



BLUGLASS

2022

**BLUGLASS (ASX:BLG)**

Acquisition of Silicon Valley Laser Fab & Assets

March 2022

# FORWARD LOOKING STATEMENT

This document has been prepared by BluGlass Limited to provide readers with an update of the Company and the Company's technology.

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This document includes certain information which reflects various assumptions, subjective judgment and analysis, and is subject to significant business, economic and competitive uncertainties, risks and contingencies, many of which are outside the control of, and are unknown to, BluGlass Limited. The assumptions may not prove to be correct. Recipients of the document must make their own independent investigations, consideration and evaluations prior to making any decisions to invest in the Company.

Information on Service Addressable Markets (SAM) is based on internal BluGlass modelling and assumptions, both of which depend on successful R&D outcomes and results achieved within estimated timetables. BluGlass recommends a cautious interpretation be taken by investors.





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A scientist in a white lab coat and glasses is working in a laboratory. She is positioned on the right side of the frame, looking down at a piece of equipment. In the center, there is a large microscope mounted on a black stand. To the left of the microscope, a large computer monitor displays a green, textured image. The background shows a typical laboratory environment with white cabinets and a tiled wall. The entire image has a purple tint.

# BLUGLASS & MARKET OVERVIEW

# COMPANY OVERVIEW

BluGlass Limited (ASX:BLG) develops and manufactures leading gallium nitride (GaN) semiconductor materials and laser diode technology for the industrial, scientific and biotech markets.

## AUSTRALIAN & US

Based operations with more than a decade's experience delivering laser diodes and LED development to the global photonics industries

## 86 PATENTS

Granted in key semiconductor manufacturing jurisdictions

## EXPERT TEAM

With many decades combined experience, led by laser diode veteran  
**Jim Haden**

## PROPRIETARY RPCVD TECHNOLOGY

Offers unique benefits to customers – including novel, brighter and higher efficiency laser diodes

## FEW COMPETITORS

BluGlass is one of four suppliers of blue Laser diodes globally

## MULTIPLE PRODUCTS

Designed to meet underserved markets with strong customer interest across all wavelengths

## KEY CUSTOMER CONTRACTS

with DARPA, Yale University and a European wafer developer

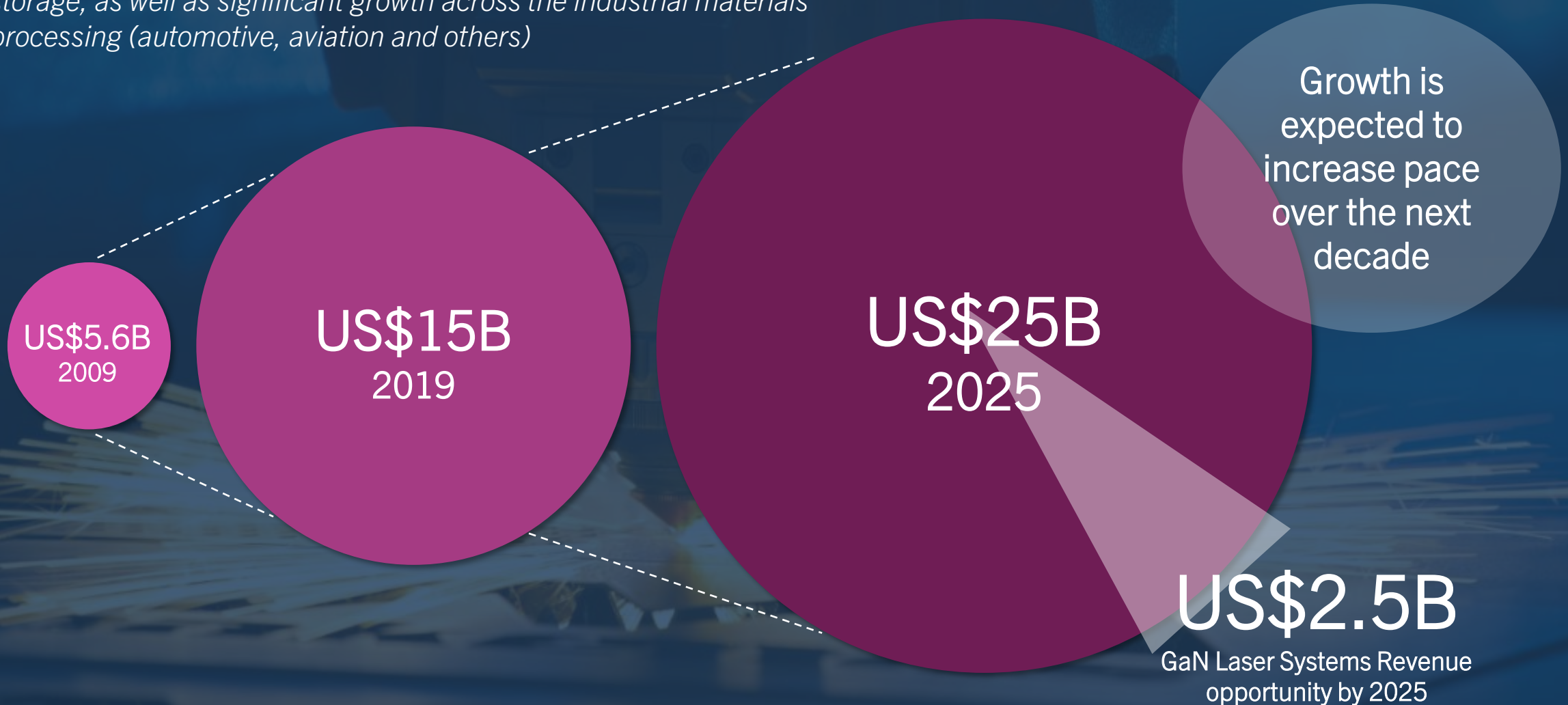
DEBT-FREE with  
\$6.24m cash at hand as at  
31 December 2021.



# INDUSTRY OVERVIEW - LASER REVENUE GROWTH FORECAST (2019 – 2025)

## Laser revenue has almost tripled in past decade

Driven by the adoption of high-tech applications around the globe such as *smart phones and TV's, 3D printing, electric vehicle and renewable energy storage, as well as significant growth across the industrial materials processing (automotive, aviation and others)*

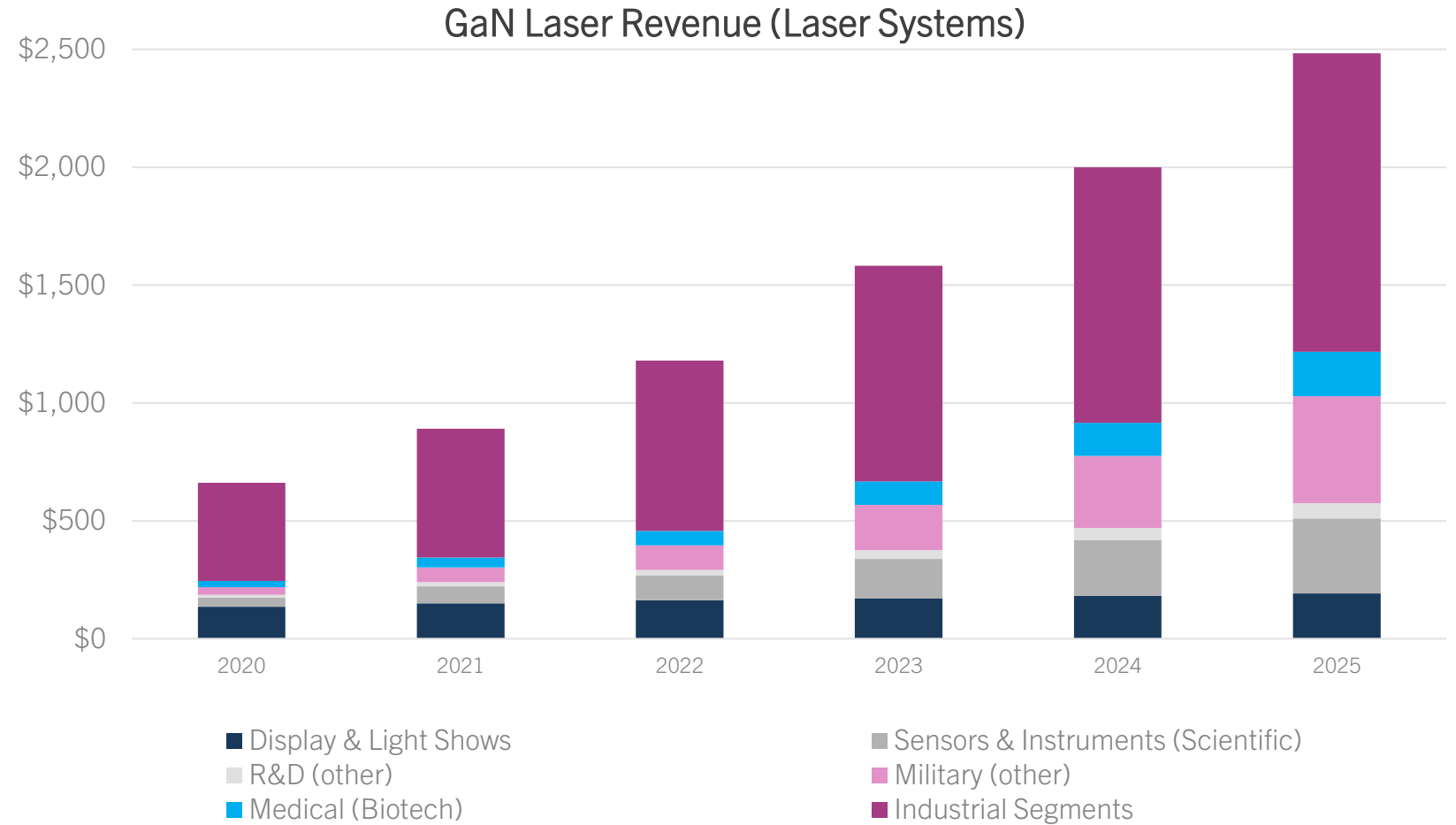


# MARKET OVERVIEW – GLOBAL GAN LASER REVENUE FORECAST BY SEGMENT (2019-2025)

**US\$2.5B**  
GaN Laser Systems Revenue opportunity by 2025

BluGlass' Service Available Market opportunity by 2025 is

**US\$735M**



Source: Strategies Unlimited and Internal BluGlass modelling based on industry sources

