22 November 2021

BluGlass 2021 AGM Exec Chair & President Address

Australian semiconductor developer **BluGlass Limited** (**ASX: BLG**) is pleased to present its 2021 Annual General Meeting.

Chair's Report

Good morning, everyone.

As it is now 11.00am and a quorum is present, I declare the meeting open.

My name is James Walker, I am the Executive Chair of BluGlass Limited, and I am pleased to welcome you to the 2021 Annual General Meeting of the company.

Virtual Meeting Details

Today's meeting is being held through an online meeting platform powered by Automic. This allows shareholders and proxies to attend the meeting virtually. All attendees can participate in a live webcast of the meeting. In addition, shareholders and proxies have the ability to ask questions and submit votes.

To vote at this meeting, you need to have registered your shareholding with Automic. If you haven't already done so, you can follow the instructions on screen to register and log in to enable you to vote at this meeting.

Questions can be submitted at any time. To ask a question press on the Q&A icon. This will open a new screen. At the bottom of that screen there is a section for you to type your question. Please start your question by typing your shareholding SRN or HIN. This will allow the moderator to identify you as a shareholder. If you would like to ask your question verbally, type your SRN or HIN and then type "I'd like to speak". Once you have finished typing, please hit enter on your keyboard to send.

While you can submit questions from now on, I will not address them until the relevant time in the meeting. Kindly start your question with the agenda item number to which it relates.

Your questions may be moderated or if we receive multiple questions on one topic, amalgamated together. Due to time constraints, we may run out of time to answer all your questions.

All questions should be addressed to me as the Chair. I will either deal with the question personally or ask someone who is better placed to respond. We will do our best to answer any relevant question raised.

I ask that you keep your questions short and to the point so that as many Shareholders as possible have a chance to ask a question.

Voting today will be conducted by way of a poll on all items of business. To provide you with enough time to vote, I now declare voting open on all items of business. You can submit your votes at any time. I will give you a warning before I move to close voting.

I trust you'll allow us some latitude if things don't go as smoothly as possible today.

Introductions

Online with me today we have in Sydney: Stephe Wilks, Non-executive Director and Ian Mann our Chief Technical Officer and Stef Winwood, Head of IR. In the USA we have Vivek Rao and Jean-Michel Pelaprat, Non-executive Directors and Mr James (Jim) Haden President BluGlass. In Perth we have Emmanuel Correia, Company Secretary.

Representatives of our Auditors, Grant Thornton, are also present.

2021 PROGRESS HIGHLIGHTS

Despite several challenges in FY21, BluGlass achieved several key milestones during the year, as we continue our transition to a profitable product development and manufacturing business.

- We demonstrated the scalability potential of our technology while increasing our epitaxy manufacturing capability, with the manufacture and commissioning of the first commercial-scale RPCVD platform, the BLG-500. Built with global equipment leader AIXTRON SE, the BLG-500 increases our epitaxial manufacturing capacity by almost double, as it is capable of manufacturing up to 42 two-inch wafers and multiple 6-inch wafer production.
- We also demonstrated "active-as-grown" tunnel junction laser diodes with good lasing behaviour in a world first proof of concept. This was both an important technical and commercial validation, demonstrating the opportunity for our RPCVD laser diodes to enable brighter and higher power lasers for use in commercial applications, such as 3D printing and industrial welding.
- During the year we strengthened our leadership and Board industry expertise, appointing renowned laser diode pioneer Jean-Michel Pelaprat as a Non-Executive Director and industry veteran Jim Haden as President. Collectively, they bring six decades' laser diode and photonics expertise to BluGlass. Jean-Michel is the co-founder and Director of US-based laser diode leader Nuburu while Jim has held senior executive and advisory roles at several of the industry's leading players, including nLight, Kyocera SLD and Coherent.
- We also continued our industry-leading innovation; demonstrated by winning a US government funded contract to collaborate with Yale University and DARPA (the US Defense Advanced Research Projects Agency) to develop novel laser diodes. We were also awarded a $250,000 Advanced Manufacturing Growth Centre grant in collaboration with the Australian National University, AKELA Laser and Objective 3D to manufacture smarter and faster plasma sources.
- The Company raised $8.4 million via an oversubscribed Entitlement Offer to existing shareholders and two share Placements to new sophisticated investors.
- And we added to our patent and trademark portfolio with a further 11 patents granted during the year. This brings our internationally granted patent portfolio to 86.

