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Laser Beam Scanning (LBS): *The* Ideal Solution for AR Wearable Products

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Definitions



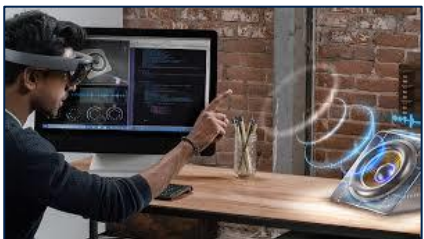
VR

Virtual Reality – Occluded view and a fully immersive experience



AR

Augmented Reality – Simple digital content is overlaid onto physical world



MR

Mixed Reality – Physical and Virtual worlds are fully merged with visually accurate depth, perspective, texture, shade etc.

The Main Challenge



- To achieve the desired form factor key determinants, to first order, are:
 - ❖ Near-to-eye compact display technology
 - ❖ Highly efficient combiner optics technology
- Start with simple and broadly useful applications → smart glasses
- Then, add additional functionality as technology & solutions mature

Key requirements for AR wearable devices

Goal: Head-up, Hands-free, All-day-wearable AR glasses which means glasses must be usable, comfortable with the requisite performance

Indoor and outdoor use

Form factor

Low Power (system)

Light weight

Low latency (motion to photon)

Range of FoV

Range of resolution

Eyebox size



Peak brightness > 1000 cd/m2 (transparent lenses)



Fashionable eyeglasses



< 1W



< 70g



< 4ms



30° – 40° (AR) to > 80° (MR/XR)



720P (AR) to > 1400P (MR/XR)