# INDUSTRY OVERVIEW – BLUGLASS TARGET MARKETS



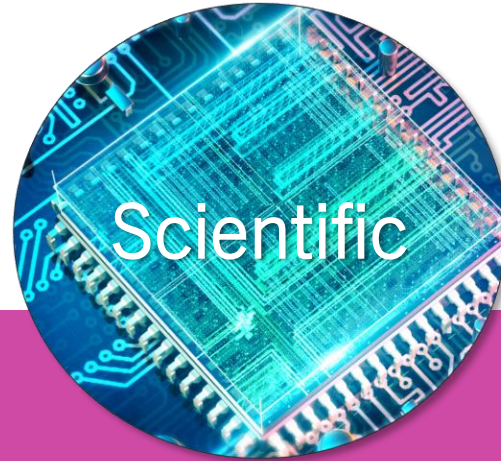
## Industrial

BluGlass' Industrial Product  
Addressable Market by 2025 is

**US\$240M**

Wavelengths: (405nm, 450nm, 525nm)  
Target Applications: Welding, Marking, 3D  
Printing

Customer Landscape inc: nLight,  
IPG Photonics, Nuburu, Optical Engines



## Scientific

BluGlass' Scientific Product  
Addressable Market by 2025 is

**US \$80M**

Wavelengths: (405nm, 420nm, 450nm,  
490nm, 525nm)  
Target Applications: Quantum  
Computing/Sensing, Spectroscopy

Customer Landscape inc: Coherent, Toptica  
Photonics, Novanta-Laser Quantum



## BioTech

BluGlass' BioTech  
Product Addressable Market by 2025 is

**US \$60M**

Wavelengths: (405nm, 420nm,  
450nm, 490nm, 525nm)  
Target Applications: Flow Cytometry, DNA  
Sequencing, Photodynamic Therapy

Customer Landscape inc: Akela Laser,  
Laser Components, PicoQuant



# LEADERSHIP TEAM

## BOARD OF DIRECTORS



**James Walker**  
*B-Comm, FCA, GAICD*  
EXECUTIVE CHAIR



**Vivek Rao**  
*MS-EE, BSc-Elec*  
NON-EXECUTIVE DIRECTOR



**Stephe Wilks**  
*BSc, LL.M*  
NON-EXECUTIVE DIRECTOR



**Jean-Michel Pelaprat**  
*BSPHy*  
NON-EXECUTIVE DIRECTOR

## MANAGEMENT TEAM



**Jim Haden**  
*MsEE BEE*  
PRESIDENT



**Brad Siskavich**  
*BSME (Mech-Engineering), MBA*  
EXECUTIVE VP



**Dr Arkadi Goulakov**  
*PhD (Physics)*  
SENIOR LASER SCIENTIST



**Stefanie Winwood**  
HEAD OF CORPORATE  
COMMUNICATIONS & IR



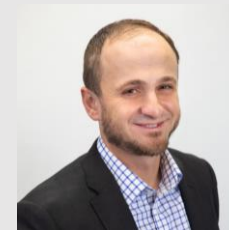
**Dr Ian Mann**  
*PhD, MBA, Msc, Bsc-ENG, FAICD*  
CHIEF OPERATIONS &  
TECHNOLOGY OFFICER



**Dr Josh Brown**  
*PhD (Physics)*  
HEAD OF EPITAXY



**Dr Marie Wintrebert**  
*PhD (Physics)*  
CHIEF SCIENTIST



**Izzat Shadid**  
*BBus (Accounting), CPA*  
FINANCIAL CONTROLLER



# TRANSACTION OVERVIEW

# TRANSACTION HIGHLIGHTS



## Once in a lifetime opportunity

To acquire full-suite laser diode (LD) front and back-end manufacturing plant (fab) for a fraction of the cost of build



## Faster development and production

4-8 x faster turns means more products quicker to market, and greater manufacturing flexibility for customers



## Greater profitability & reduced production costs

Significantly reduced manufacturing costs to increase profitability and accelerate projected cash breakeven to 2024/2025



## Significantly increased manufacturing scalability

4 x greater annual wafer capacity with owned-fab (vs contract manufacturers)



## Greater operational control & simplicity

Eliminate supply chain complexity and variation by bringing full fabrication process in-house. Improve quality control, operational consistency and improved yields



## Expert manufacturing team

Ability to hire highly skilled, industry experienced fabrication team



## Enhanced performance

Accelerate enhanced product development roadmap including: RPCVD LDs, Tunnel Junctions, and shorter and longer wavelength development programs (UV and Green LDs)



## Capital raise

Opportunity to invest as BluGlass expands its manufacturing capacity as a full-suite GaN LD supplier, disrupting the fast-growing \$2.5B global market



# COMPELLING STRATEGIC RATIONALE



## Strategic Continuity

Acquisition fast-tracks longer-term plan to bring fabrication processes in-house, reducing costs and scaling operations.

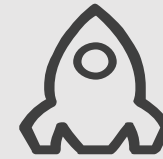
Once in a lifetime opportunity to acquire working fab for fraction of cost to build.



## Continuous Operations

Ongoing Contract Manufacturing agreements to ensure operational continuity over next 12 months.

Enables BluGlass to adapt facility to GaN fabrication and transfer processes from CMs without impacting product launch or delivery.



## Accelerated Roadmaps

Initial product launch on track for mid 2022 with Contract Manufacturers.

Accelerates higher-value product roadmaps, including RPCVD Tunnel Junction laser diodes and in-demand longer/ shorter wavelength lasers (UV/Green).



## Faster Profitability

Increased manufacturing capability enables BluGlass to realise competitive advantages and value proposition.

Acquisition reduces production costs, increases profit margins, and brings forward cash-flow positivity to 2024/2025.

# TRANSACTION SUMMARY

## Agreement to acquire Silicon Valley Laser Fab

### Transaction Overview

- BluGlass and the Fab Owner have entered a non-binding agreement for BluGlass to acquire the Facility Manufacturing Equipment (**the Fab equipment**)
- BluGlass has agreed terms with the landlord to acquire the lease of the existing fitted out manufacturing site (**the Fab**)
- BluGlass has agreed terms for key staff on-site to be employed by BluGlass Inc.
- The agreed equipment purchase price is US\$2.5M
  - made up of \$2.0M cash and \$500K in new BLG shares

### Transaction Funding

- The transaction is to be funded by an
- Institutional placement
  - Rights Issue to eligible BluGlass shareholders

### Offer timeline

- |                            |                        |
|----------------------------|------------------------|
| • Offer announced          | 24 March 2022          |
| • Record date              | 29 March 2022          |
| • Entitlement Offer opens  | 1 April 2022           |
| • Entitlement Offer closes | 5pm AEST 12 April 2022 |
| • Allotment of new shares  | 29 April 2022          |

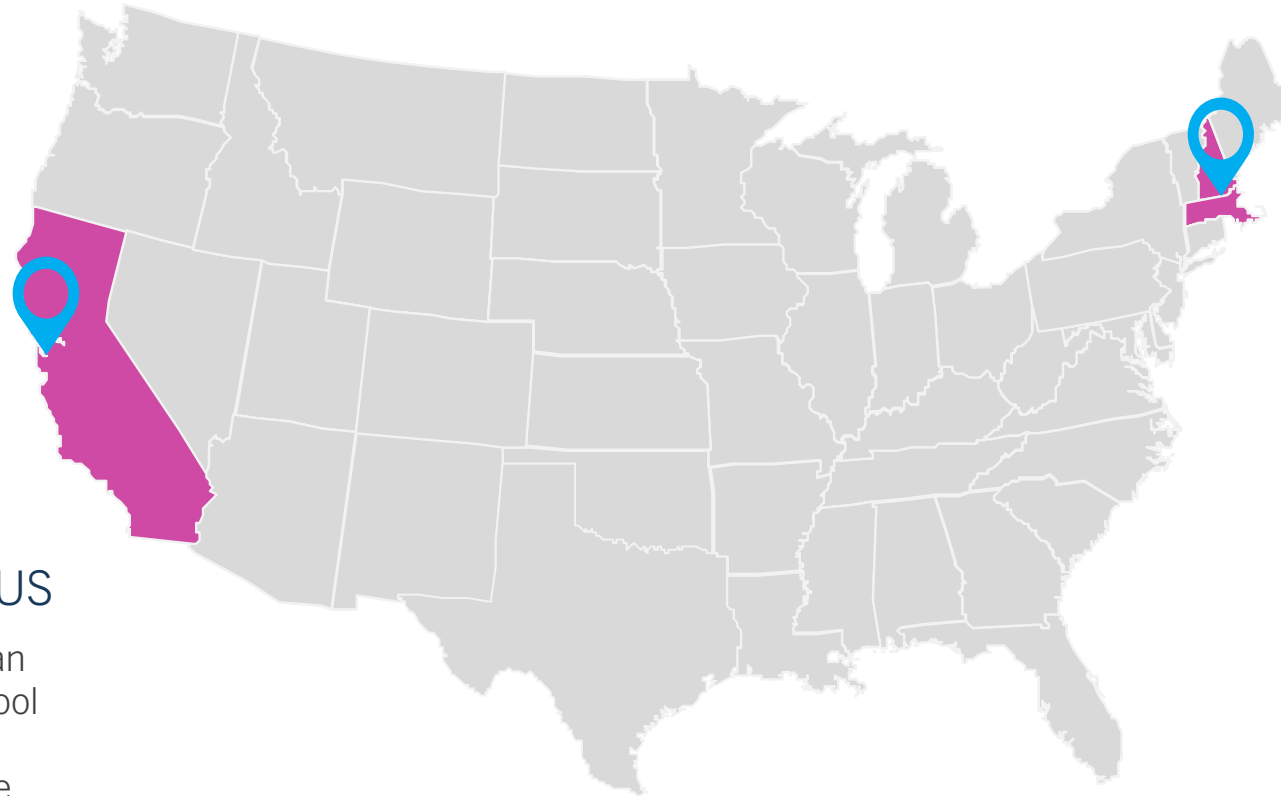
# GROWING US PRESENCE CREATES SYNERGISTIC OPPORTUNITIES

## Full-suite US based GaN LD manufacturer

Strategically positions BluGlass for US defense/govt contracts; supports growth in key target markets (biotech, LiDAR, AR/VR, Sensing etc).

