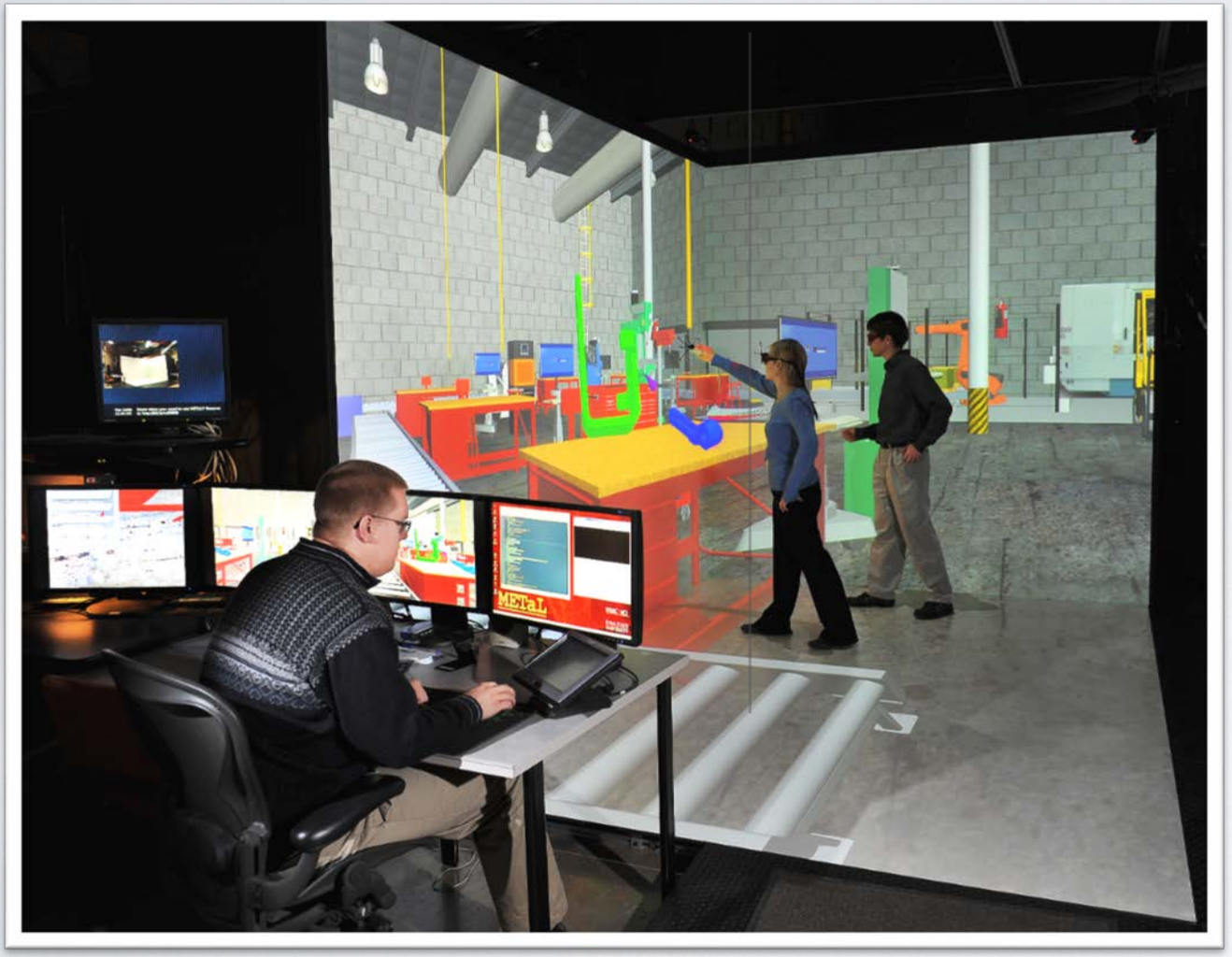
Mechanical Tracking

To Make it Work

- Position Tracking Technology
- Display Technology
- Sensory Feedback

Multiple Projection Surfaces

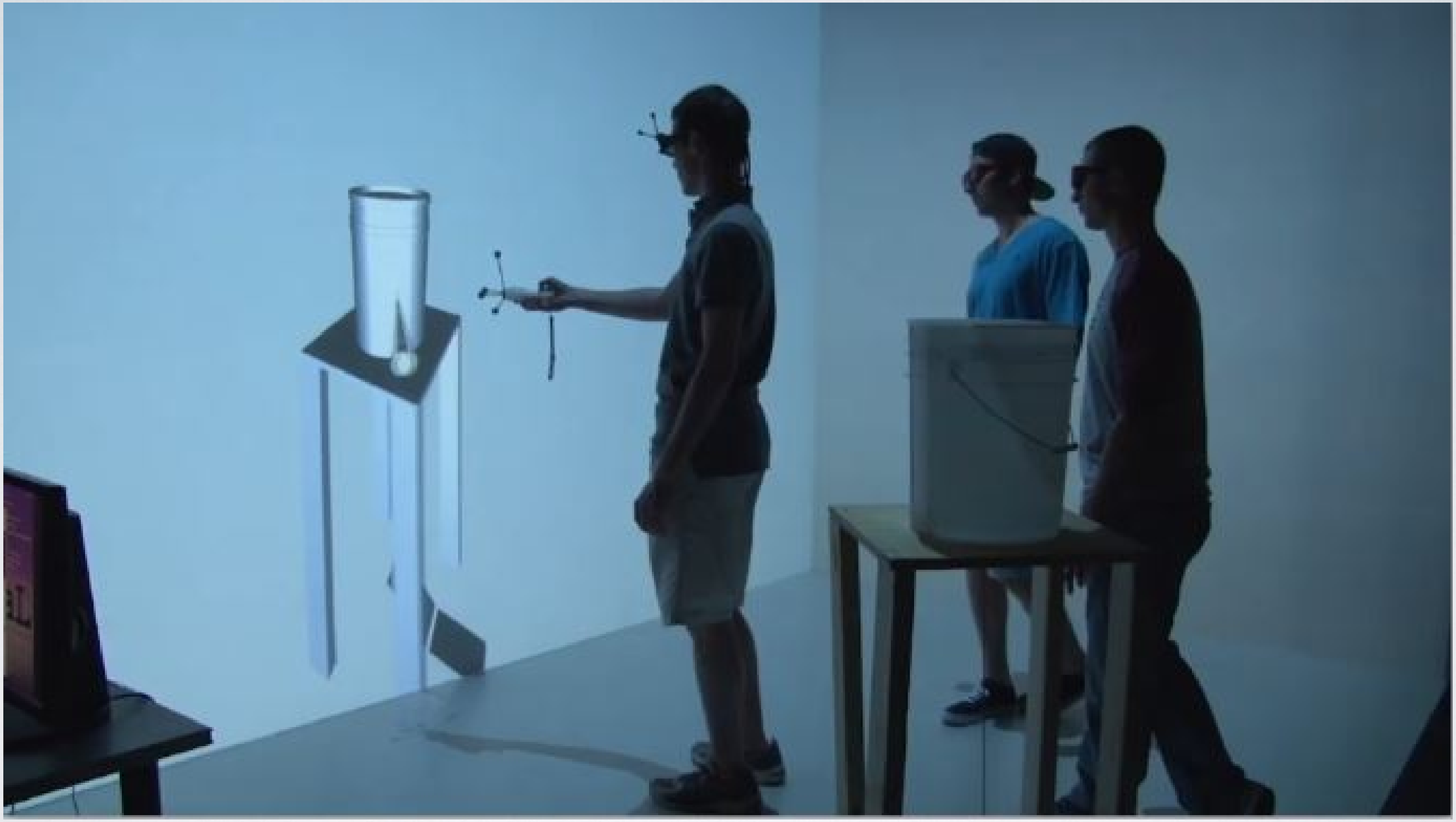
METaL
MULTIMODAL EXPERIENCE TESTBED AND LABORATORY