CHALLENGES

Like many other companies, FY21 was a challenging period for BluGlass. The ongoing COVID-19 pandemic impacted our supply chain and foundry customers, and fabrication, packaging and product reliability issues delayed the launch of our first direct-to-market gallium nitride laser diodes.

Reliability testing of our laser diode prototypes showed packaging flaws and degradation of the optical facet at high power and in continuous wave conditions. Improvements to metalisation of the laser diode prototypes is also required, which is critical as it controls the input of electrical current into the laser and the removal of heat from the device. These technical challenges are in the post-epitaxy production steps, which are currently outsourced to third-party manufacturing suppliers.

We are working with multiple fabrication specialists to address our laser diode reliability issues and currently have two new design iterations progressing through final stages of the manufacturing supply chain. These prototypes are performing in line with commercial specifications for output power and wavelength. Jim will provide more detail on our technical progress and product roadmap shortly.

While any technical setback is disappointing, product reliability is a common challenge in the photonics industry. Laser diode development is incredibly complex, and our reliability challenges have highlighted the need for in-house expertise and knowledge at both a management and Board level. US-based industry veteran Jim Haden has been appointed to lead BluGlass, tasked with solving our reliability challenges, delivering products to market, and transitioning the company from its cutting-edge R&D origins to a sustainable and profitable commercial laser diode manufacturer. Jim brings extensive technical expertise and hands-on experience solving similar technical challenges, ensuring we are well-positioned to resolve our reliability issues and optimise laser diode performance.

The addition of Dr Arkadi Goulakov as a Senior Laser Scientist and Jean-Michel Pelaprat as a Non-Executive Director further enhances our laser and photonics expertise.

FINANCIAL PERFORMANCE

In FY21, BluGlass recorded an operating loss of $6.29 million, up from a loss of $5.99 million in the previous year. The increase reflects higher R&D expenditure as we develop our direct-to-market laser diodes combined with a 45 percent reduction in foundry revenue, due to the global COVID 19 impacts to our customers in Europe and the US.

Increased development costs were partially offset by our higher R&D tax rebate, up 21 percent over the prior year to $3.32 million. This rebate relates to development work conducted in 2020.

Our successful $8.4 million capital raise in July was well-supported by existing shareholders and included two Placements to new sophisticated investors. BluGlass is funded through to our expected first orders with a cash position of $8.1m. This includes our R&D rebate of $3.3 million for development work in 2021, received earlier this month.

IP UPDATE

In FY21, BluGlass continued to protect and build its intellectual property portfolio, granted 11 further patents in key semiconductor manufacturing jurisdictions. Our IP portfolio now comprises 86 internationally granted patents across eight patent families.

Our patent and trademark portfolio are critical for the business, particularly in protecting our technical breakthroughs, innovative new designs and industry-leading manufacturing techniques. Our RPCVD tunnel junction technology is unique and has already demonstrated the potential to create brighter and better performing laser diodes, which has significant commercial implications for our future.

OUTLOOK TO FY22 & BEYOND

While FY21 was not the year we envisaged, BluGlass has used its technical and commercial setbacks to prepare the business for future growth. We are well on the way to transitioning from our R&D beginnings to a profitable, commercial laser diode manufacturer with next-generation laser products within the 405nm, 420nm and 450nm wavelengths.

We have invested in an internationally experienced laser diode team to lead the development, optimisation, and commercialisation of our gallium nitride laser diodes. Our clear technology roadmap, which Jim will outline shortly, enables us to overcome our reliability challenges, launch our first laser diode products, secure customer orders and generate revenue.

Longer term, our RPCVD tunnel junction laser diodes provide us with a significant market opportunity, offering brighter, more efficient, and better performing blue GaN laser diodes.

On behalf of the Board, I'd like to thank both our loyal and new shareholders for their continued support and patience over the past year. Our direct-to-market laser diode strategy remains the quickest path to ongoing product revenue and the Board is optimistic for the Company's future.

I'd also like to acknowledge the hard work and dedication of the BluGlass team during what has been a particularly challenging year.

I will now hand over to President Jim Haden.

President's Report

MARKET OVERVIEW – GLOBAL LASER REVENUE FORECAST (2019-2025)

Thanks James.

For those of you who haven't met me, my name is Jim Haden. I am the President of BluGlass Limited, having joined the Company in September this year, and I am pleased to be speaking to you at this year's Annual General Meeting. I'd like to extend my welcome to everyone joining this call.

As James mentioned earlier, I have more than three decades of experience across the laser industry and have worked at several industry leaders in the market: including Spectra Diode Labs, JDS Uniphase, Coherent, nLight, and Kyocera SLD. It's an exciting time both for the industry and for BluGlass. I think the opportunities and outlook ahead are very bright.

