

# **Preliminary Design Review for Fluidic Lens to be used in Ophthalmic Correction**

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# Fluidic Lens Can Replace Bulky Phoropter

- Basic phoropter generates, in discrete values
  - $\pm 20$  D of optical power
  - $\pm 3$  D of cylinder in any direction
- Variable Focal Length Lenses
  - Single lens can create any wavefront correction within its range.
  - Three lenses can create any cylinder in any direction with any power correction

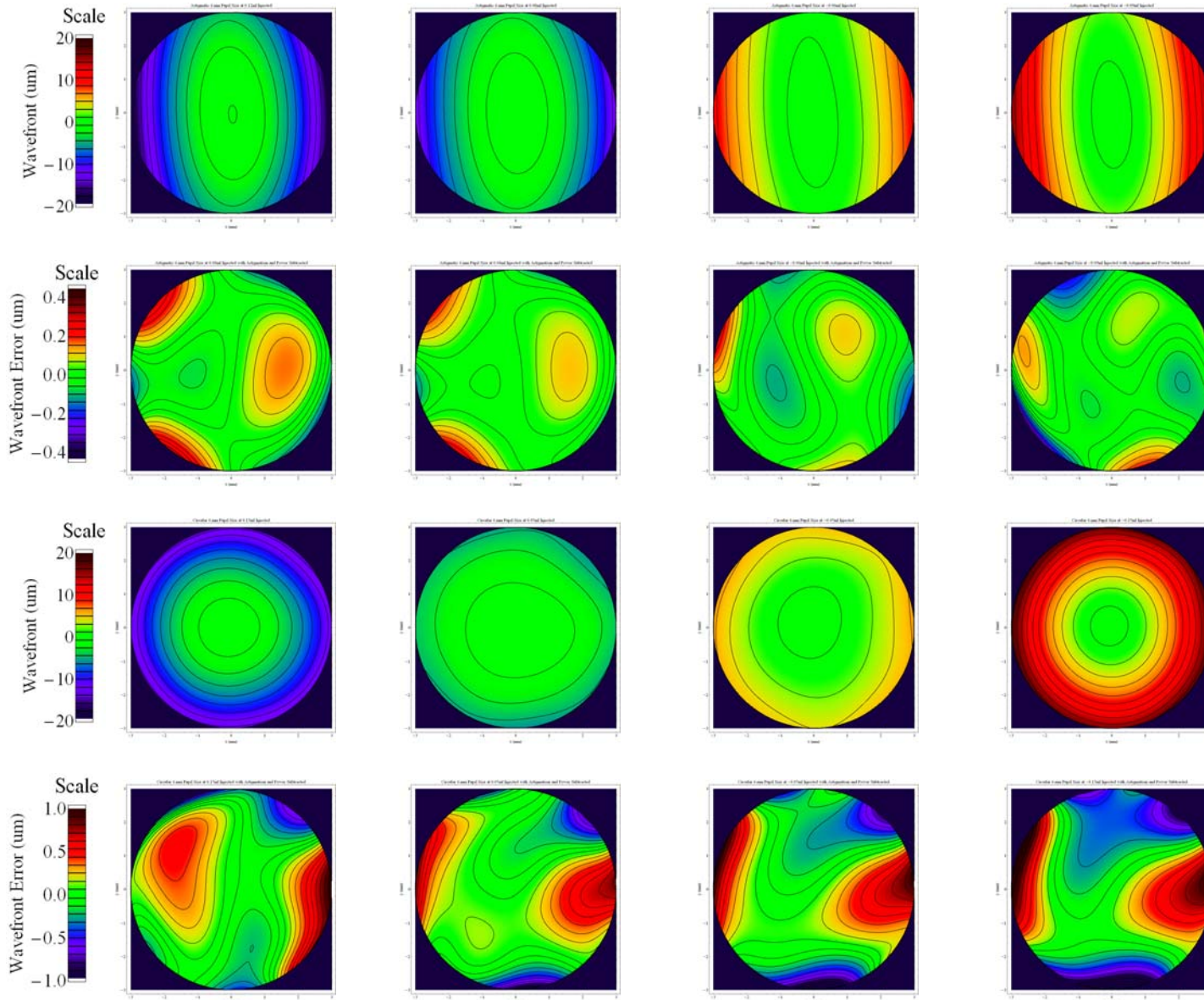


From: [http://www.news.navy.mil/view\\_single.asp?id=12477](http://www.news.navy.mil/view_single.asp?id=12477)