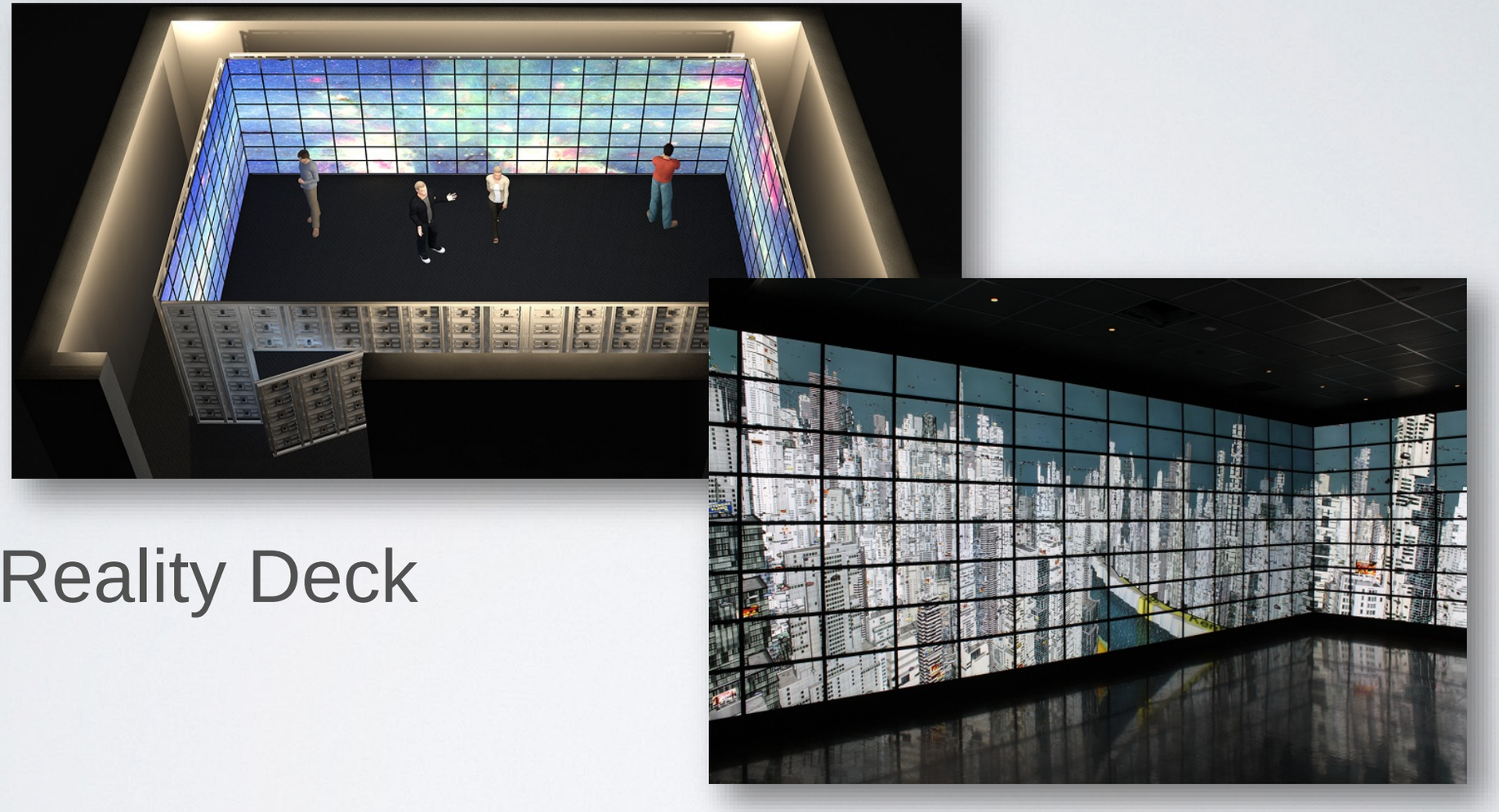
CAVE

- 2 walls, 1 floor
- 3 stereo projectors
- Optical tracking
- Wii remote wand

CAVE

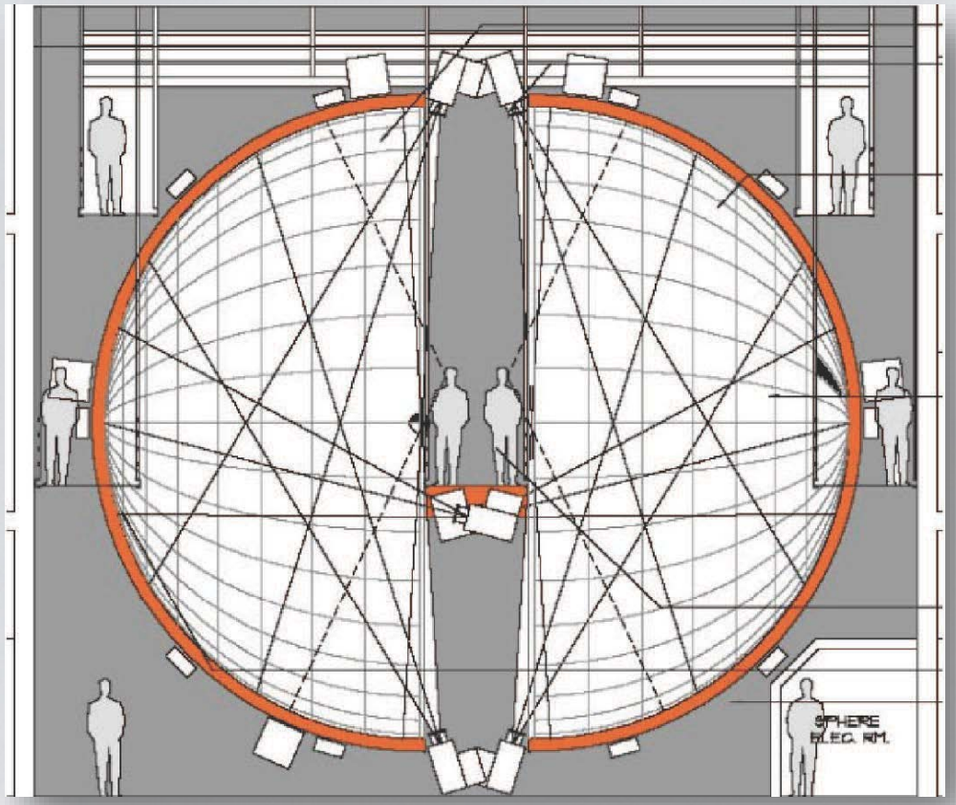


Projection systems