We are operating in a large and rapidly growing market. As you can see, in the decade from 2009-2019 the total laser end market nearly tripled in size, gaining close to $10 billion in annual revenues – growing from just over US$5.5 billion to US$15 billion in 2019. This growth is accelerating – forecast to grow another US$10 billion to more than US$25 billion by 2025.

This growth is being driven by the increasing adoption of high-tech devices and applications: from smart phones, laptops, flat screen TVs, medical and bio-tech devices, to electric vehicle and renewable energy battery storage, as well as advanced 3D printing of both plastics and metals; all of which utilise lasers to enable cost effective manufacturing. Industrial materials processing, which spans automotive, aviation and others, is also driving significant growth.

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

Looking at the total laser end market by application; you can see here that the combined industrial and photolithography segment is a very large piece of this pie with a total representation of 42%. The industrial portion of this accounts for a full third of the total market alone, being worth more than $5B in 2019. Photolithography applications add a further $1.3B in value. These two markets are being driven by global megatrends - increasing adoption of connected technology, electronics and other high-tech manufacturing which are driving micro and macro materials processing demand.

Industrial applications are a key focus for BluGlass, as we believe that GaN technology will gain significant traction in this market due to the significant performance advantages of visible laser diodes, in particular blue, for these applications. We will also focus on the scientific and medical industries, and opportunities in defence, again where there are clear technology benefits for high performance visible laser diodes.

While telecommunications account for a large share of the market, it's not an area we're targeting with our GaN laser diode offerings.

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

GaN laser diodes are fairly new to the laser industry. While growing from a much smaller base than the enormous total laser markets, we believe that due to the demonstrated technology benefits of visible lasers, the GaN market segment will continue to grow its market share as higher power, higher brightness and more efficient products enable new applications and take infrared (IR) laser market share.

To give you some context of why this is occurring; copper, an important metal used across the electronics sector, absorbs on the order of 50% of incident blue light compared to only 2-5% of infrared light, making powerful blue lasers a superior choice in much of the materials processing sector. Back in 2008, the output powers of blue diodes were limited to around 60 mW, with an efficiency of only 15%. By 2017 these figures had leapt to 3.5 W and 44%, while in 2019/20 companies reported even higher efficiencies of 46% and powers approaching 5W/chip.

Consequently, forecasts suggest that the total GaN laser diode segment will account for almost 10% or $2.5B of the total $25B laser market (laser systems) by 2025, growing faster than originally predicted by market experts. The industrial segment account for nearly 50% of the $2.5B.

MARKET OVERVIEW – BLUGLASS SERVICE AVAILABLE MARKET (2020-2025)

Given our GaN platform roadmap combined with market forecasts, our available market is expected to reach US $735M by 2025. Industrial, scientific, and biotech are the key verticals where BluGlass will focus initially. Together these three verticals comprise approximately 75% of our available market.

Further, we've estimated that the $735M market will require on the order of 460 MW of power, assuming increased average power per chip and decreasing average selling price (ASP) per watt of power. Without considering downstream capacity constraints and assuming mature laser diode yields, we can deduce that BluGlass has the existing epitaxy capacity now to meet 20% to 25% of this total SAM to approximately deliver revenues of US$170M (AU$233M).

The Serviceable Available Market (SAM) is the portion of the market that we can acquire with similar platform offerings and excludes captured markets from vertically integrated companies.

INDUSTRY OVERVIEW – GaN MARKET VERTICALS

As I mentioned, industrial, scientific and biotech markets are the key verticals for BluGlass. There are broad applications within these sectors including industrial welding, 3-D printing, micro-electronics, semiconductor, forensics, endoscopy, and medical diagnostics.

Display is less interesting to us as an entry point because of the highly competitive landscape and low pricing of the 450nm sources. In the future, our advanced RPCVD epitaxial benefits may lead to optimised, longer wavelength lasers, such as green lasers as 525nm sources for display, in particular for projector applications, but it's not an immediate priority. Lighting and competing with white light are not markets of focus for the Company for many reasons.

INDUSTRY OVERVIEW – BLUGLASS TARGET MARKETS

Customers within our key verticals typically have similar requirements. They need high-powered multi-mode or low-powered single-mode laser diodes, flexible manufacturing in a range of wavelengths, as well as the ability to develop novel designs to facilitate new applications.