# Basic Requirements

- Purpose: To create a series of lenses that continuously reproduces the basic performance of a phoropter
- Must fit in front of a human eye
- Lens stack must be capable of producing Zernike terms  $Z[2,0]$ ,  $Z[2,-2]$ , and  $Z[2,2]$  independently
  - $\pm 3$  diopters of astigmatism in any direction.
  - $\pm 5$  diopters of optical power
- Combination of alignment and lens errors must produce less than 0.30 microns RMS error.
- Lens stack should be no thicker than 2 cm, and should be as thin as possible
- Must have a method of continuously altering the pressure within each lens.
- Lenses are filled with deionized water for testing

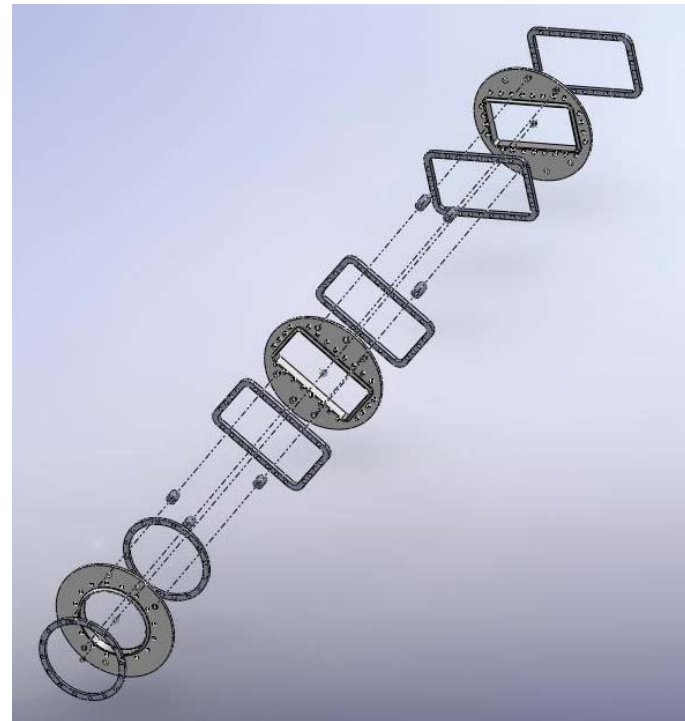
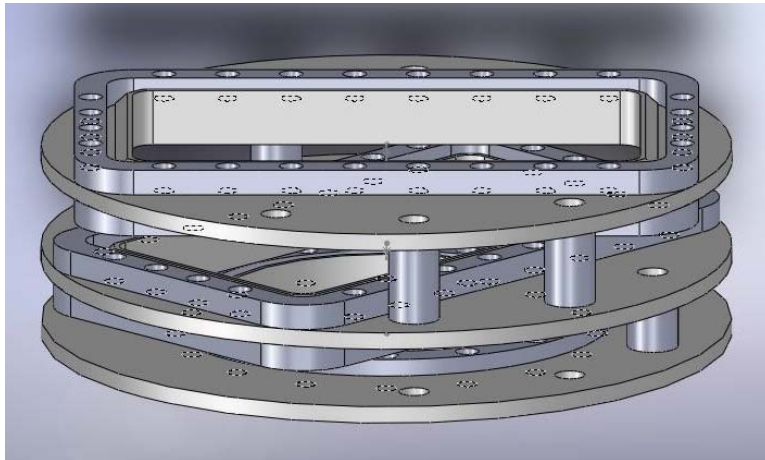
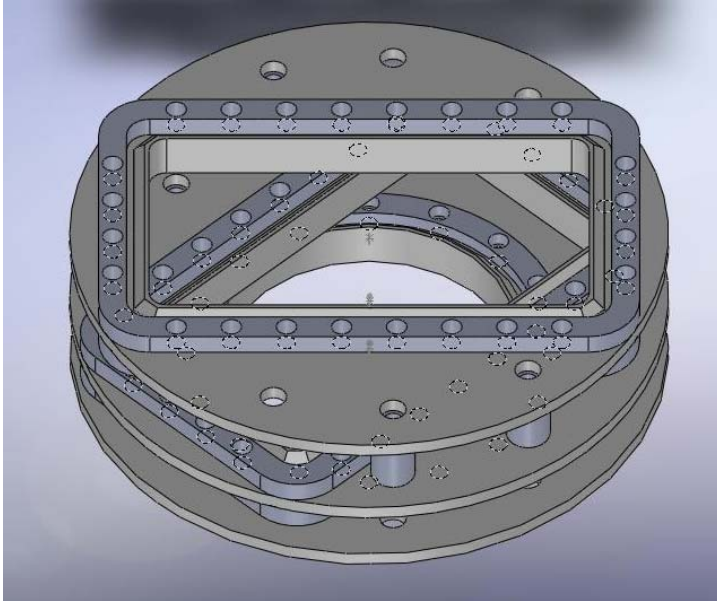
# Wavefront Profiles