## Access to largest single location talent pool in the US

Silicon Valley provides access to an unrivalled single location talent pool in the US, including highly skilled semiconductor and GaN expertise.



## Established US team and infrastructure

Silicon Valley fab and Boston area testing facility enables BluGlass to develop closer and stronger strategic relationships with customers and partners.

## Greater access to capital

Greater market understanding of semiconductor sector. As product portfolio grows, the US provides greater access to expansion capital and higher valuations of US operational businesses.





# AQUISITION RATIONALE



## CURRENT SCENARIO

The GaN laser diode industry is growing rapidly; BluGlass needs to increase production speed.

Customers are demanding greater flexibility, faster development times and enhanced performance.

### Limited turns and long development cycles



Outsourced manufacturing constrains BluGlass' ability to quickly solve technical challenges, enhance products and deliver new innovations

### High production costs



Constrains profit margins and results in profit sharing with Contract Manufacturers

### Limited GaN expertise



Contract Manufacturers have deep GaAs Laser Diode expertise, but lack equivalent GaN expertise

### High construction costs



Building an equivalent fab today would cost ~US\$40M

## FUTURE STATE

Acquire a commercial Laser Diode fabrication plant and equipment (Fab) along with expert manufacturing team to deliver greater flexibility, faster development and enhanced performance.

### 4-8x faster turns and development cycles



Significantly improves BluGlass' ability to solve technical challenges, deliver new innovations to market

### 50% lower wafer production costs



Halves wafer production costs and accelerates projected cash breakeven from 2024/2025

### Develop GaN expertise



BluGlass-owned fab enables development of talent and optimized processes to deliver state-of-the-art GaN devices

### Acquire functioning fab for US\$2.5M



Before adaption to GaN fabrication costs of US\$2.5M and additional US\$1.8 Capex.



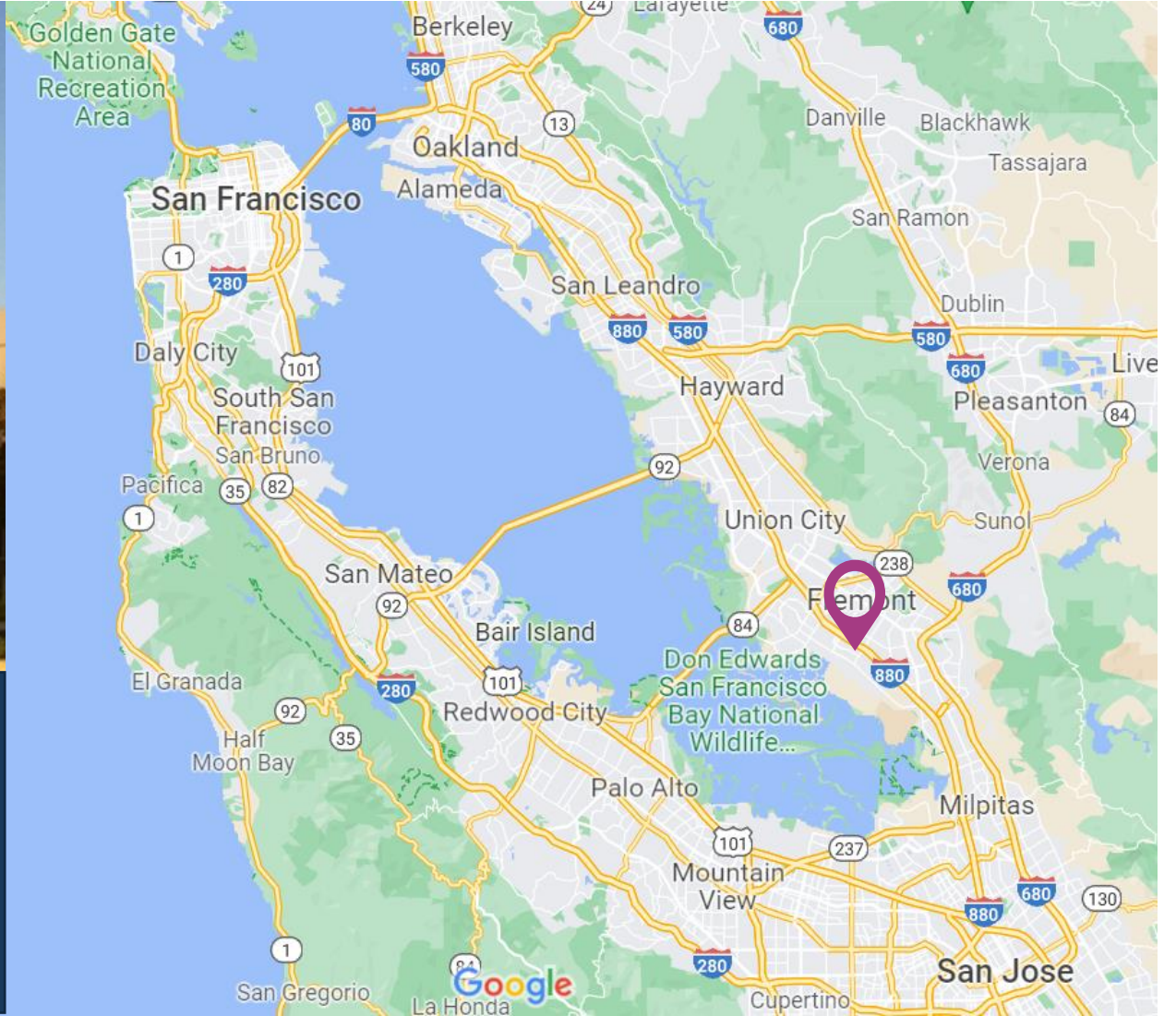
# SILICON VALLEY FACILITY – FREMONT CA, USA



Conveniently located Silicon Valley facility located in Fremont, CA.

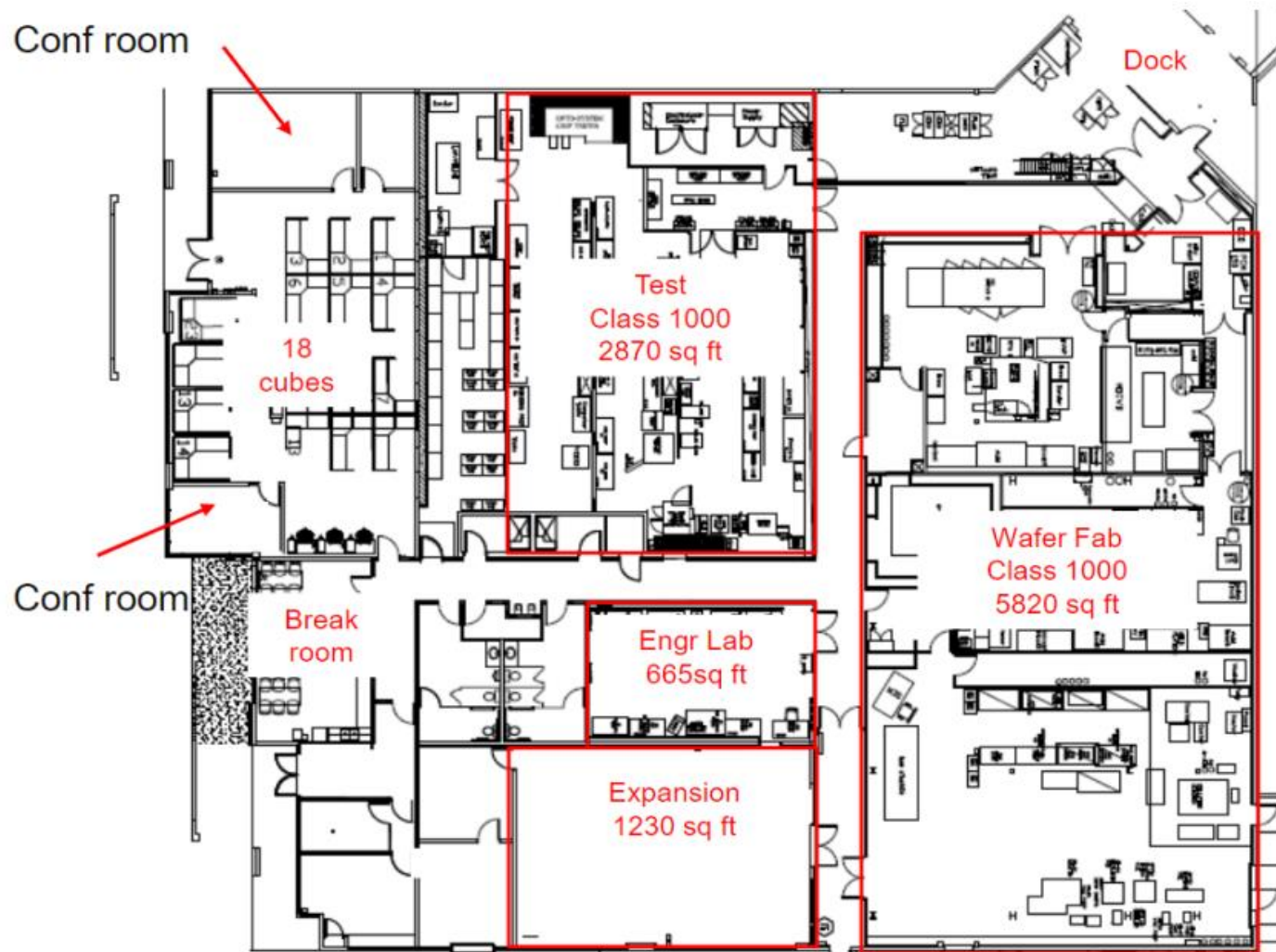
San Francisco Airport  
San Jose Airport  
Oakland Airport