BluGlass' product roadmap aligns well in the industrial, scientific and biotech markets. The combined forecasts of just these three verticals, given our anticipated product offering, is approximately US$380M by 2025. Our potential customers include: IPG, nLIGHT, Nuburu, Optical Engines, Coherent, Toptica, and many more.

The Product Addressable Market: (PAM) is the subset of our SAM that we will realistically address with our specific product offering (given performance, form-factor, the barrier to entry, and so forth). This is effectively our target market to which we will initially introduce our products.

INDUSTRY CHALLENGES – ECONOMIC DRIVERS

There are several industry challenges and economic drivers influencing our product development roadmap across our target markets.

Customers are telling us that there is a need for increased manufacturing flexibility. They are looking for cost-effective solutions that are easy to integrate, and these are not readily available in the market at present. Further, within those solutions, customers require a combination of greater power, brightness and efficiency per dollar invested.

Like the computing industry, the laser market demands more output power for less $ per unit – in the case of lasers, this is $ per watt. The drive for more power per chip has been driving the industry since its inception. Interestingly, on the flip side, customers will pay higher prices for brighter sources, because brighter sources are easier and cost less to integrate. Scaling brightness is one of the reasons we are avoiding the general lighting sector, which requires converting blue to white light resulting in the sacrifice of a significant portion of the laser's brightness.

Efficiency is also a key metric for BluGlass. Power conversion is incredibly important not just from an environmental perspective but as a way for customers to save money. Higher efficiency reduces the total cost of ownership for our customers, especially when they are running high-powered lasers in 24/7 operations as needed in many of the industrial applications that we're targeting.

Customer integration ties into delivering the easiest-to-use light for our customers by providing greater manufacturing flexibility and customisation; not just of novel device architectures but of integration designs.

Customers will pay more for high-brightness, high-efficiency, plug-and-play customised modules that provide not only a brighter solution but are easier and cheaper for customers to integrate and use in their systems.

INDUSTRY CHALLENGES – BLUGLASS VALUE PROPOSITION

These economic drivers and the unmet needs of customers provide opportunity for BluGlass to compete with large incumbent players such as Nichia and ams Osram.

Our target market position leverages our manufacturing flexibility to provide plug and play, easy-to-use laser light. We aim to achieve this positioning by offering unique form factors and integrated packages. Form factors refer to the shape, size, interface, and other physical components of the laser. It also includes how the laser electrically and physically connects to their system, and whether the light is delivered through a fiber, or straight from the emitter itself. Vertically integrated packaging means combining our laser diode components with heat sinks to moderate the temperature of the device, and optical components to tailor the beam profile. Higher levels of integration provide customers with easier-to-use light.

This leads to a differentiated product offering, leveraging our novel laser architectures, such as multi-chip modules and our proprietary remote plasma chemical vapour deposition (RPCVD) enhanced lasers, to achieve brighter, more cost-effective lasers with higher efficiency. We will also offer more flexible and custom manufacturing.

So why do customers need BluGlass?

Simple. Our proposition addresses a key customer challenge and is unique in the market. Existing large players do not provide flexible form factors, which means customers need to undertake significant and expensive customisation and post-purchase packaging in order to simply implement and use the laser light.

In the short-term, we're focusing on addressing immediate unmet manufacturing needs in some underserved wavelengths from 405nm to 450nm, delivered in standard packaging.

Longer-term, BluGlass will provide multiple unique benefits to customers including high efficiency and expanded wavelengths while delivering easy-to-use laser light with flexible manufacturing options, ultimately reducing integration costs for our customers.

PLAN TO TRANSITION BLUGLASS TO PRODUCTION & PROFITABILITY

To achieve such a market position, BluGlass needs to transition to a sustainable and profitable development and production company.

In other words, we need a competitive advantage, which we will create using a combination of strategic positioning and operational effectiveness.

- Strategic positioning is achieved through differentiated activities or performing similar activities in a different way. An example of this is our unique RPCVD epitaxy, a core and differentiating competency. We are performing a similar activity (growing lasers) but in a very different way, which enables us to produce lasers that can address the significant performance loss in visible lasers today due to the high percentage of power lost in heat in standard laser architectures. Additionally, we believe the RPCVD technology has potential to provide performance advantages for longer wavelength GaN lasers, in particular green laser diodes.

- To enhance our operational effectiveness, we will seek to develop unique advantages to outperform competitors in key operational competencies. We have already started improving our supply chain management and are identifying operational areas that will increase our competitive advantages if in-sourced. As we scale, we will look to bring further core competencies in-house. I'll speak a bit more about this shortly.