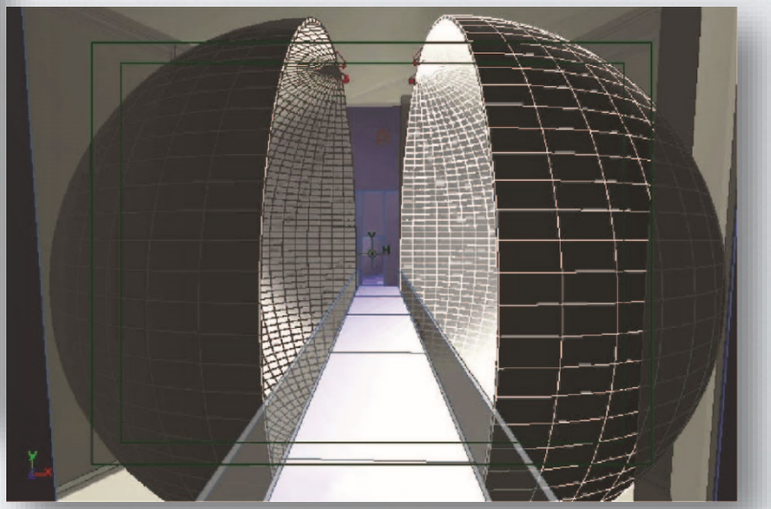


Reality Deck

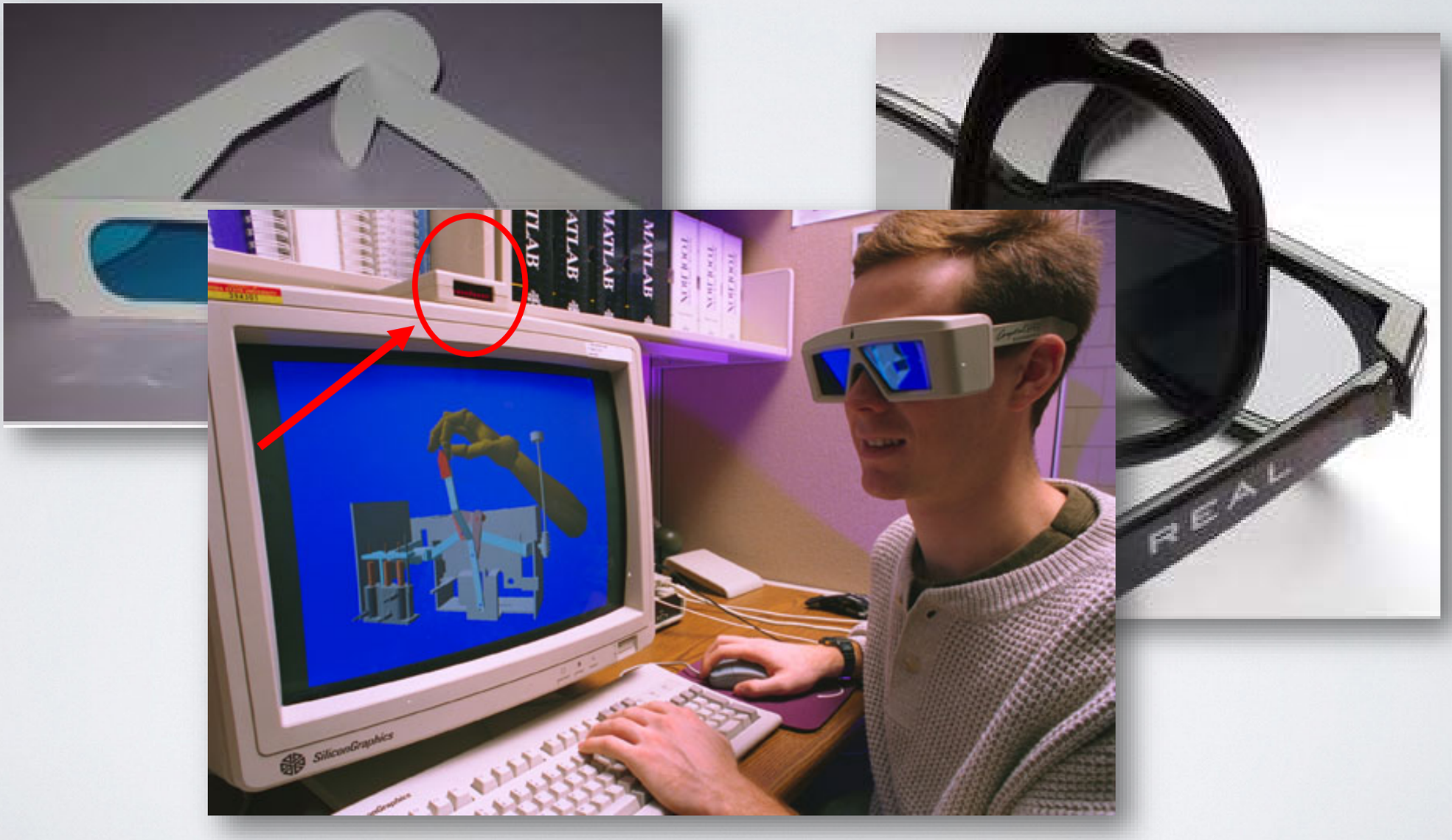
Projection systems



AlloSphere



Stereo Glasses



See Through Displays

Head Mounted Display (HMD)