31 miles  
16 miles  
22 miles





# FACILITY OVERVIEW



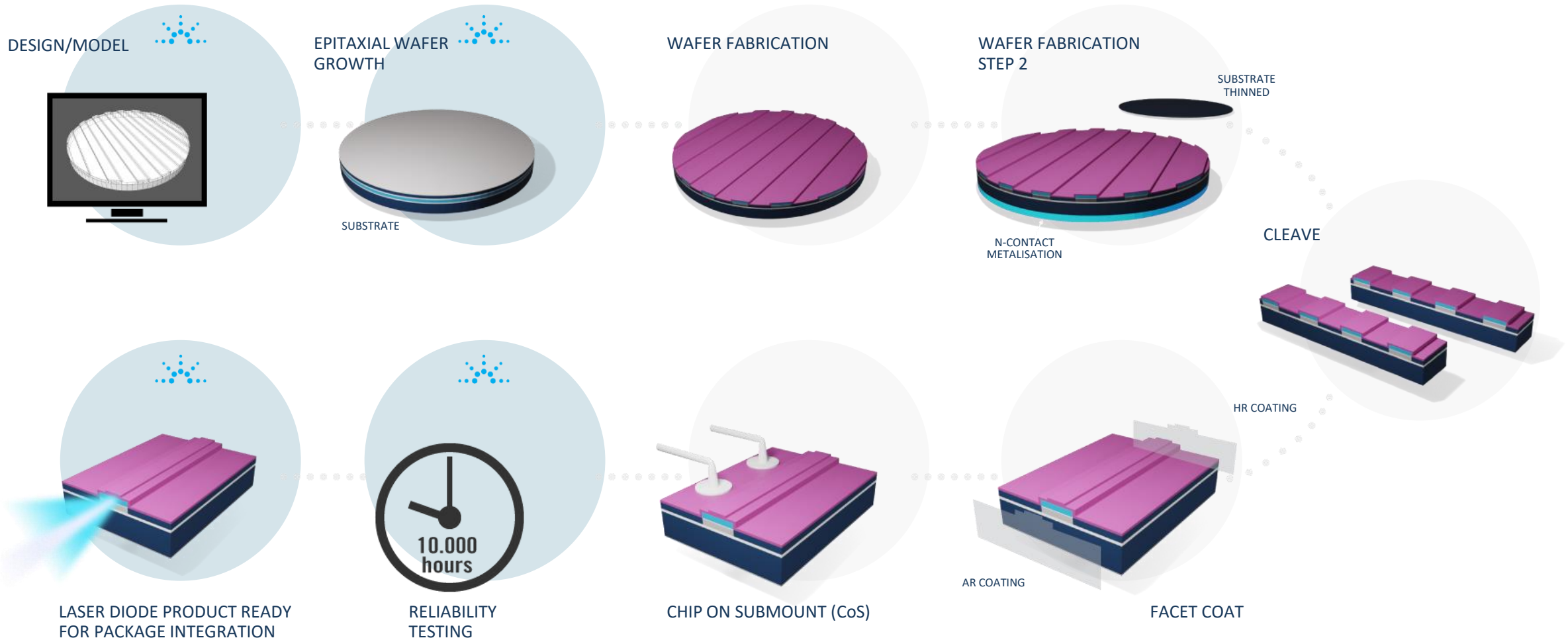
## 19,000 sq ft purpose-built Laser Diode Manufacturing facility featuring:

- Move in ready 2"-4" compound semiconductor manufacturing facility
- Equipment pad with liquid nitrogen, deionized water, waste neutralization, emergency generator, exhaust stack, & safety control systems installed
- Class 1000 cleanrooms (generally tests to ~100 or better)
- Existing epitaxy infrastructure for future growth if needed
- Access to the largest single location talent pool in the US

