



Short roast of freeform optics market

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Optics for AR/VR
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Freeform Surfaces Became Another Sexy Marketing Term



- Began as fully, arbitrarily shaped/asymmetric
 - > Optimax: mainly non-spherical optics or unusually aspherical, but still rotationally symmetric
 - > Focuslight/LIMO: specializing in 1D version of cylindrical optics, but radially symmetric
 - Limitations may result in loss of needed capabilities
 - > Sky-high market size projections
 - > OK to take advantage of growing movement
 - Winners include simplest, low-R&D cost solutions like slightly modified, mature diffusors (ex. PowerPhotonic)

Two Potentially Largest Market Segments for Ff Optics



- Consumer apps in general stand out
 - > Few totally dependent at present on ff optics
 - STMicroelectronics: “freeformish” optic over VCSEL array
 - > AR/VR possibly in five years (total price < \$200)
 - Creating adequate ecosystem around it necessary
 - Highly complex ff optics (light engine, delivery into eye)
- Auto lighting/illumination (Mainly 2025+)
 - > Relatively cheap means of differentiation
 - Autonomous driving in big way pushed even further out

Case for Automotive Sector as Biggest Ff Optics Opportunity



- AR/VR needs killer app to have big volumes
- Lighting increasingly becoming car signature
 - > Unique style headlights, pathways to autos, etc.
 - Design tools, materials, etc. exist today
 - > Gradually requires more engineered diffusors
- Yet, autos are highly integrated products
 - > Need to convince Tier 1s (\$250M+ opportunity)
 - > Requires optics no higher than \$50-100/vehicle
 - Multiple suppliers will drive costs down

Evaluation of Two Ff Optics Vendors



- Jenoptik
 - > Excels at grayscale lithography/diamond turning
 - Pseudo-continuous structures with only one mask
 - > Still, odd desire to select its own customers
- Viavi/RPC Photonics
 - > Taking ff to extreme
 - Very randomized statistical surface for specific designs
 - > Appears to have business relationship with Osram
 - But issues with customer's struggle to be bought by ams

Additional Ranting Against Public-Private Partnerships



- PHABULOuS is project-centric like all PPPs
 - > Time sink with bare minimum results
 - > Too many firms with no singular outcome control
- Europe needs to move more towards entrepreneurial model
 - > EPIC facilitating funds from bankers/incubators
 - Proactive internal development at each supplier
 - Emphasis on sustainable cash flow
 - Reflective of maturation of overall optics market

Thank You!



Q & A