This strategy and market positioning will transition BluGlass from its innovative research and development heritage to a commercial enterprise with growing revenues as we move the Company to profitability. This, in turn, will enable BluGlass to increase our ability to attract the industry's best talent, and our ability to provide competitive offerings to meet the needs of our customers.

SHORT AND LONG-TERM STRATEGIC REQUIREMENTS

Our short-term priority is the development and launch of our initial laser diode solution, targeting areas of the market that are not being sufficiently addressed by the big players. We will then continue to improve our baseline products, building on the fundamental core competencies to create new and better products.

Our long-term objective is to deliver on all three conditions for a successful strategy – first profit, second to produce a secure and satisfying environment for our employees and third to provide satisfaction to the market and our communities.

PLAN TO TRANSITION BLUGLASS – PRODUCT

Product, culture, and talent are key to transitioning BluGlass from where we are to where we want to be. On the product side, our goal is to provide a continuous flow of winning products to the market. Our immediate focus is on improving four key areas to launch our first laser diode products – epi, metals, facets, and bonds.

We are capitalising on our existing epitaxial expertise and using metrics in each of these four key areas to identify early warning signals and, just as importantly, early success indicators of device performance. Establishing and emphasising these metrics allow us to measure outcomes of process iterations more quickly, therefore reducing the product improvement feedback loop. In other words, we are using in-line metrics that don't require a full product. Some of these metrics can be measured while we build the product and others involve running experiments that are separate from products – often called short loops.

These short loops enable us to move toward designing and testing improved epitaxy, metals, and facets before we have an entire product available to us. We are using the expertise of our contract manufacturers, or CMs, to run these short loops and help us to progress towards delivering commercial lasers.

Longer term, we will transition to a more structured phase gate production introduction process – also known as New Product Introduction or NPI. This provides a structure, so each new product goes through a similar process. And as we refine the process, we get better and quicker at introducing new products and avoiding pitfalls.

PLAN TO TRANSITION BLUGLASS – CULTURE AND TALENT

As we transition to a product development and production culture, we want to maintain BluGlass' culture of world-class innovation and our entrepreneurial spirit. These have been vital in our development of the RPCVD technology, which makes BluGlass truly unique in the market; and going forward will be a critical core competency to differentiate our products and enable us to gain market share in the future. However, we also want to instil a culture of commercial discipline with sophisticated data and analytical production protocols.

We want to ensure we can attract and retain world-class talent and that we are optimising that talent based on needs and funding. We will further empower our employees, aligning their tasks to the achievement of our goals, delivery of our initial product offering, and product roadmap. This will improve the confidence of management that everyone is working on what is most important. And for each employee, it gives them the ownership and understanding that they are working on something important, something that matters to the company and its investors.

BLUGLASS LASER DIODE MANUFACTURING STEPS

Turning now to our laser diode manufacturing steps. Many of you will have seen this slide before, as it's a good visual representation of our manufacturing supply chain and focus areas. There are in-line and other metrics we can measure at each of these stages; however, we can't ultimately validate the four key laser diode elements until late in the development process when we reach reliability testing.

The first key element is design and growth of our epitaxial laser structures. The most important foundation of good commercial laser diodes is high gain, low loss epitaxy. Moving along to our second key element, wafer fabrication and metalisation. In standard laser architectures, low resistance positive and negative metal contacts are required to enable the electrical current that drives the laser during operation. At this fabrication stage the positive or p-contact is deposited on the epitaxial side of the layers. We then thin the substrate (what the epitaxy wafer is grown on) and deposit the negative contact metals, or the n-contact on the back side. The next two elements are cleaving the wafer into the individual bars of lasers followed by facet coating of the two optical faces or facets of the laser.

The next process module is chip on submount (CoS). For higher levels of integration, the bare chip is bonded (or soldered) to a material that is design to closely match the thermal expansion of the chip and allow efficient heat transfer from the chip to the system environment. The most important bond is the chip to the submount itself, which requires sound adhesion between the metals and the semiconductor as well as a void-free bond between the semiconductor and the submount.

Then we have reliability testing to qualify the product platform and a shorter test and burn-in process to screen each chip and finally a laser diode product that is ready for integration.

BLUGLASS LASER DIODE FORM-FACTOR OFFERINGS

Our plan once products are launched is to offer our customers a range of form-factors with varying levels of ease of integration to best suit their product requirements. On the far left we have our minimal viable product through to the easiest-to-use laser light on the far right.