# BLUGLASS LASER DIODE SUPPLY CHAIN TODAY

## Inhouse steps

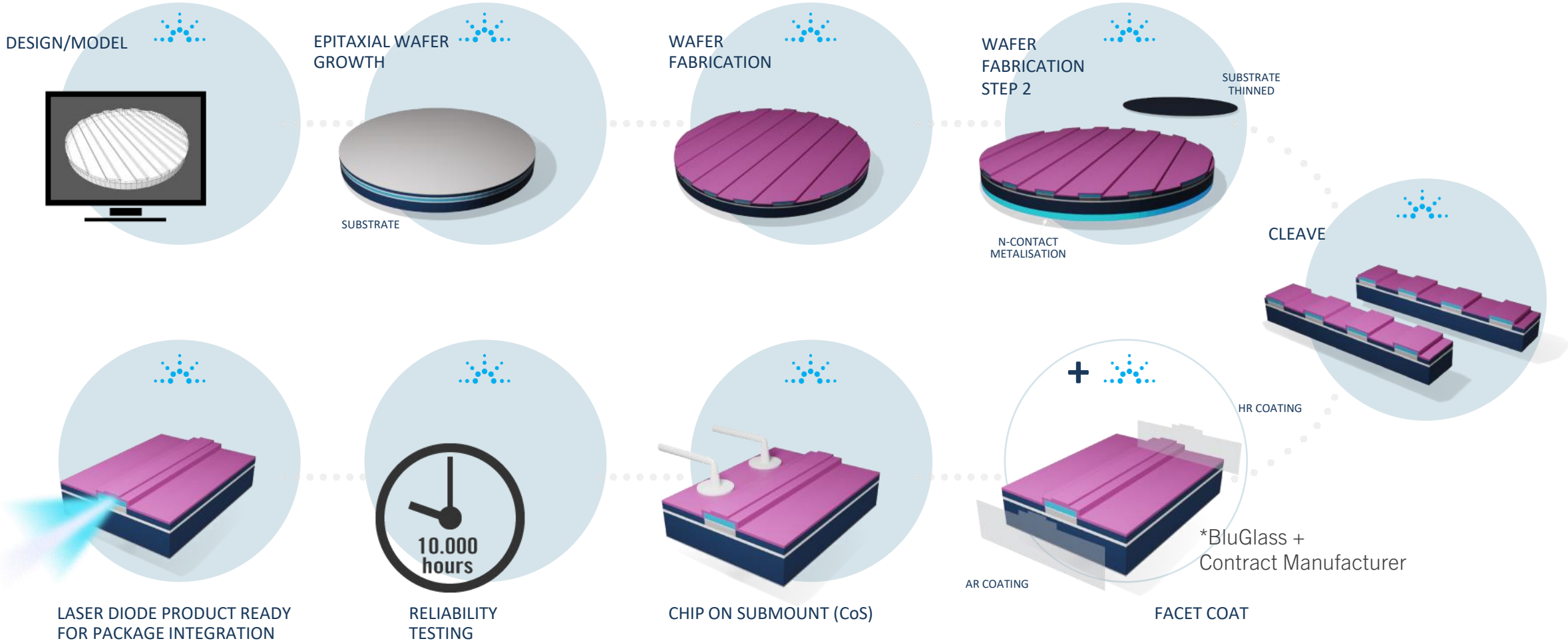
## Currently out-sourced steps



# BLUGLASS LASER DIODE SUPPLY CHAIN POST AQUISITION

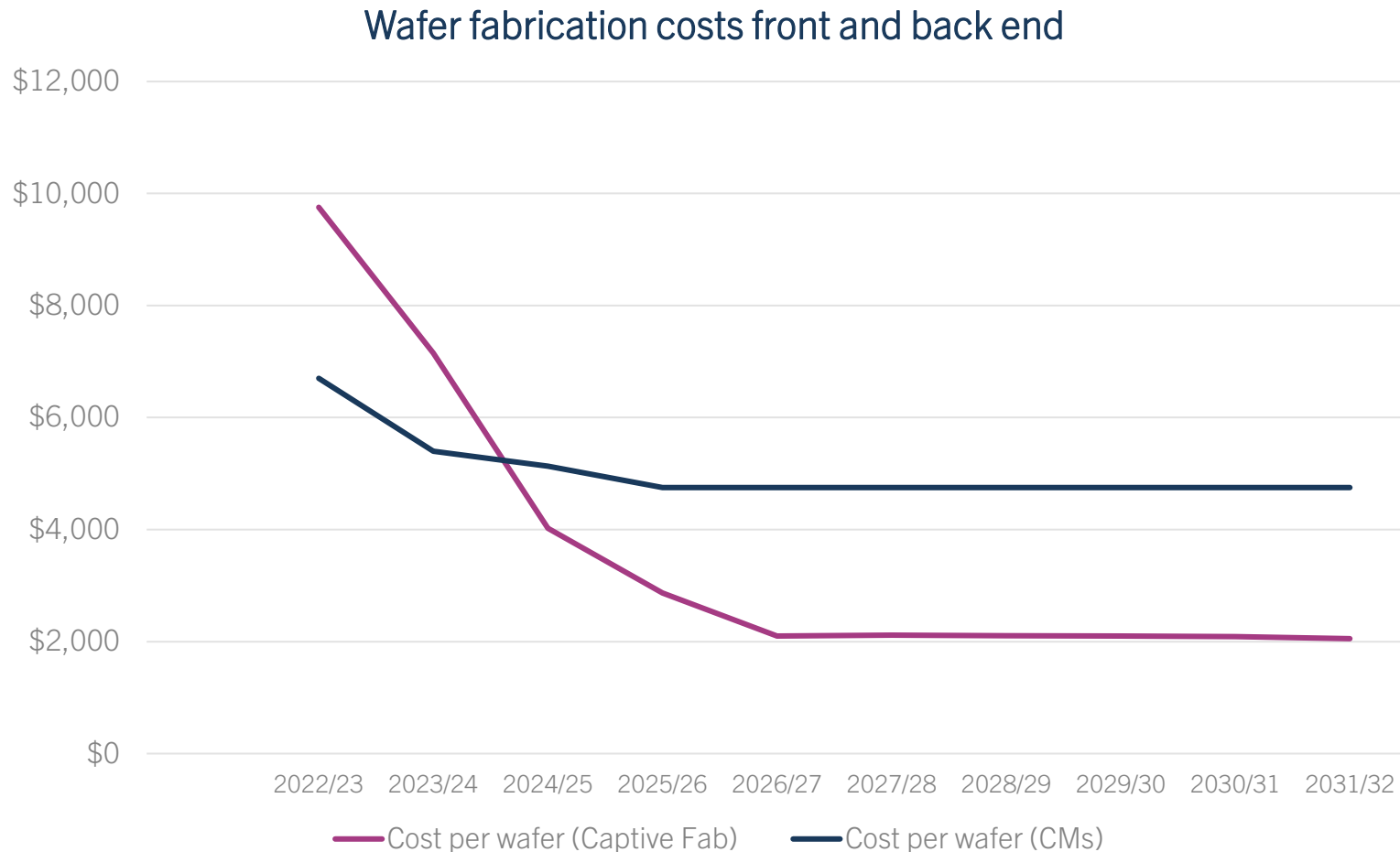
## Current in-house steps

## Steps brought in-house with acquisition





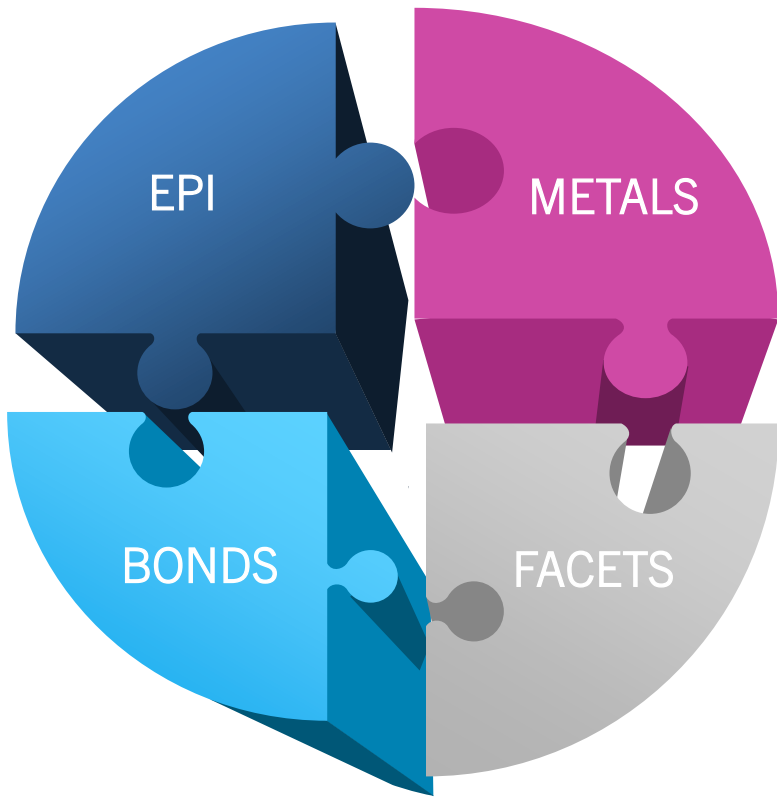
# LOWER COST OF WAFER PRODUCTION FROM 2024



Production cost crossover point is reached in CY2024 when cost per wafer drops below \$4800.

- Burdened internal wafer costs include:
  - Rent, electricity, IT, facilities, and a contingency equal to the facilities cost
  - Labor (including engineering & facilities) and materials (consumable costs)

# ASSETS ACQUIRED TO ADDRESS KEY PRODUCT DELIVERABLES



## 01. EPI CAPACITY *(Infrastructure only)*

- Possible future epitaxy expansion if required
- Wafer cleaning equipment for regrowth

## 02. METALISATION CAPABILITY

- More flexible design of low resistance n & p metal layers required for high-efficiency operation
- Evaporator for Indium deposition
- Internal capability to refine cleaning and annealing processes to ensure good adhesion, uniform resistance, and subsequent cavity pumping
- Wet and dry etching, dielectric deposition for lateral confinement and metal isolation

## 03. FACETS – CLEAVING, POLISHING, COATING CAPABILITY

- Lap and polish process
- RIE and ICP dry etch process to assist cleaving performance and yield
- Automated stacker

## 04. BONDING – & MOUNTING CAPABILITY

- Die-shear
- Wire bonding equipment
- Inspection equipment
- *Compliments our bonding and packaging capability in New Hampshire*

# SPEED AND AGILITY ARE FUNDAMENTAL TO INNOVATION

## Faster Development

- ⊗ Current turn cycle limited to 4-5 development iterations/year despite multiple contract manufacturers (CMs)
- ⊗ Developing a new chip or enhanced product designs often require multiple iterations
- ✓ Owned fab enables short loops to be turned in a week or less
- ✓ Full iterations (similar designs) will have significantly faster turn time of ~3-weeks, allowing up to 48 development iterations/year with captive-fab
- ✓ With appropriate staffing, BluGlass can run parallel lots staggering Process of Record (PoR) and Engineering (development) lots

## Expert Team

The facility has been run by a highly skilled, expert manufacturing team with decades of laser diode production experience. Contingent Offers have been made to key staff including:

- Expert laser fabrication engineers
- Skilled wafer processing technicians
- Facility and maintenance expert who knows this facility and equipment



# RISKS AND MITIGATIONS

Risk	Risk Description	Mitigation Status	Does Acquisition De-Risk?
Time to develop products/time to market	Delays could allow new entrants into the rapidly growing GaN laser diode space. Or for existing players (white-lighting, optical storage, DVD) to pivot to our preferred markets	Work with CMs to increase throughput (low probability of success)	Yes. It will increase our throughput especially for development
Limited resources	Capacity to take on multiple development programs and explore parallel revenue streams	Requested more engineering resources from CMs (low probability of success)	Yes. We're sending contingent offers to the existing team from the Silicon Valley fab in parallel to fundraising efforts
Limited capabilities	Lack of processes limiting chip design flexibility	Our long-term strategy is to move processes in-house over many years	Yes. This fab comes with several process capabilities unmatched by our CMs
RPCVD development of competitive advantages	Limited CM engineering resources and expertise to process novel device architectures	Work with Universities on custom fabrication development	Yes. Ability to develop custom processes to de-risk and expedite development
Long term Laser Reliability	There are four key risk areas required to develop and produce reliable semiconductor lasers	Working in parallel internally with five CMs to refine these four areas	Yes. Bringing the processes in-house not only adds more capabilities, but it also simplifies interactions, increases our speed, and flexibility



# TRANSACTION FINANCIALS

# CAPACITY SCENARIOS

The Silicon Valley fab acquisition increases BluGlass' revenue generation capacity by 300%, delivering higher profit margins and lower production costs.

