ARSENY ALEXEEV

HEAD OF RESEARCH & PROCESSES

WaveOptics

Wednesday, 29 April 2020, 16:00 CEST

EPIC Online Technology Meeting on
Freeform Optics for AR/VR

WAVEOPTICS DESIGNS, MANUFACTURES (SEMI-FABLESS) WAVEGUIDES AND LIGHT ENGINES

THE TWO KEY COMPONENTS OF EVERY AR HEADSET

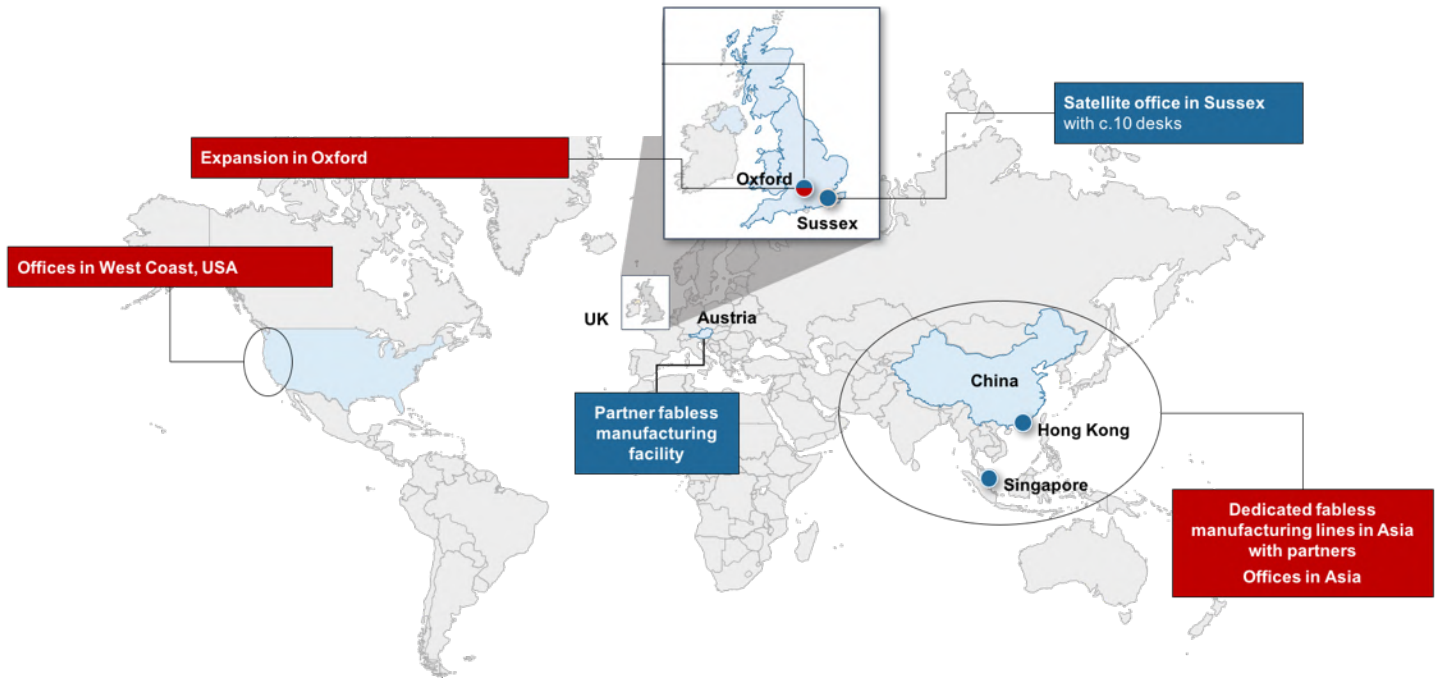
WAVEOPTICS AT A GLANCE

- Trading since 2014
- ≅ $60M raised to date
- 108 people (April 2020)
- Pioneers in waveguides and light engines technology
- Internal specialists in all field of nano and micro optics
  - Modelling (in-house developed tools)
  - Fabrication (all types of lithography)
  - Metrology (own tools and techniques)
  - Optical testing (on-site optical labs)
  - Prototyping (on-site NPI facilities)

MARKETS

- Enterprise – logistics, field service, retail, medical, etc.
- Consumer electronics, gaming industry, personal devices

LOCATION OVERVIEW



WAVEGUIDES PRODUCT LINE

BEST IN CLASS PERFORMANCE

FIELD OF VIEW OPTIONS

One-plate waveguides
KATANA samples will be available in Q1 2020 with 28° FOV.

Two-plate waveguides
VULCAN are available today with 28° & 40° FOV.

Three-plate waveguides
ODIN samples will be available in Q2 2020 with 40° and 55° FOV.

VULCAN 28° & 40°
available now

	KATANA	VULCAN	VULCAN	ODIN
Field of View (degrees)	28°	28°	40°	55°
Input pupil diameter (mm)	4	4	4	3 x 2.5
Nominal eye relief (mm)	24	20	25	18
Eye-box (mm)	12 x 11	15 x 11	19 x 15	12 x 7
Efficiency (Nits/lumens)	160	400	175	50
MTF (Cycles/degree)	18	18	18	18
Transmittance	85+	80+	80+	70+
Contrast	40:1	40:1	40:1	40:1

LIGHT ENGINES PRODUCT LINE

PARING WITH OUR WAVEGUIDES

FIELD OF VIEW OPTIONS

40° projector (SATURN)
is available today.