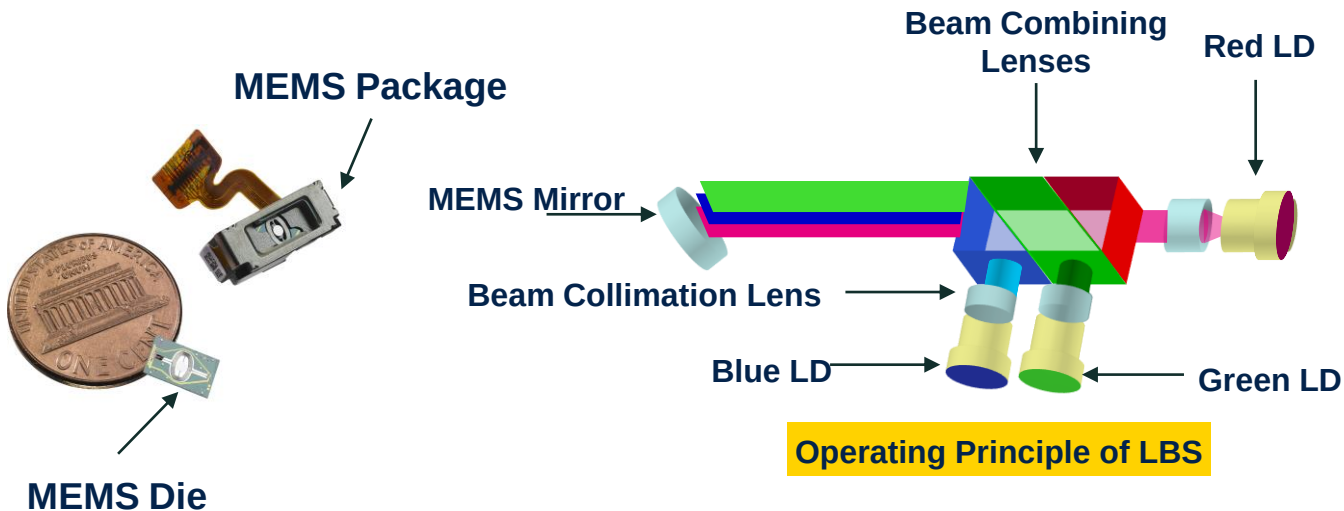


> 10mm x 10mm

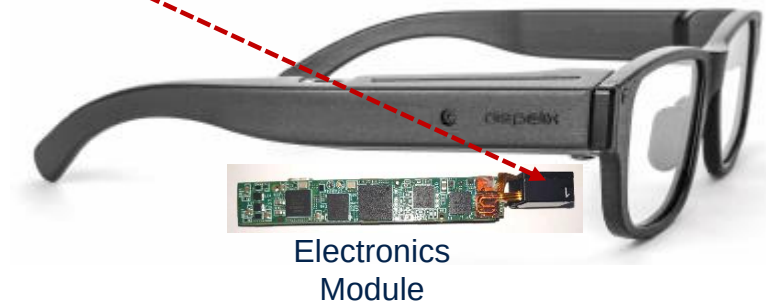
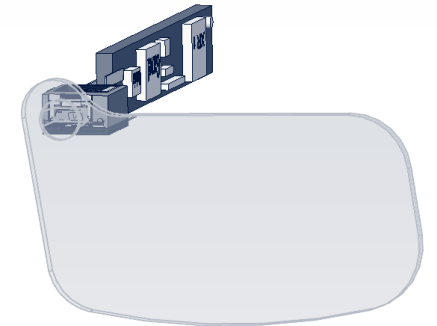
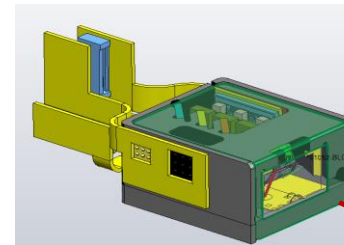
Laser Beam Scanning (LBS) – The Ideal Solution

Ultra small microdisplay
Compact illumination source
