3D TV
Autostereoscopic video
Depth Cues:

1 view point (cyclops)

Stereopsis

2 or more view points

Motion Parallax

Perspective

Relative object size

Occlusion

Atmospheric haze

Accommodation (focus)
Stereoscopic Cameras

Kodak Realist 35mm camera

HinesLab StereoCam™ 35mm, 65mm & HD dual-camera 3-D rig

Minoru 3-D webcam

HinesLab.com
Stereoscopic viewing:

• Cross-eyed viewing of side-by-side images.
  (Allows viewing of large hi-res images.)

• Parallel viewing of side-by-side images.
  (Stereopticon, View-Master, binoculars, stereo microscope)

HinesLab.com OSSC, Feb. 10, 2010
Stereoscopic viewing with 3-D Glasses

- Anaglyphic
- Passive Polarized
- Active Shuttered

HinesLab.com
OSSC, Feb. 10, 2010
Stereoscopic viewing with 3-D Glasses (cont’d.)

Dolby™ wavelength multiplexing (R’s, G’s, & B’s for both eyes)
Stereoscopic image on single strip film

Polaroid Vectograph
1938 US Pat. 2,203,687

See StereoJet at www.SFimaging.com
Vertically-Interleaved Stereo or Autostereo

- **Lenticular** screen over two or more interleaved images. Views vs. resolution. Limited width viewing zone. Max size approx. 20 x 30”.

- **Raster-barrier 3D**, similar to lenticular. Used as large back-lighted advertising displays.

- **3M film**, alternately directs light to left and right eyes in sync with alternating image.

HinesLab.com

OSSC, Feb. 10, 2010
Autostereoscopy
(3D without glasses)

• **Head Tracking**
  • Provides stereo views to one viewer.
  • Cameras (or real-time CGI) must be synched to simultaneously mimic viewer’s motion.
  • Temporal lag can cause nausea.
  • Expensive, noisy and mechanically complicated.

HinesLab.com
Autostereoscopy
(3D without glasses)

• Head Tracking, cont’d.
(Solid-state version):
• SeeFront.com uses computer camera to track eyes X, Y & Z and moves images under twisted lenticular screen to chase eyes.
Autostereoscopy
(3D without glasses)

• **Holography**

• **Volumetric displays**
  Optically projected floating images.

• **HinesLab Holo-Box™**
  with horizontal and vertical motion parallax.
Autostereoscopy
(3D without glasses)

HinesLab
Patent Pending

HinesLab.com

OSSC, Feb. 10, 2010
HinesLab Autostereoscopic System Goals

• No 3-D glasses.
• Provide motion parallax without head tracking or moving parts.
• Viewer will have freedom of movement.
• Allow for multiple viewers of different heights.
• System must use a single video board.
• System must be broadcast compatible by a single TV station, and to allow DVR recording and 3-D playback.
• No 3-D glasses.
• Simplicity of a single LCD and conventional optics.
• Single video board controller.
• Broadcast compatible by a single TV station, and recording and playback at home with conventional DVR

HinesLab.com
### HinesLab 3DTV Image Formats

<table>
<thead>
<tr>
<th>Liquid Crystal Panels</th>
<th>XGA 1,024 x 768</th>
<th>SXGA 1,280 x 1,024</th>
<th>HDTV 1,920 x 1080</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Individual images: 512 x 384 pixels</td>
<td>Individual images: 640 x 512 pixels</td>
<td>Individual images: 960 x 540 pixels</td>
</tr>
<tr>
<td></td>
<td>Individual images: 341 x 256 pixels; 20&quot; demo at HinesLab</td>
<td>Individual images: 426 x 341 pixels</td>
<td>Individual images: 640 x 360 pixels</td>
</tr>
<tr>
<td></td>
<td>Individual images: 256 x 192 pixels</td>
<td>Individual images: 320 x 256 pixels</td>
<td>Individual images: 480 x 270 pixels</td>
</tr>
<tr>
<td></td>
<td>Individual images: 204 x 153 pixels</td>
<td>Individual images: 256 x 204 pixels</td>
<td>Individual images: 384 x 216 pixels</td>
</tr>
</tbody>
</table>

Exit pupils & width of viewing space:

- XGA: 5" W.
- SXGA: 8.75" W.
- HDTV: 16.25" W.
- 5 rows, 21 images Efficiency: 21/25 = 84%
Avionics Display
10 square images on 3 horizontal rows.

HinesLab.com
OSSC, Feb. 10, 2010
In-line Optical Path

7-Lens system

HinesLab 3DTV, U.S. Pats. 5,430,474 & 5,614,941
Viewing screen
can be made from separate components or combined into one.

(1) Lenticular screen with the lenticules oriented horizontally, spreads light vertically, without affecting the horizontal spread.

(2) Weak diffuser spreads the light to blend the edges of the exit pupils.

(3) Fresnel field lens converges diverging light toward the viewer's eyes, making the screen uniformly bright.

HinesLab.com
Exit pupils
projected by the screen

Using Fresnel field lens.
With addition of lenticular to spread light vertically.
With addition of diffuser to spread light uniformly.

HinesLab.com
OSSC, Feb. 10, 2010
Exit-Pupil Illumination Uniformity

50% illumination levels of projected exit pupils

Illumination of exit pupil #1

Illumination of exit pupil #2

Illumination of exit pupils #1-7
HinesLab 3DTV
U.S. Pats. 5,430,474
5,614,941
HinesLab Autostereoscopic 3D TV
HinesLab Autostereoscopic 3D TV

**Condensor section:** 7 lamps, cold mirror, Fresnel field lens, LCD projection panel, and 7 projection lenses.
3D TV Projection Lenses
HinesLab Autostereoscopic Video Arcade Games

Cross-eyed stereo.

HinesLab.com