Our most basic products are single emitters or a bar of chips, featuring multiple chips on one bar. Customers can purchase these, but they require significant customisation and post-purchase packaging.
Chip on submount is the level of integration which has a single laser chip bonded onto a submount as we previously discussed. Like the chips, these can be purchased but again they do not provide easy to use light. Post-purchase processing is difficult for our customers and requires the addition of both mechanical and optical components to integrate the chips into their products.

Moving along to our individually packaged devices. The top image is what is called a "T09 can", and the bottom is called a c-mount. These devices are easier to use but still require quite a bit of optical componentry to integrate them into a laser system.

Multi-chip packages or arrays are where we provide multiple emitters in a single package. Those emitters have lenses that condition the light and enable us to focus it into an optical fiber, which channels the light from many chips. Think of the optical fiber as a small hose that flows light instead of water. This light is very usable, with high brightness (tied to our brightness metric). It's low divergent light that's easy to use and simple to integrate into a system so customers are willing to pay more per watt than they would for lower levels of integration.

While different customers will require laser diodes in each of these form factors, our roadmap is focused on moving from low integration into higher levels of integration. Our ability and willingness to manufacture underserved wavelengths and sell products in a range of form factors is a key differentiator, which will enable us to win market share.

THE FOUR KEY INGREDIENTS FOR RELIABLE COMMERCIAL LASER DIODES

While I have already touched briefly on this, it is worth reiterating in some detail the four key elements required for commercial laser products, and how BluGlass will deliver each of these to solve our reliability challenges and launch commercial products for sale.

These ingredients are low loss, high gain epitaxy; low resistance high-adhesion metalisation; low loss, passivating facets; and mechanically sound bonds for enhanced thermal management.

While our epitaxy is performing in line with expectations, we are continuing to improve our growth metrics. This includes establishing shorter feedback loops with in-line metrics, such as photoluminescence, where we can measure wavelengths and intensity across the wafer prior to downstream processing. Given our investment in epitaxy over many years, we have significant epitaxy capacity and can rapidly scale. In fact, our estimates suggest we have the epi capacity to reach 20%-25% of BluGlass' 2025 service available market of US$735M.

On the metals front, we are developing low resistance ohmic contacts to improve efficiency and reliability of our laser diode prototypes. We are refining the cleaning and annealing processes with our CMs to ensure good adhesion, uniform resistance and subsequent uniform cavity pumping. Controlled pumping of the lasers is vital for reliability.

Facets require a clean cleave and low loss anti-reflective (the optical output side of the laser) and highly-reflective (the mirror face of the laser that concentrates the light within the laser cavity) coatings. To address our observable facet damage, we are refining our AR and HR processes with our contract manufacturers, in addition to improving upstream and downstream handling processes.

Finally, the last key needed are bonds. Sound thermal-mechanical bonds are incredibly important, enabling heat flow away from the laser. If the laser gets too hot, it's detrimental to performance and reliability. Sound mechanical bonds will withstand heating and cooling events during normal laser cycling.

We remain focused on improving these four key elements to resolve our reliability challenges.

LASER DIODE PRODUCT AND OPERATIONS TIMELINE

In the 2021 calendar year we've had two key feasibility demonstrations. Encouragingly, our prototype unbonded single-mode devices are achieving single mode operation equivalent to bonded chips from our competitors. We've also demonstrated the first RPCVD tunnel junction laser diodes in a world first proof-of-concept demonstration.

This quarter we're working through the metal validation process with our contract manufacturers. That leads into thermal mechanical bond tests, which we are already running in parallel. Once we reach our next baseline with better metals and thermal mechanical components, we can accelerate validation of our progress on delivering sound facets and the sum of all four key laser diode elements in life tests (reliability testing).

Laser diode beta sampling to customers for trials will follow (CYQ2-Q3 2022) in the 405nm and 450nm wavelengths, and we anticipate our first laser diode sales will occur from mid next year as single chip modules or chip on submounts. These sales and revenue generation are anticipated to ramp up from 2023 and beyond.

Early next year, we'll also start the development of our multi-chip modules and expand our product wavelengths. That development activity will take us through to mid-2023 and the end of 2023 respectively.

Operationally, our US test facility in New Hampshire is fully operational. We are also in the process of qualifying our supply chain with our contract manufacturers and preparing our supply chain for volume manufacturing. Over the next two quarters, we will commence low-level pilot volumes of chip-on-submount and single chip packaging in the test facility.