High brightness (light engine)
Low Power (system)
Thin, lightweight lenses

MEMS Micromirror with LBS
Advanced laser diode packaging
 $>10^6$ cd/m² (nits)
< 1W
DOE or HOE Waveguides

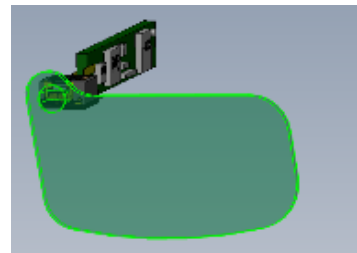
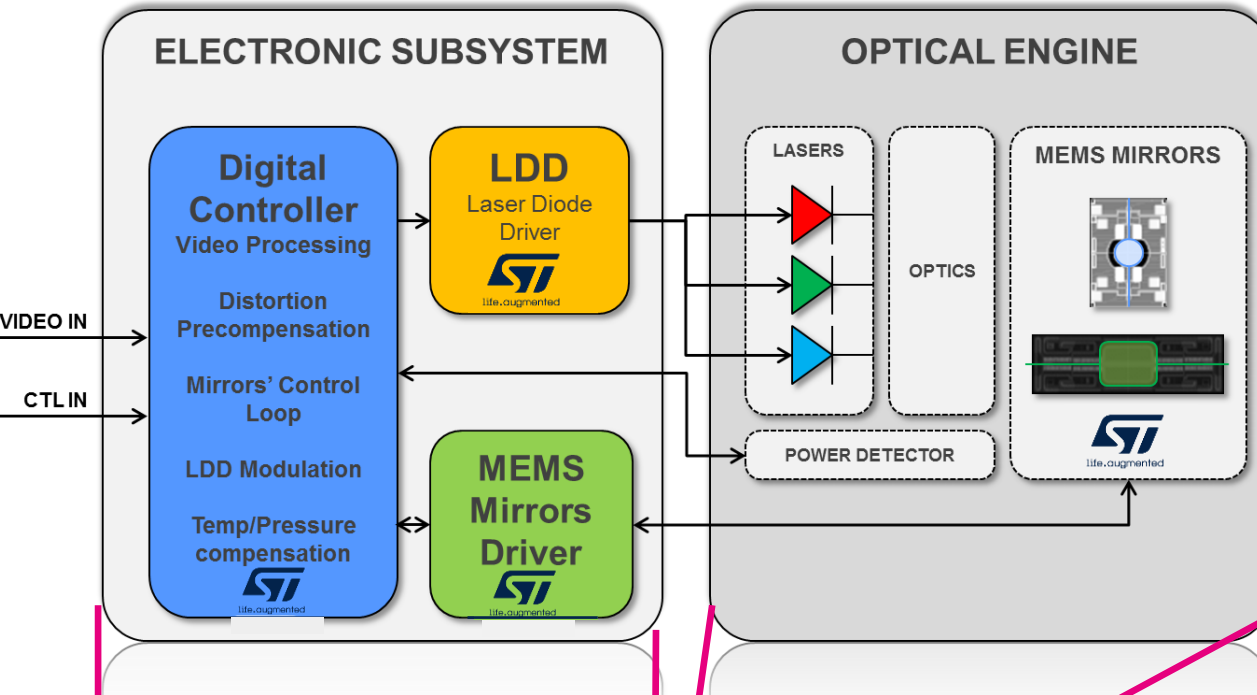