Image courtesy of Lockheed Martin

See Through HMD

Oculus Rift

Cell Phone HMD

Click to open expanded view

Zeiss Vr ONE Samsung Galaxy S5 Virtual Reality Headset

from Zeiss

4 customer reviews | 12 answered questions

Price: $159.99 & **FREE Shipping**

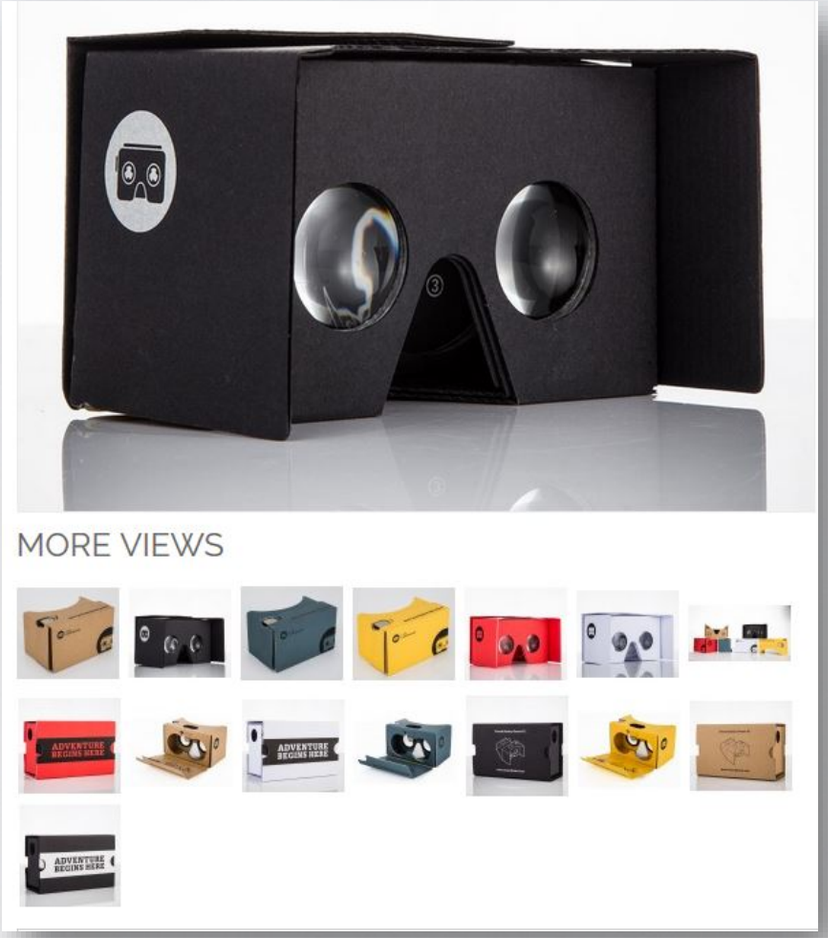
Only 19 left in stock.

Ships from and sold by Wired Gadgets.

- With Limitless Possibilities With the VR ONE, the smartphone you carry in your pocket can take you to worlds of virtual and augmented reality. With already hundreds of apps available on Google Play and AppleApp Store made for mobile VR devices you can simply download and launch the app, lock your smartphone in the VR ONE precision tray and slide it in the VR ONE. Experience VR games, videos, and amazing experiences that were never before possible.
- The Zeiss VR ONE delivers an unrivalled viewing experience with Zeiss precision lenses and the 5.2 inch display of the Galaxy S5 providing stunning and engaging visuals at a mobile-leading resolution. With the VR ONE, the effect is the equivalent of sitting in the best seat of a theatre, being on-stage at a performance with full 360 degree 3D video, and being able to enjoy

Google Cardboard

Buy your new Cardboard 2.0 viewer from [I Am Cardboard] for $19.99. Black, Blue, Red, Yellow, White and Brown.