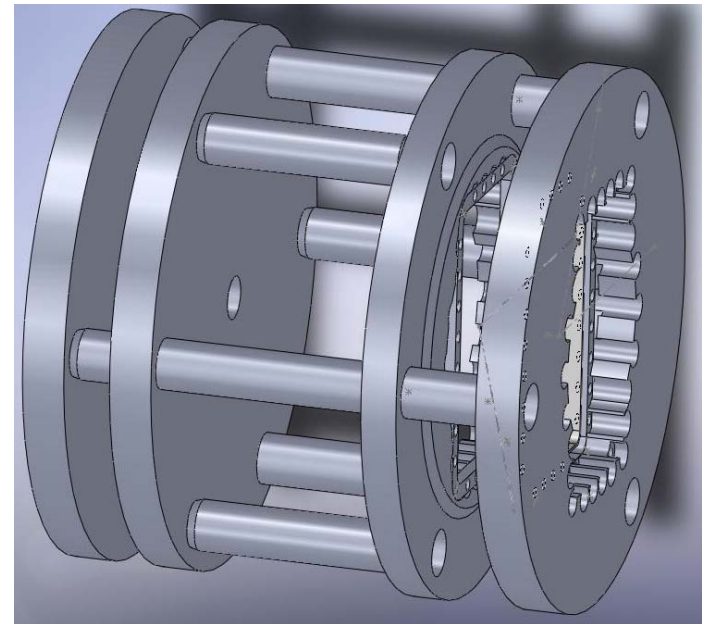
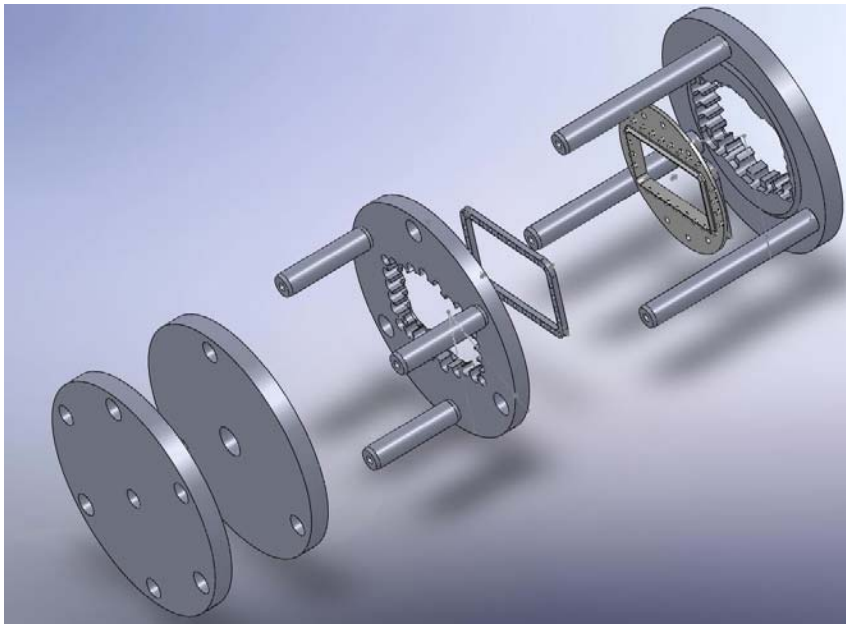
# Zernike RMS RSS Without Power and Astigmatism

- $\pm 3D$  of Cylinder
  - Each Astigmatism lens has approx. .07  $\mu m$  RMS residual error on each surface
- $\pm 7D$  of Sphere
  - Each Circular lens has approx. .2  $\mu m$  RMS residual error on each surface
  - Must Compensate for the Cylinder Residual
- RSS of errors: 0.35  $\mu m$ 
  - Alignment improvements can reduce this significantly

# Proposed Lens



# Alignment Jig



# Action Items

- Alignment Jig tolerances
- Alignment Jig drive mechanism
- Spacer post tolerances
- Lens planarity tolerances
- Lens order