Longer-term, we'll also be transitioning our coating capability in-house. To drive even higher brightness, we need best in class coating which is not something we can find from our third-party providers. Going forward, as it becomes cost effective to do so, we expect we will need to bring in-house other core competencies.

ECONOMIC SCENARIOS – BLUGLASS TARGET MARKET REVENUES

This slide gives you a sense of what revenues from our three key target markets – industrial, scientific and biotech –may look like as we build market share. It is not a revenue forecast, but three economic scenarios that take into account factors such as delivery of technical milestones, customer demand and product sales. As you can see, we expect industrial lasers will be early adopters of our laser diodes.

As we launch our multi-chip modules, we expect to see greater revenue contribution from the scientific and biotech markets.

SUMMARY AND OUTLOOK

Solving reliability and launching our first laser diode to market is our primary objective and in order to do so we are concentrating on delivering the four key elements to achieve reliable, commercial products ready for sale: (Epitaxy, Metals, Facets and Bonds).

Strategically, we are focused on providing products to address significant unmet needs in the industry via unique form factors, vertical package integration, novel laser architectures including multi-chip arrays and RPCVD enhanced lasers.

We are targeting large and growing markets. BluGlass' end market opportunity is growing rapidly to represent a $2.5B market with very few competitors (market is comprised of three main suppliers presently)
Finally, we are solving problems for our customers, providing plug-and-play easy-to-use light.

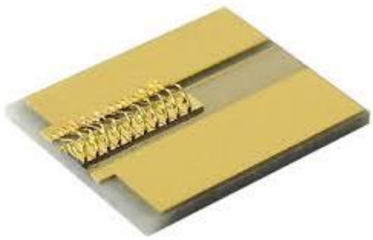
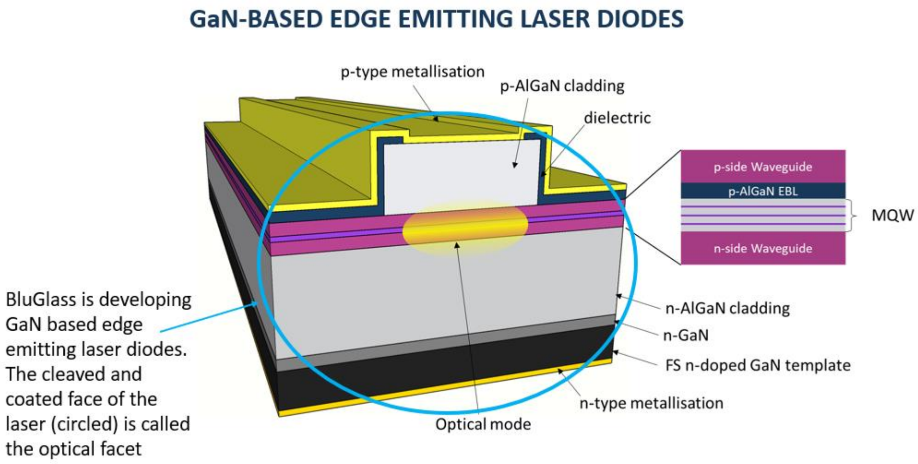
Before I hand back to James to commence the Official Business of today's Meeting, I would like to reassure shareholders that our reliability challenges are very common in the laser industry. While they are new to BluGlass, they are not new to me, and I have personally experienced and solved many of these pitfalls for other companies throughout my career. I look forward to doing the same at BluGlass and launching our first commercial laser diodes to market.

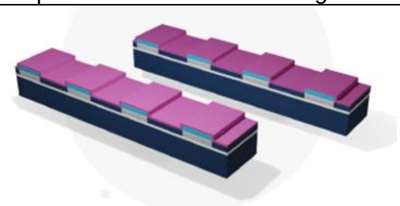
Thank you to all our shareholders, stakeholders, and customers for your support. I'd also like to acknowledge the hard work of the BluGlass technology team, the support staff, and the health and safety committee for their dedicated efforts over the past year with its challenges, including the global impact of COVID-19.

I'll now hand you back to James.