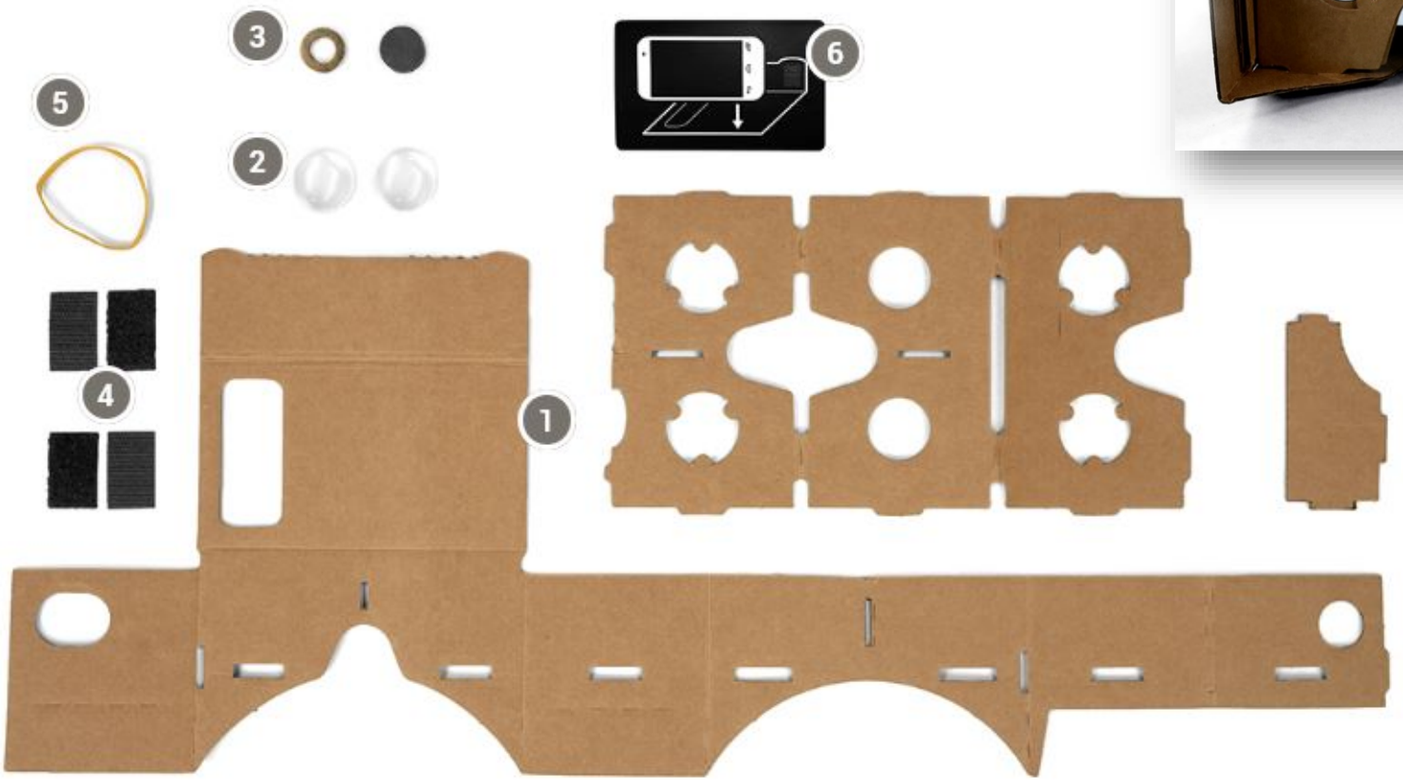


Build your own HMD

https://developers.google.com/cardboard/

Construct a VR viewer from everyday items you can find in your garage, online or at your local hardware store.

Here's what you need to get started:



3D VIEW · MASTER

Cell Phone and Tablet AR

Cell Phone and Tablet AR

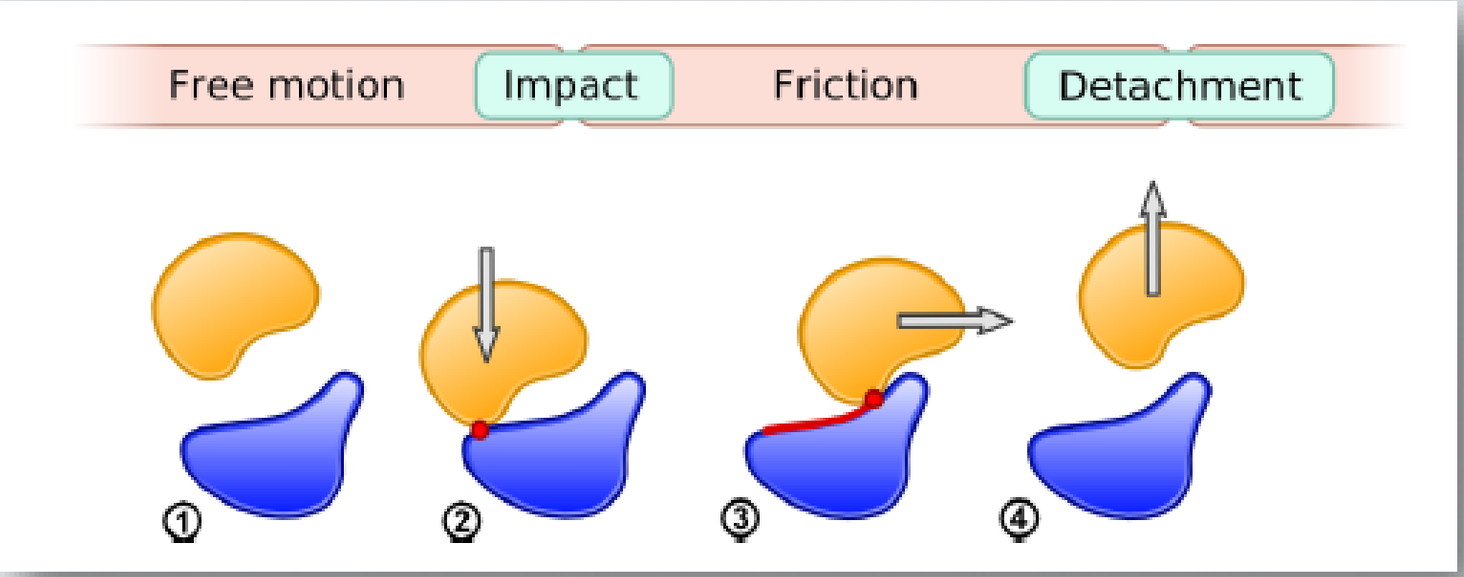
To Make it Work

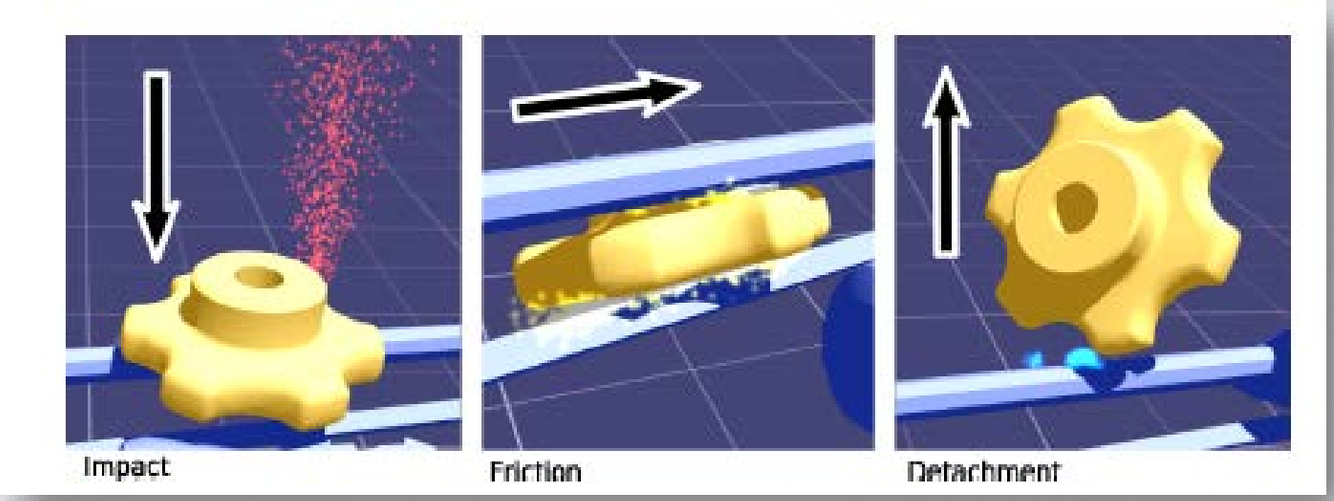
- Position Tracking Technology
- Display Technology
- Sensory Feedback

Sound

- Increase awareness of surroundings
- Cue visual attention