Operating Principle of LBS

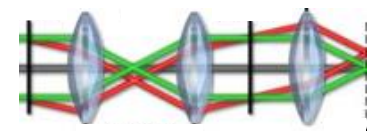
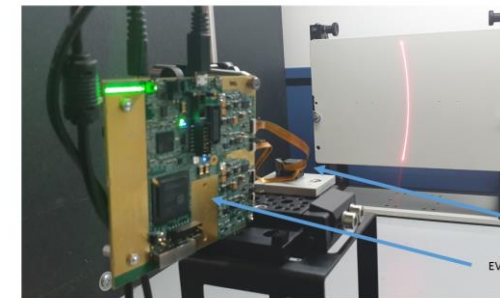
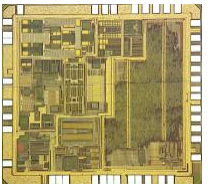
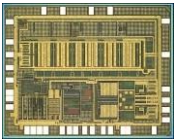


Insert First LBS Video Here

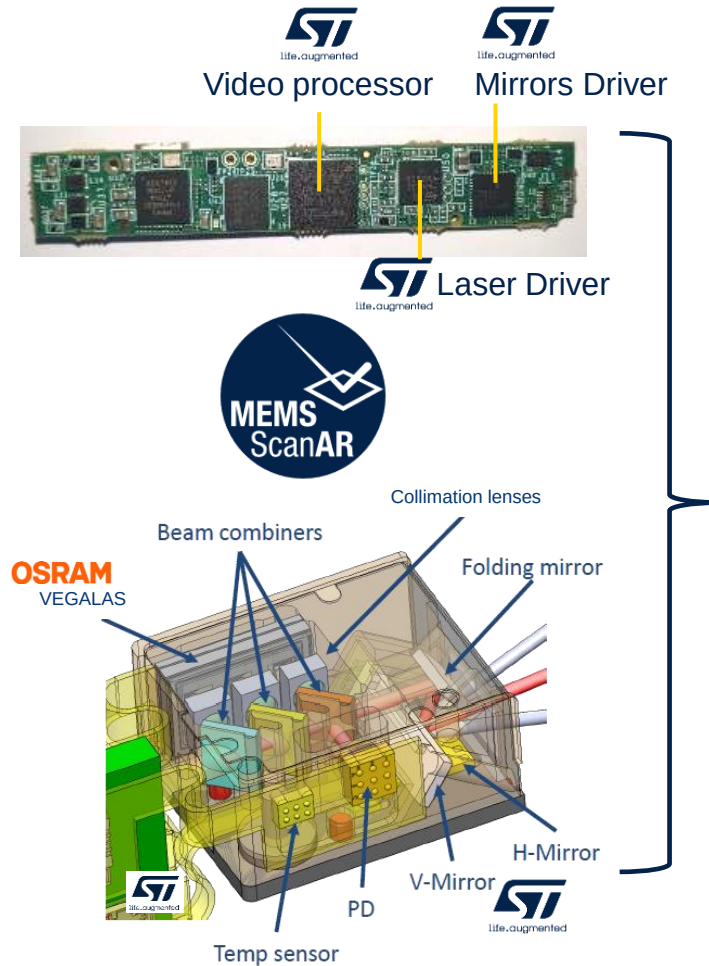
LBS Reference Design Architecture



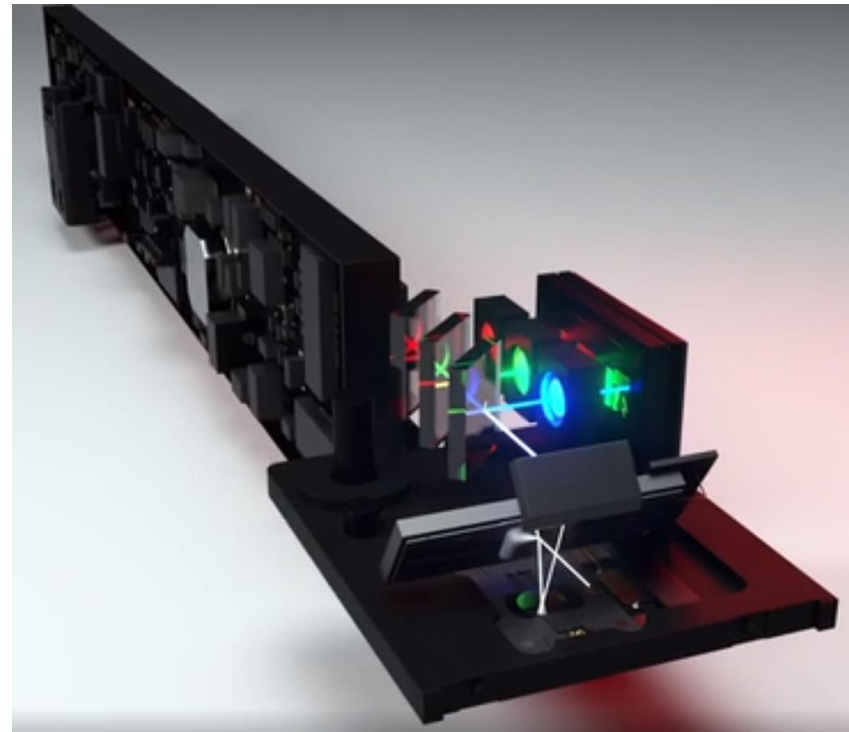
- **MEMS Mirrors**
- **Mirrors Drivers**
 - Electrostatic, Magnetic, Piezo drivers
 - High efficiency / Energy recovery drivers
- **Laser Diodes Drivers**
 - <500ps rise/fall time for crisp pixels
 - Ultra low power – Optimized for AR
 - 3 / 4 channels (RGB / + IR)
- **Control Loops and Video**
 - HW / SW Mirror control loop
 - Laser control loop
 - Calibration
 - Video processing
- **Relay Optics**
 - ST patented design to maximize performances with waveguides