28° projector (MARS)
available in Q1 2020

55° projector (PLUTO)
Built initially to support our
Ultra-High Field of View demos

TECH SPECS

	NEPTUNE	MARS	SATURN	PLUTO
Field of View (degrees)	28°	28°	40°	55°
Projector technology	DLP	LCOS	DLP	LCOS
Image orientation	Portrait	Square	Landscape	Landscape
Aspect ratio	9:16	1:1	16:9	16:9
Display resolution (px)	480x584	720x720	1280x720	1980x1080
MTF (Cycles/degree)	18	18	18	18
Flux at exit pupil (Lumens/Watts)	>6	>6	>10	>6
Projection type	Colour sequential	Colour sequential	Colour sequential	Colour sequential

WAVEGUIDES MANUFACTURING

WE PARTNER WITH THE BEST R&D LABS AND NANO-FABS AROUND THE WORLD

1 NIL

Mass production of waveguides on wafers

2 OPTICAL COATING

Wafers are coated and cured

3 LASER CUTTING

Individual waveguides are cut from their fabrication wafers

4 ASSEMBLY

Individual waveguides (red & blue) brought together

5 EDGE BLACKENING

Tinted to enhance augmented reality images

6 CHARACTERISATION

All waveguide assemblies are tested for accuracy and optical performance

LIGHT ENGINES MANUFACTURING

WE PARTNER WITH THE BEST ODMs AND OEMs AROUND THE WORLD

NPI facility

We have recently introduced our UK based New Product Integration facility. Our NPI facility has an assembly line, that includes waveguide stacking, edge blackening & testing.

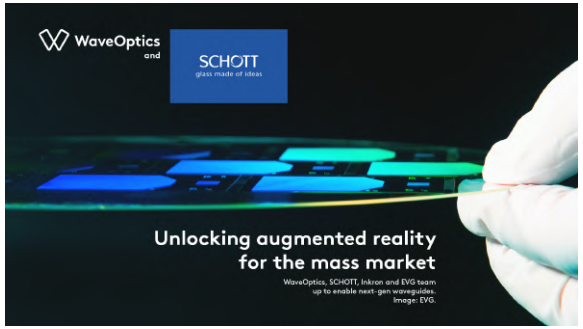
There is a dedicated space for module and projector assembly where we are able to test out designs and prototypes - this helps speed up the product design process for WaveOptics standard products, as well as customer projects.

WHAT CAN WE OFFER TO OUR PARTNERS AND CUSTOMERS?

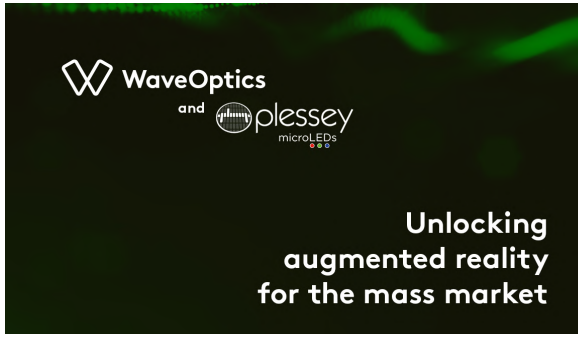
CUTTING-EDGE R&D OF NANO- AND MICRO- OPTICS

CO-DEVELOPMENT

✓ Bring up of NIL processes for new RESINS and GLASS



✓ R&D of cutting-edge optical components for LIGHT ENGINES



ADVANCED METROLOGY

✓ SEM / FIB / TEM of non-conductive imprints

✓ High-resolution AFM using ultra-sharp tips

✓ Automated extraction of Critical Dimensions (CD) from SEM and AFM images with 10nm accuracy

✓ FTIR / Raman / EDX for chemical component analysis

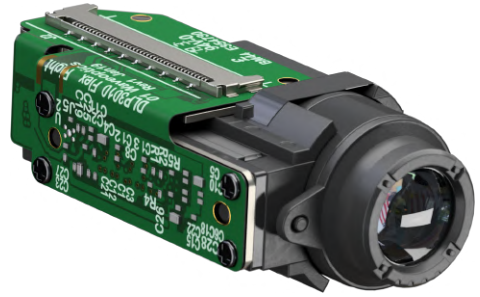
✓ Advanced Ellipsometry and Spectrophotometry measurements for accurate extraction of n and k at nanoscale.

✓ Advanced optical metrology with nm and pm precision: pitch, CDs, OPD, etc.

OUR PRODUCTS

✓ Waveguides

✓ Light Engines



WHAT ARE WE LOOKING FOR (WISH LIST)?

- ? NIL resins with confirmed (measured) uniformity of n and k at the nano-meter scale.
- ? High RI NIL resins and glass with n>1.9. (and low k).
- ? Solvent-free, low viscosity resins with n > 1.7 (and low k).
- ? Curved glass and NIL replication on curved surfaces.
- ? Fabrication of NIL masters on 8/12 inch wafers with resolution <50nm and high density of nanostructures.
- ? Advanced optical components for light engines – smaller sizer, more lumens, less power consumption.

Our aim is to be the key optical component
for customers creating AR Wearables and Smartglasses

WaveOptics
INSIDE

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