OPTIMAX®
Manufacturing the Future

Rapid Prototype Freeforms for AR/VR Applications

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Optimax Systems, Inc.

Largest Optics Manufacturer in North America

Founded in 1991

120,000 ft^2 (11,000 m^2) facility in Ontario, NY, USA

ISO 9001: Certified

Inc. 5000 Top Growing Businesses

Diversified market portfolio

380+ employees

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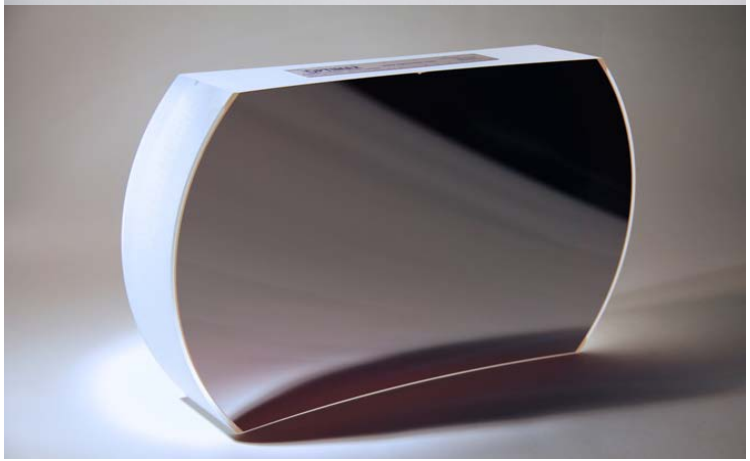
Optimax Systems, Inc.

Custom engineered solutions to help customers achieve goals



Custom Optics

- Prototyping
- Partner for high precision production
- Aspheres, cylinders, freeforms, prisms, spheres

Thin Film Coatings

- Designed to customer's specifications
- AR, HR, beamsplitters, polarizers and filters
- E-beam, plasma ion assisted deposition, ion beam sputtering (IBS)

Precision & Quality

- Commercial and custom metrology solutions
- Highly engineered, application specific manufacturing
  - Space Flight
  - DUV Lithography
  - High Energy Lasers

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Why freeforms?

AR devices are poised to be over $100B market

Challenges devices need to overcome

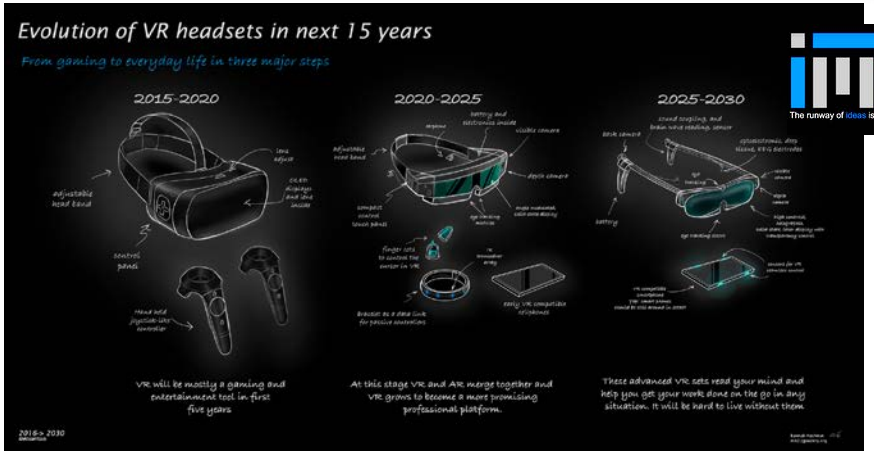
- Too bulky
- Too heavy
- Low FOV
- Low resolution
- Low brightness
- Inherent vision limitations

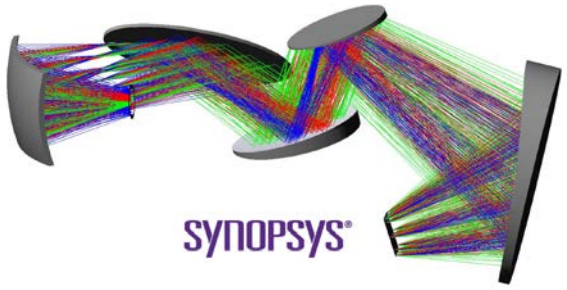
Freeforms offer opportunity to address challenges

Freeforms offer unique advantages in optical designs

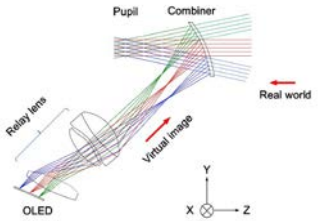
- Miniaturization
- Off-axis
- Lighter weight
- Conformal shapes

Increased freeform complexity can lead to increased manufacturing complexity.