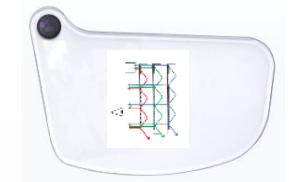
STAR0 Reference Design Proof-of-Concept



STAR0 Reference Design



dispelix



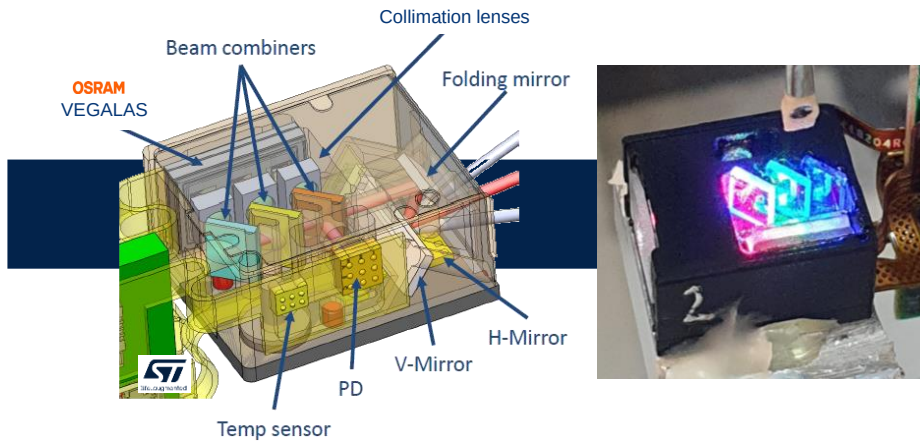
Demo Specifications

FOV (diagonal)	30°	24° (H) x 18° (V)
Brightness	1300	cd/m ²
Image aspect ratio	4:3	
Eyebow	10x10	mm
Color	RGB	
Resolution	33	pixels/deg
Refresh rate	60Hz	

Images as Seen Through the Glasses



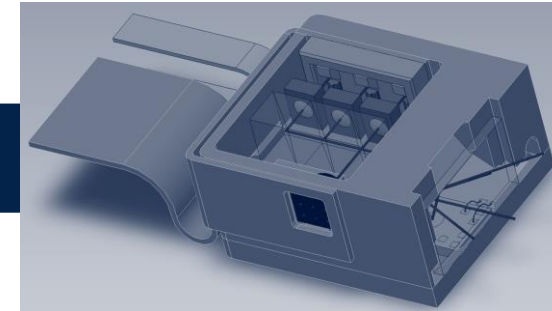
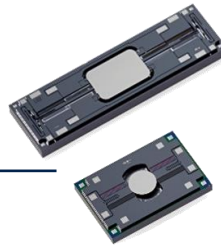
ST LBS Optical Engine: Roadmap



Current Generation

Optical Engine for STAR0

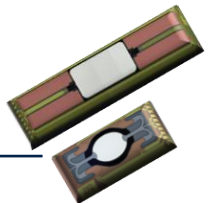
Helen OE FoV (Diag)	56°
Output Brightness	1.5 – 10 lm
Resolution	960 x 600p
Size	0.75 cc
MEMS Mirrors	Electrostatic



Next Generation (2H2021+)

Optical Engine for STAR1

OE FoV (Diag)	65°
Output Brightness	1.5 – 10 lm
Resolution	1280 x 720p
Size	< 0.7 cc
MEMS Mirrors	Thin Film Piezo



50% Less Power Consumption
than STAR0

LBS Solutions Enables Optimization of Design Trade-offs

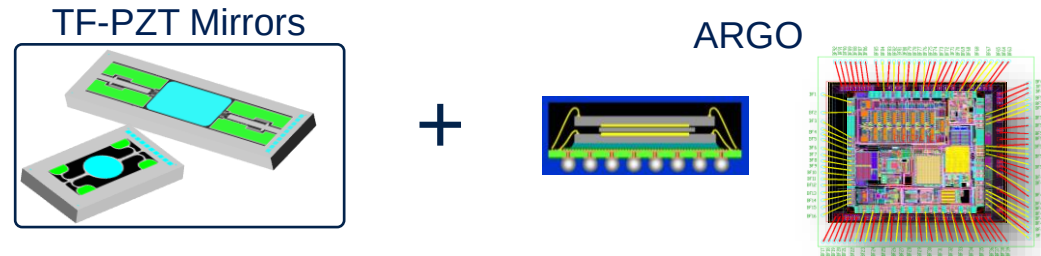
AR Glasses Design Tradeoff Considerations