- Convey a variety of complex information without taxing the visual system
- Enhances the visual experience

Object contact





http://people.rennes.inria.fr/Anatole.Lecuyer/vrst_sreng.avi

Haptics

To touch ….

Combination of Real and Virtual

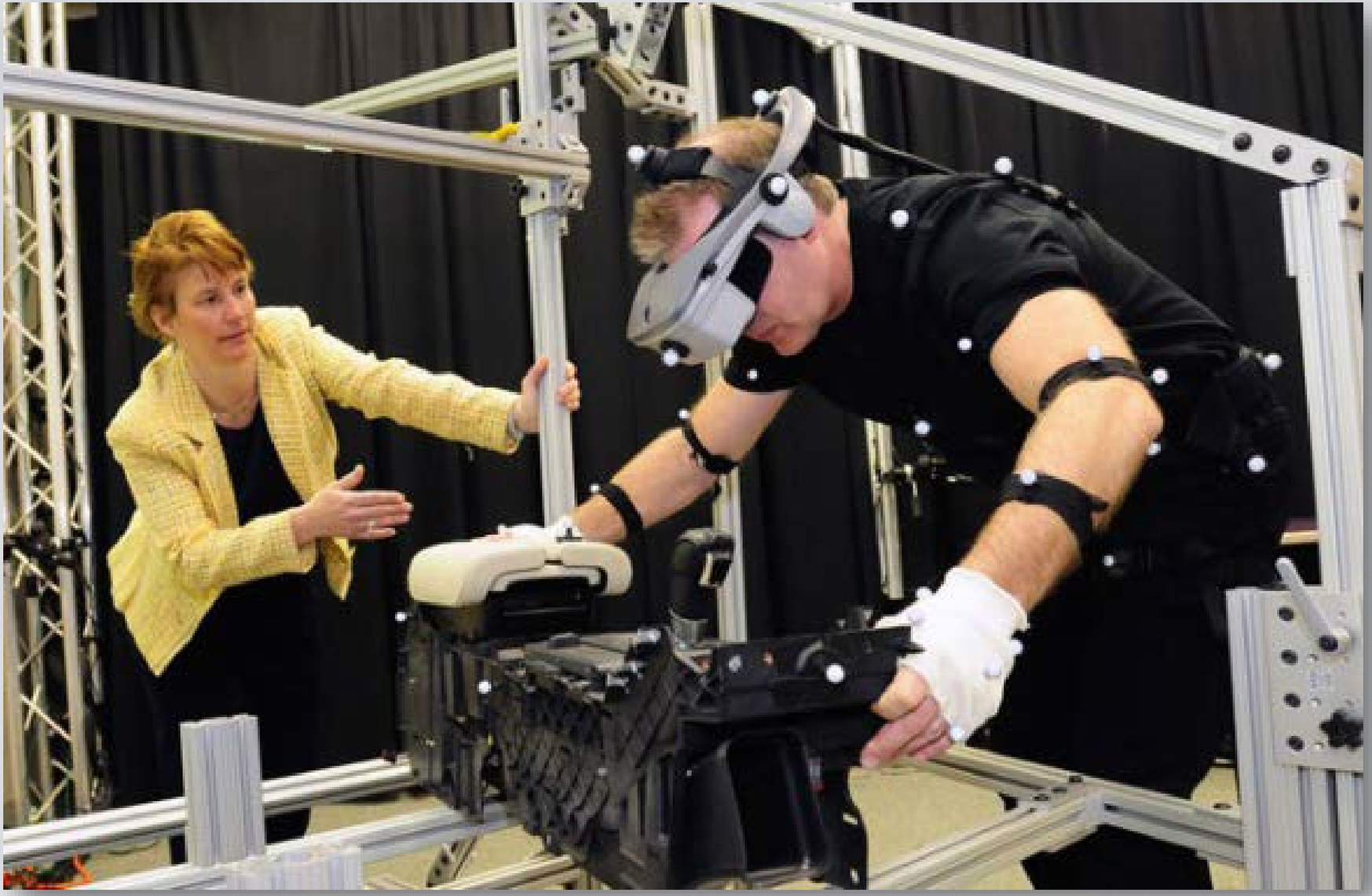
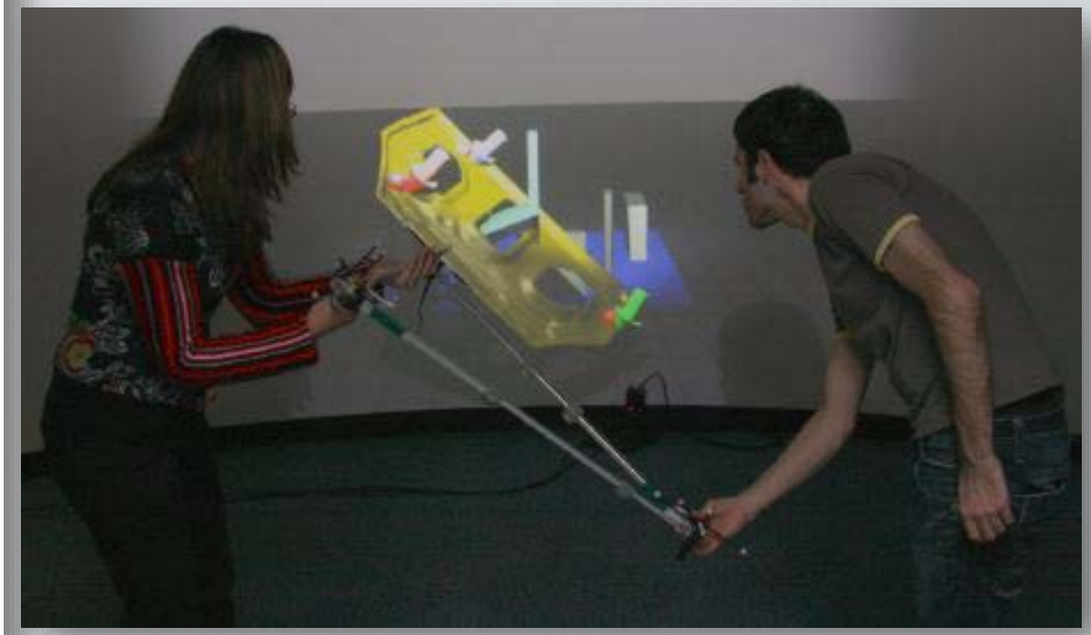