3D CAD Export view of final optimized AR system



Lidong Wei, et al., Opt. Express **26,** 8550-8565 (2018);

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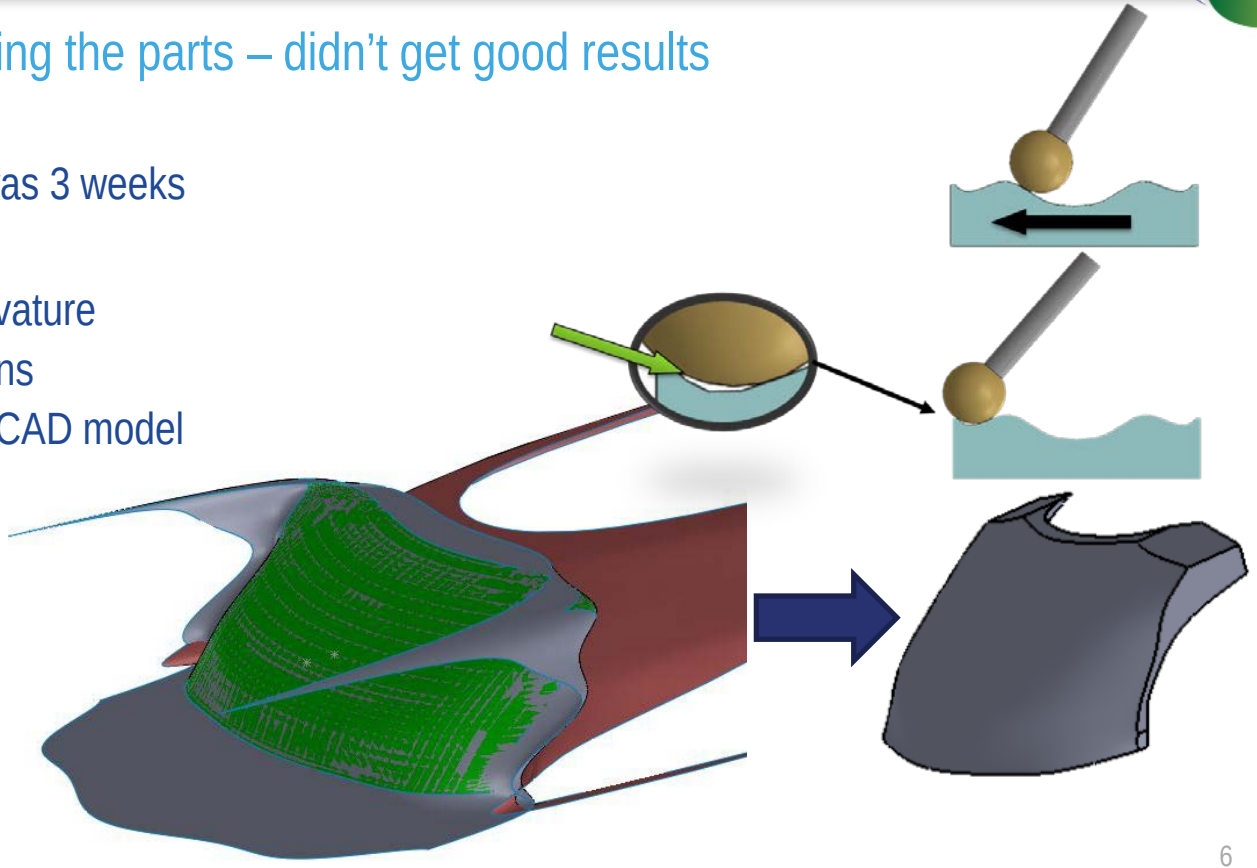
Real life example:

Refractive equation-driven freeform

- Customer attempted molding the parts – didn't get good results
- Parts very time-sensitive
  - Time from order to delivery was 3 weeks
- Manufacturing challenges
  - Very small local radius of curvature
  - Mid-spatial frequency concerns
  - Difficulties creating accurate CAD model



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Freeforms continue to be the future

Trending towards higher precision and more extreme surfaces

Freeforms are being used to reduce system size, off-axis design, conformal windows and beam correction

- Freeform designs and manufacturing methods continue to evolve
- Early partnership between designers and manufacturers leads to more manufacturable *total error* freeform systems

Experience leads to breakthroughs

- Collaborations driving toward more extreme surfaces
- Interested in partnering with additional universities, research institutes and industry to continue the *journey to higher precision freeforms*

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