Example only

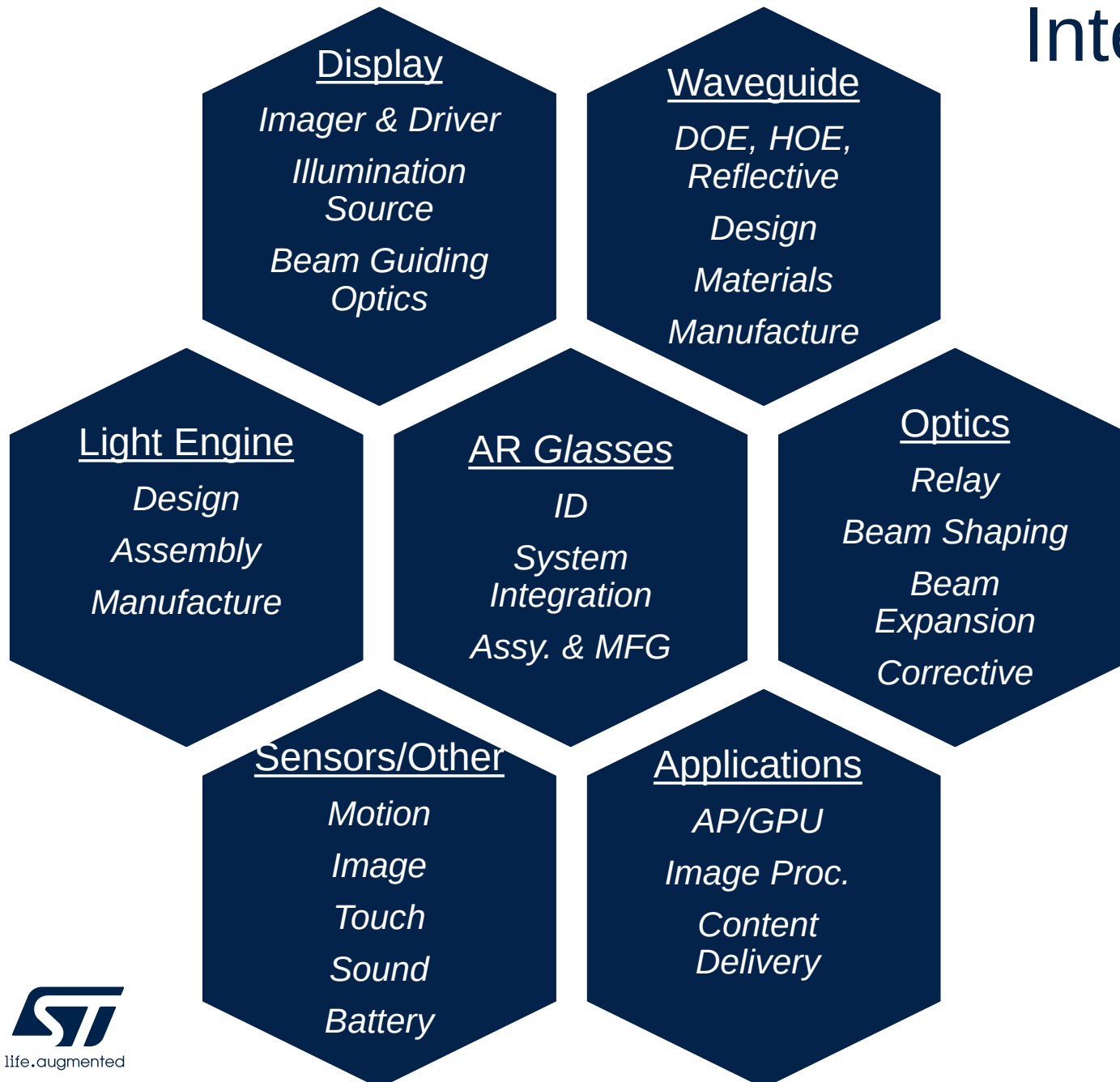
Design of AR wearables must be holistic in nature

- Optimize for the application
 - Simple text, symbology and graphical overlay
 - FoV ~ 30°-40°, >10mm eyebox, >1000 nits, <70g, monocular, eyeglass style
 - Fully immersive experience with holographic rendering
 - FoV >80°, >10mm eyebox, >500 nits, >1440P, <200g, binocular, HMD style



$$P_{ES} = CV^2 f \rightarrow P_{PZT} = \frac{1}{10} CV^2 f$$

Integration of Technologies



A number of complex technologies, designs, processes and methods need to come together seamlessly.

ST has devices, technologies or solutions for almost all categories, and partners for others.