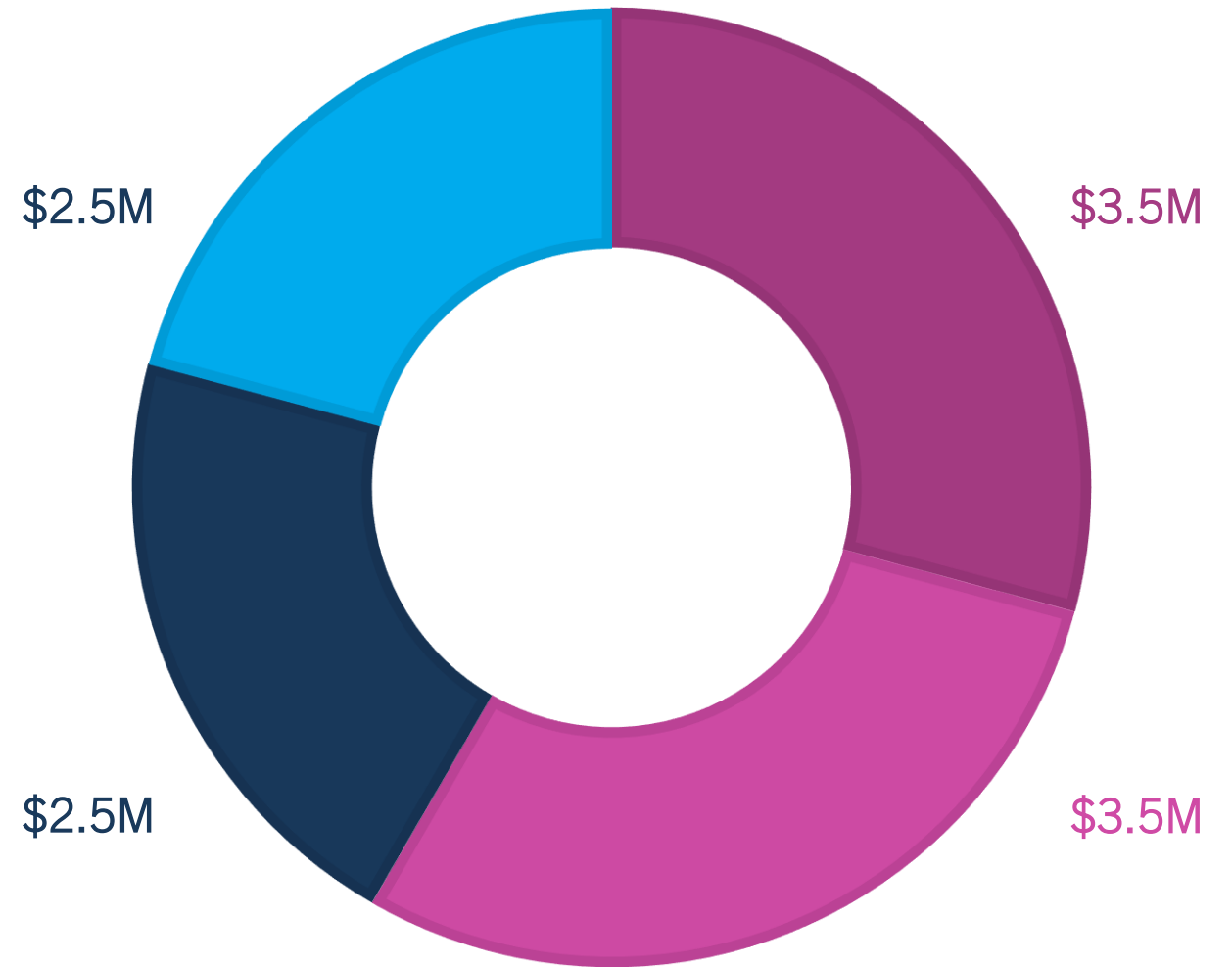
Contract Manufacturer Capacity		Owned-Fab Capacity	
Annual Epitaxy Wafer Capacity (Silverwater)	~10,000 wafers	Annual Epitaxy Wafer Capacity (Silverwater)	~10,000 wafers
Annual Wafer Fabrication Capacity	~2,500 wafers	Annual Wafer Fabrication Capacity	~10,000 wafers
Annual Development Iteration Capacity	~4-5 full iterations + 10's of short loops	Annual Development Iteration Capacity	Up to 48 full iterations + 100's of short loops
Annual Revenue Capacity	~US\$40M	Annual Revenue Capacity	~US\$160M
Estimated Gross Margin	~30%	Estimated Gross Margin	~45%
		Cash Flow Positive	2024/2025



# USE OF FUNDS

## Seeking to raise A\$12M

- Silicon Valley Fab Acquisition (Lease & Equipment)
- Facility adaption GaN Laser Diode production
- Additional Capex required (inc. advanced capabilities)
- Operational Expenditure & Talent Hire



A close-up photograph of a microscope's objective lens positioned over a bundle of fiber optic cables. The cables are illuminated from below, creating a bright, glowing effect. The entire image has a soft, purple-pink color cast. The text 'LATEST RESULTS' is overlaid in white on the left side.

LATEST RESULTS

# DELIVERING AGAINST CLEAR PRODUCT DEVELOPMENT PIPELINE

BluGlass has demonstrated strong progress on initial product offering

	Demonstrated	In development	Next Generation	
<b>Violet</b>	405nm	MM – 1W SM – 100-200mW	MM – 1.2W SM – 250mW	MM: Multi Mode SM: Single Mode
	420nm	MM – 1W SM – 100-200mW	MM – 1.8W SM – 250mW	
<b>Blue</b>	450nm		MM – 3.5W	MM – 5W
	470nm		MM – 1.6W SM – 100 -250mW	MM – 2W
	488nm		SM – 100-200mW	MM – 1.5-2W
<b>Green</b>	525nm			MM – 1.5-2W SM – 100-200mW

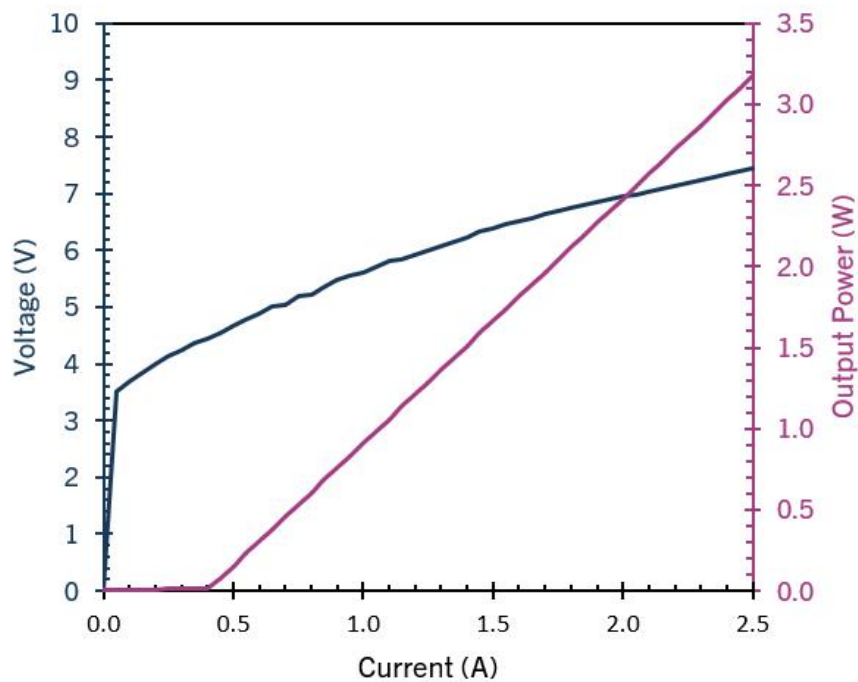


# PROTOTYPE DEMOS - 405 NM MULTIMODE HIGH POWER

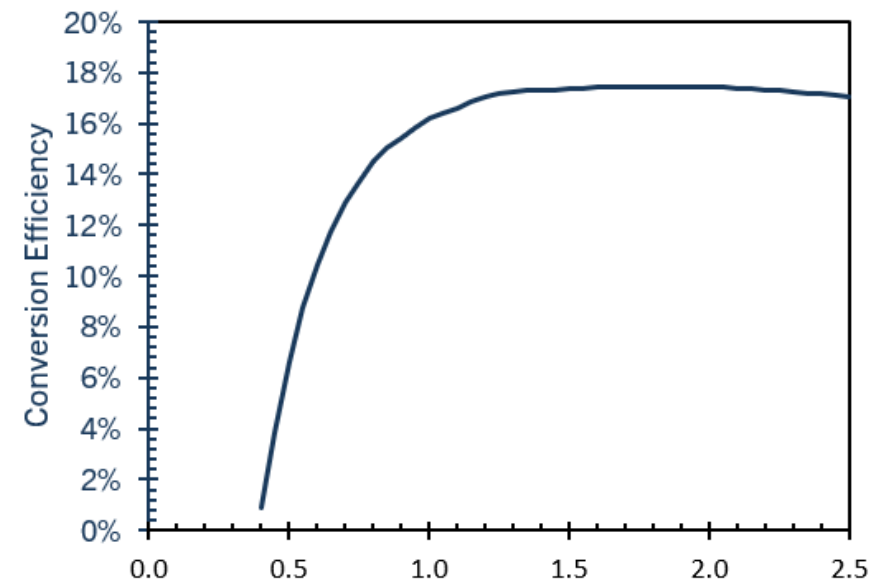
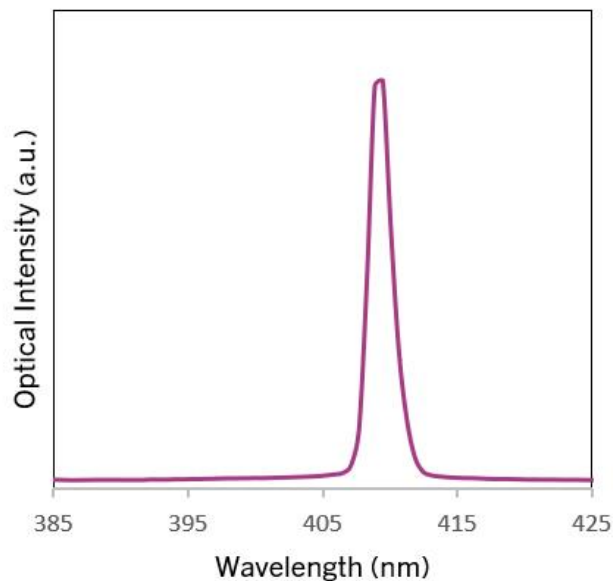
## 405nm MULTI MODE 3W LASER DIODE

### Preliminary Pulsed LIV Results

Max. Power	3.17W
Max. Current	2.5A
Max. Slope	1.51W/A
Threshold current	0.40A
Max. Wavelength	409nm