Image courtesy of Ford Motor Co.

Tangible Haptics

Steinicke, F., Bruder, G., Hinrichs, K., Jerald, J., Frenz, H., Lappe, M. 2009. Real Walking through Virtual Environments by Redirection Techniques. Journal of Virtual Reality and Broadcasting, 6(2).

Reconfigurable Tangibles



Aguerreche, L., Duval, T., Lecuyer, A. Reconfigurable Tangible Devices for 3D Virtual Object Manipulation by Single or Multiple Users, Proceedings of the 17th ACM Symposium on Virtual Reality Software and Technology, VRST '10, November 22-24, Hong Kong, China, pp. 227-230.

https://www.youtube.com/watch?v=J1BlXBi4O1w

Haptics

https://www.youtube.com/watch?v=xQxNT1DAoT4

Why should you care?

- Do you need to communicate your ideas to someone else to either get their input or their buy-in during the decision making process?
- Does your data involve understanding spatial relationships?
- Is your data multidimensional?

Where is VR/AR being used?

- Ergonomic analysis of product assembly or customer use
- Manufacturability of products
- Visibility studies of products
- Geotechnical data display
- Engineering analysis results display (fluid flow, structural strength, etc.)
- Design reviews

Where is VR/AR being used

- Communicating design intent to customers
- Interactive museum displays
- Advertising
- Identifing location of community resources
- Visualizing stock market trends
- …

Quotes from Users

- Looking at certain components in CAD, they appear one size, but they are actually another size.
- It gave you a perspective of how far to kneel down to see that part engagement.
- Especially the view that you were bringing up while thinking about the clearances and the space within the unit. I didn't have that same perspective, but when you mentioned that and then I got a chance to look at it I thought – oh yea, now I can see it.
- Those bench tools aren't going to clog up the workspace as much as I thought.
- In 3D models (CAD) you can take a measurement of how far the distance is, but when you have the pump in real size, it actually makes a difference…because you have to get in, then walk around it.

Quotes from Users

- You can always picture it in your head and imagine how it's going to move, but when you see it in VR, it's a different experience altogether.
- I thought it was funny that we went through the same meeting yesterday with everybody's laptops open, doing other work on the side and not fully engaged, and got completely different results when experienced it in VR.
- It's interactive. You're there. You're in it. Versus sitting in a conference room around a table. It's too easy to have your laptop open and do some other things. Here you are standing up, there's no surface for your laptop. You've got glasses on. It's just visual and immersive.
- Experiencing it in VR is definitely going to put me ahead of the game. When it comes to going to the supplier, I'm not going to be surprised in what I saw. I have clear expectations of it now.

Virtual Reality isn't science fiction any more …

It’s for real!

Image courtesy of Lockheed Martin

Thank you!

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