It Takes a Village to Create and Sustain Emerging Markets

LaSAR Alliance: Conceived, created, organized and implemented by ST

LaSAR Alliance Objectives

- Enable, facilitate and promote the development of technologies, devices and solutions around LBS for near-to-eye display products
- Establish ecosystem making available to ODMs and OEMs commercially viable and available components and solutions towards the design, development and manufacturing of augmented reality wearable products
- Create a forum for discussion and exchange of ideas on key challenges around LBS, including complementary technologies and solutions
- Longer term, develop standardization for technologies, devices & solutions around LBS

ST Objectives

- Position ST as the de facto leader in LBS and industry thought leader and facilitator
- Influence the design and development of complementary technologies
- Promote a monolithic design approach around ST LBS solutions
- Enable seamless integration of other key ST technologies and components in AR & related product categories

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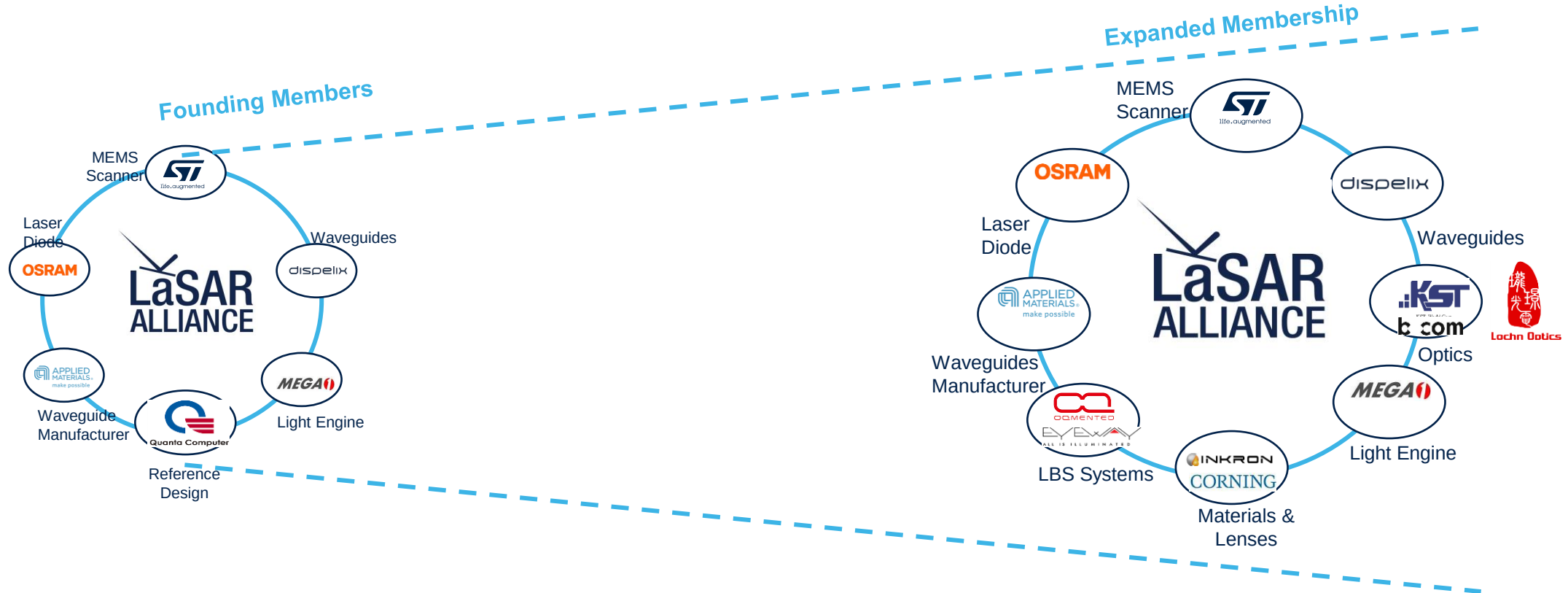
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Non-profit entity incorporated under IEEE ISTO and open to all

The LaSAR Alliance Ecosystem



More Partners to be Announced
&
Open to More Members
Join the Alliance!
www.LaSARAlliance.org

Insert Second ST AR video here

Thank you

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