MM Pulsed Spectrum



### FLEXIBLE FORM FACTORS

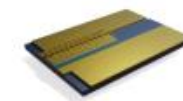
TO Cans



C-Mounts and F-Mounts



Chip-on-Submounts

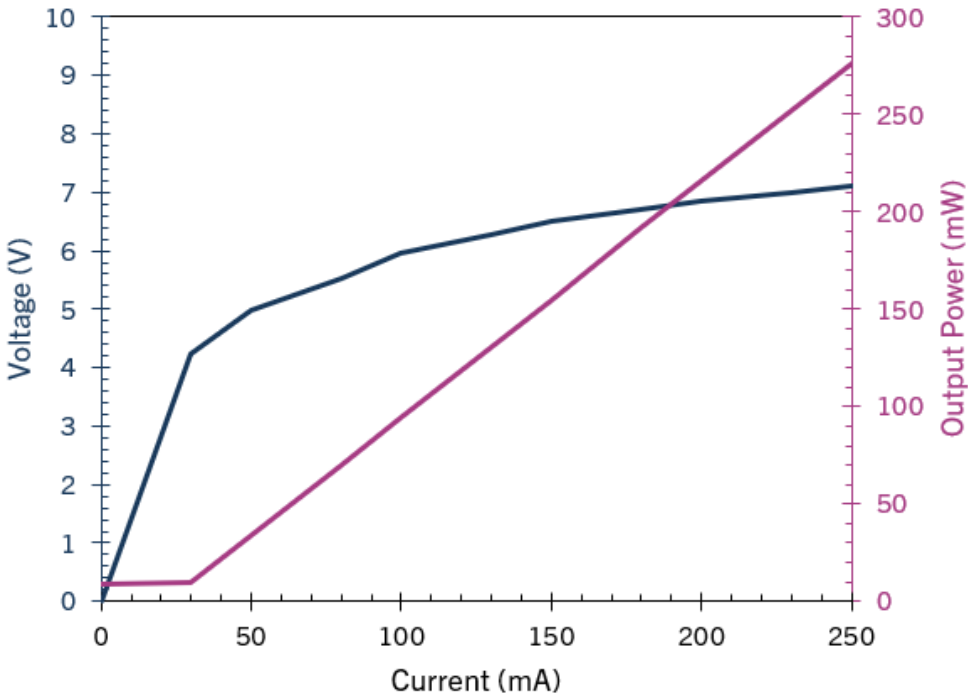


# PROTOTYPE DEMOS - 405 NM SINGLE MODE

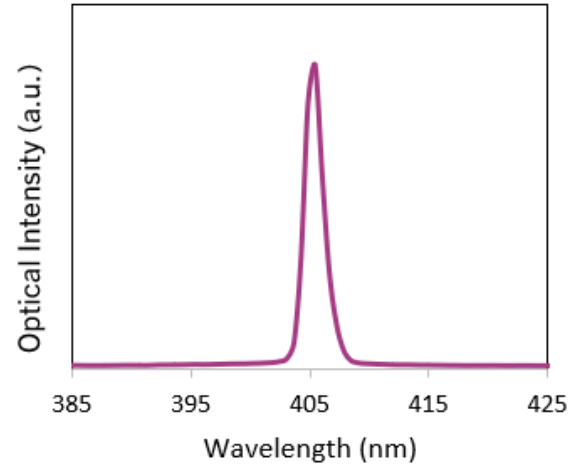
## 405nm SINGLE MODE 250mW LASER DIODE

### Preliminary CW LIV Results

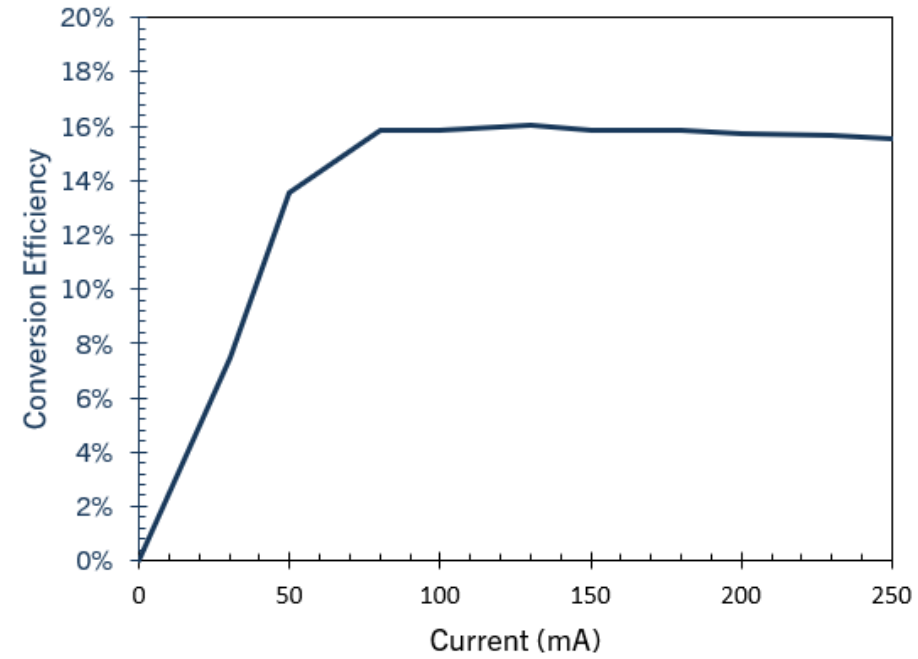
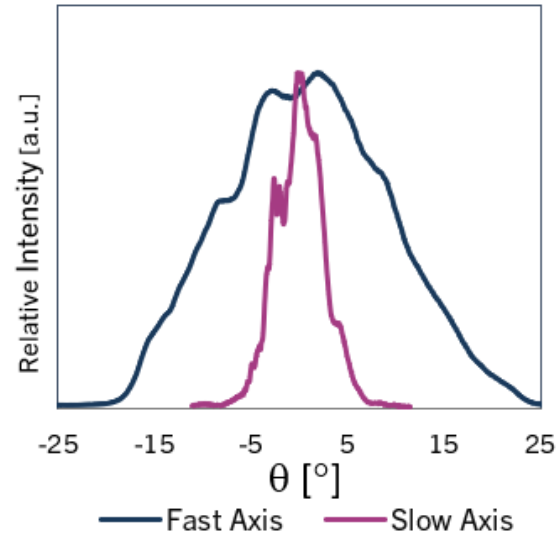
Max. Power	280mW
Max. Current	250mA
Max. Slope	1.21W/A
Threshold current	22mA
Max. Wavelength	406nm



### SM CW Spectrum



### Far Field Data. F Mount Devices



### FLEXIBLE FORM FACTORS

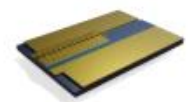
TO Cans



C-Mounts and F-Mounts



Chip-on-Submounts

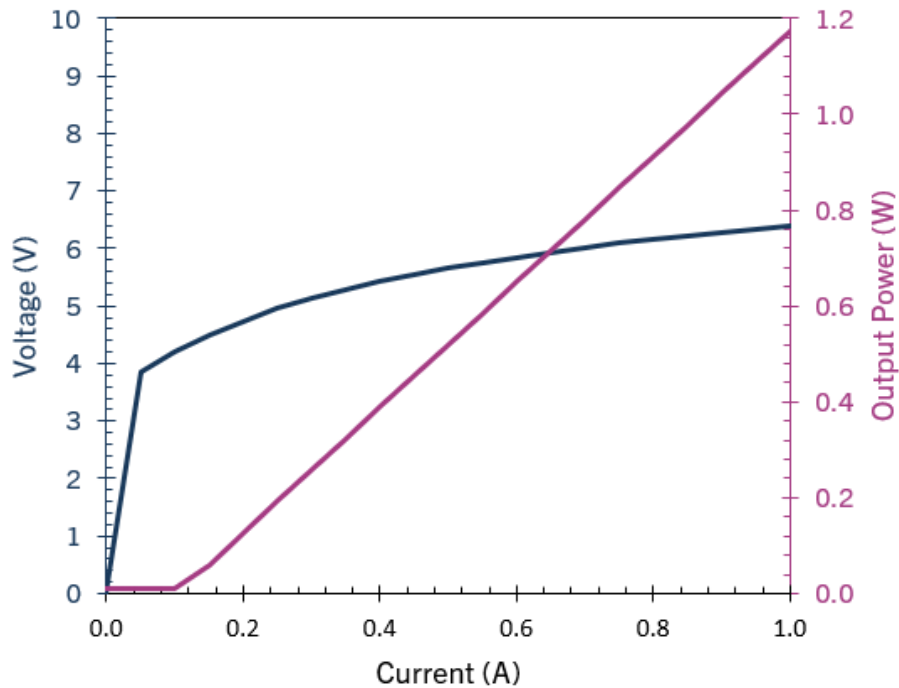


# PROTOTYPE DEMOS - 420 NM, 1W MULTIMODE

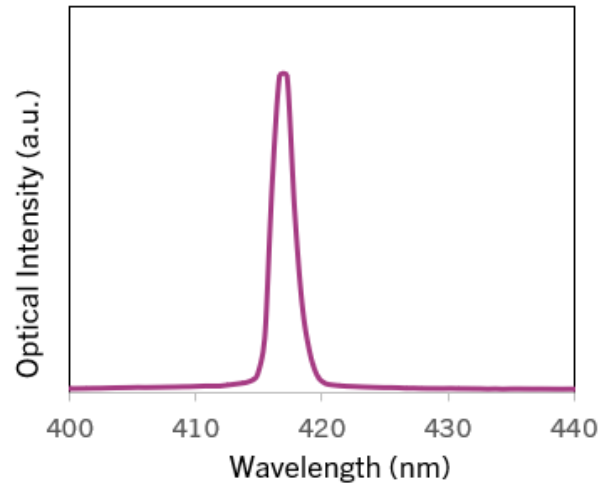
## 420nm MULTI MODE 1W LASER DIODE

### Preliminary CW LIV Results

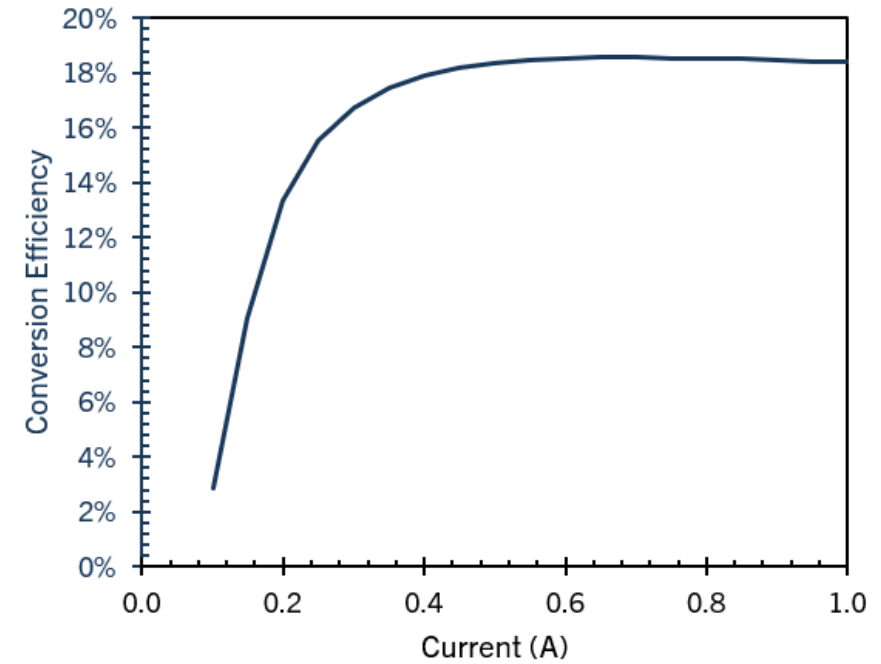
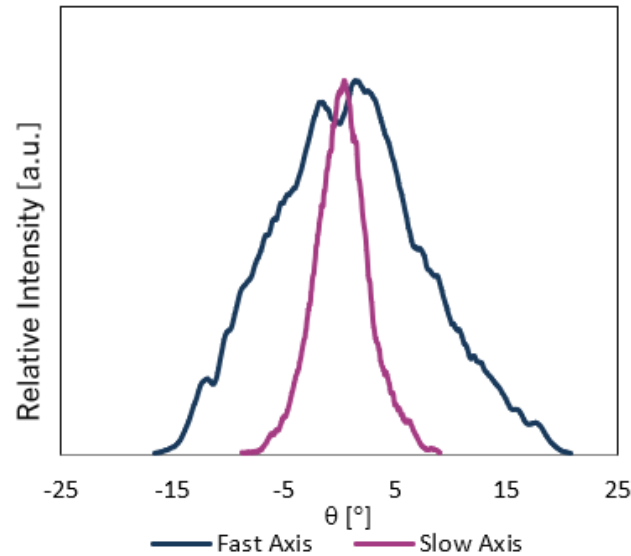
Max. Power	1.17W
Max. Current	1.0A
Max. Slope	1.31W/A
Threshold current	0.10A
Max. Wavelength	420nm



### MM CW Spectrum



### Far Field Data, F Mount Devices



### FLEXIBLE FORM FACTORS

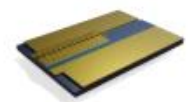
TO Cans



C-Mounts and F-Mounts



Chip-on-Submounts



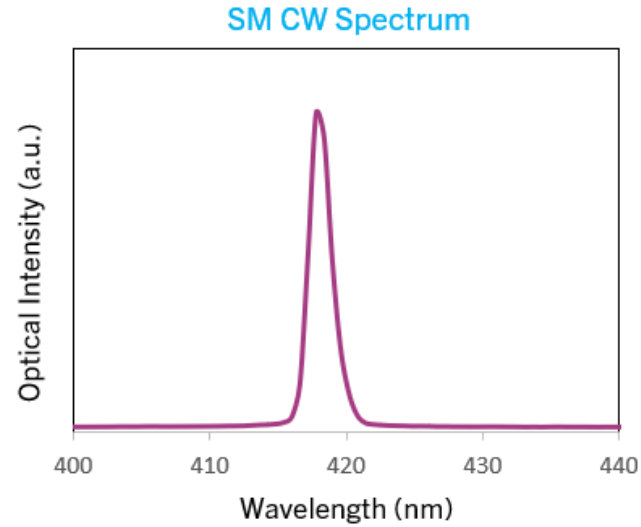
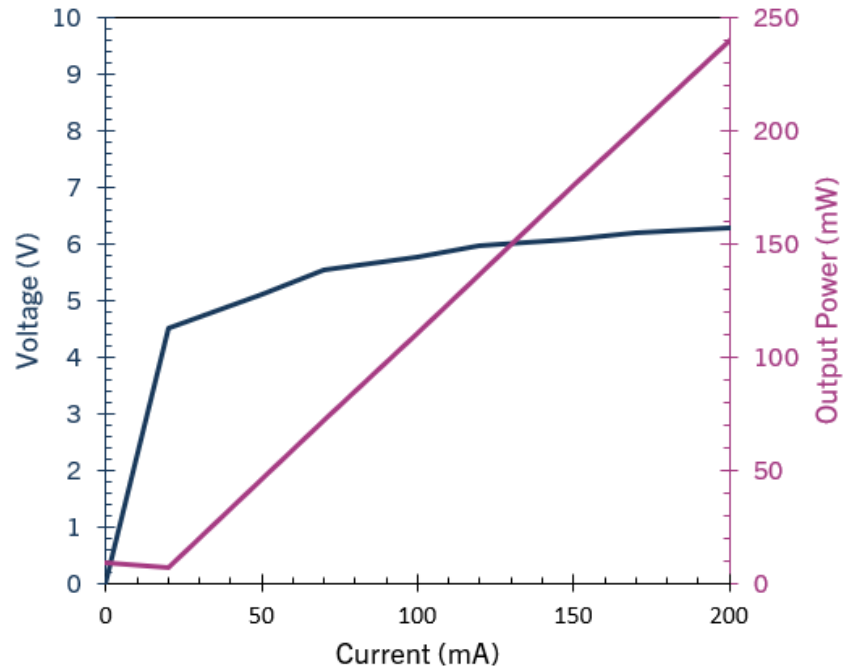


# PROTOTYPE DEMOS - 420 NM MULTIMODE

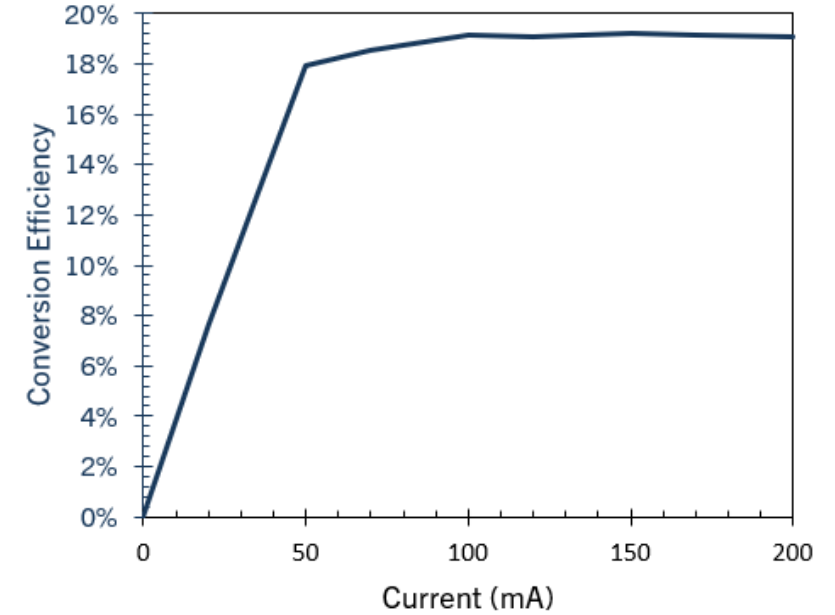
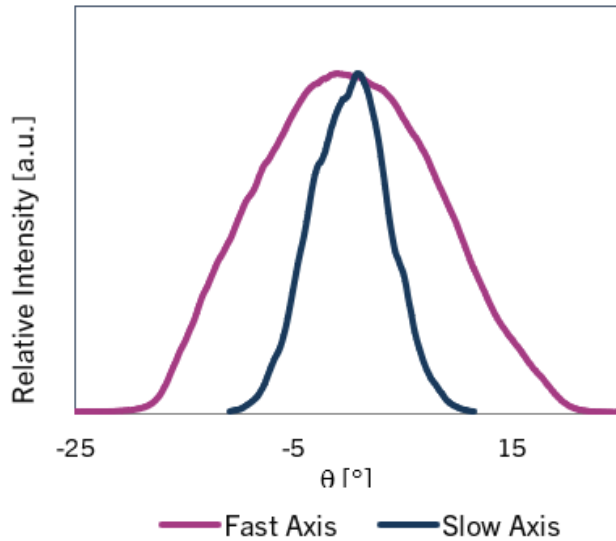
## 420nm SINGLE MODE 250mW LASER DIODE

### Preliminary CW LIV Results

Max. Power	240mW
Max. Current	200mA
Max. Slope	1.30W/A
Threshold current	20mA
Max. Wavelength	420nm



### Far Field Data, F Mount Devices



### FLEXIBLE FORM FACTORS

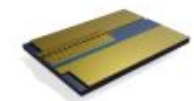
TO Cans



C-Mounts and F-Mounts



Chip-on-Submounts





# OUTLOOK



# INVESTMENT HIGHLIGHTS

## Fast-track company goals

Acquisition supports company vision and **fast-tracks longer-term plan** to bring fabrication processes in-house, reducing costs and scaling operations.

**Once in a lifetime opportunity** to acquire working fab for fraction of cost to build.

## Demonstrated LD Improvements

**Strong performance improvements** in latest results, generating high-levels of interest at Photonics West.

Focus on delivering four key ingredients (Epi, Metals, Facets, Bonds) to address reliability and **launch laser diode products.**

## Clear Roadmap

Initial product launch on track with Contract Manufacturers.

Opportunity to accelerate higher-value RPCVD Tunnel Junction laser diodes and in-demand longer/ shorter wavelength lasers (UV/Green).

## Large & Growing Markets

Global laser revenue is forecast to exceed **US\$25B by 2025\***.

The GaN segment is growing faster than anticipated, forecast to reach **US\$2.5B by 2025\***.

**One of only four** end-to-end GaN laser diode manufacturers globally.

\*Source: Strategies Unlimited 2020





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2022

THANK YOU

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