BLUGLASS

Glossary

AR & HR Coating (Anti-Reflective & High Reflective Coating)	For the lasers to achieve optimal performance, the two edge surfaces (facets) of the long device are coated with specially engineered optical coatings. One coating - the **Highly-Reflective (HR) Coating** – is designed to reflect close to 100% of the light back into the laser cavity, while the **Antireflective (AR) coating** on the other end is engineered to reflect only a specific fraction of the light while transmitting the rest with minimal loss or absorption. These coated facets are essentially mirrors that form a cavity where the light is reflected back and forth. The confinement of the light in this manner is a key principle in the function of a laser diode. Additionally, the thin film AR and HR coatings also protect the GaN edge surface from the environment.
Bond or thermal-mechanical bond	During standard operation, the laser diode chip itself gets hot. To draw the heat away from the device, the chip is bonded to a submount. A sound thermal-mechanical bond is incredibly important, to ensure the heat can be removed from the laser efficiently. If the laser gets too hot, it's detrimental to performance and reliability. Sound mechanical bonds must withstand heating and cooling events during normal laser cycling
Chip on Submount (CoS)	 The chip-on-submount (CoS) architecture is a popular package style for laser diode modules. It features large gold wire bond pads that provide contact to the cathode and anode of the semiconductor laser diode. The submount plays a role in the thermal management of the device during operation.
C-mount	A C-mount package is an industry-standard package whereby the laser is mounted directly onto a metallic heat sink. Unlike a TO can, a C-mount is not hermetically sealed and leaves the laser chip exposed to air.
Emitter	Laser diodes and light emitting diodes (LEDs) are both emitters. The key differentiator is that in laser diodes the light that is emitted is coherent, while in LEDs it is incoherent. There are two general configurations for laser diodes, edge emitters and surface emitters, and each have their own advantages depending on the application. Surface emitting lasers are generally used in telecommunication applications however typically display low output powers. Edge emitting laser can deliver significantly higher output powers and are used in applications requiring high power such as industrial welding and cutting.
Epitaxy	Epitaxy refers to a type of crystal growth or material deposition in which new crystalline layers are formed in precise structures on a substrate. The deposited crystalline films are called an epitaxial film, epitaxial layer, or thin-film layer.
Facet	

	The cleaved and coated faces of the laser are called facets. The front facet or optical facet is where the light is emitted, while the back facet reflects the light back into the laser cavity.
Form factors	Form factor is a hardware design aspect that defines and prescribes the size, shape, and other physical specifications of components.
GaN (Gallium nitride)	Gallium nitride (GaN) is an important semiconductor material used in billions of electronics devices around the globe. GaN is a group III nitride direct bandgap semiconductor commonly used in blue light-emitting diodes and laser diodes for a wide range of commercial applications. The materials wide band gap of 3.4 eV affords it special properties for applications in optoelectronic high-power and high-frequency devices.
Heat sinks	A Heat Sink is a material that is designed to absorb and dissipate excess heat from the semiconductor device.
Laser diode	A Laser Diode is a semiconductor device similar to a light-emitting diode (LED). It contains a p-n junction and an active region where the light is generated. The light is confined within a cavity by facets with AR and HR coatings. The confinement causes stimulated emission and leads to amplification and results in the output light being coherent and able to be highly focused.
Laser system	A laser system is the final product that integrates the laser diode device, the packaging, and the electrical driver hardware. A laser system is what the end user purchases (e.g a medical device, 3D printer or industrial wielding machine).
LD bar or bar of chips	 A bar of chips features multiple laser diode chips on a single bar (example picture illustrates four LD chips on a single bar). For certain applications and integration solutions, customers may prefer to purchase the devices in bar form rather than individual chip form. LD bars, while advantages over chips for certain applications, often requires significant customisation and post-purchase packaging.
MOCVD	Metal Organic Chemical Vapour Deposition (MOCVD) is a technology that is used to deposit very thin layers of atoms onto a semiconductor wafer (wafers are thin disks mostly made of sapphire or silicon). It is the industry standard method of manufacture of gallium nitride semiconductors.
Multi-chip module	 Multi-chip packages or arrays are where we provide multiple emitters in a single package. Those emitters have lenses that condition the light and enable us to focus it into an optical fibre, which combines the light from many chips. Think of the optical fibre as a small hose that flows light instead of water. This light is very usable, with high brightness (tied to our brightness metric). It's low divergent light that's easy to use and simple to integrate into a system so customers are willing to pay more per watt than they would for lower levels of integration.
Multi-mode laser	A multi-mode laser contains multiple output beam modes, while a single-mode laser contains only one. A key advantage of a multi-mode laser is that it can generate high output powers. A potential drawback of a multimode laser is that the beam quality is not as good compared to a single mode laser. This limits how small a multi-mode laser can be focused. Multi-mode lasers are used in applications where the requirement of high output power outweighs the requirement of high beam quality.
Packaging	The coated laser chips are mounted onto a mechanical and thermally suitable material and physically packaged. This protects the laser device from the environment and allows for both the electrical connection to the device and the optical output. In the case of high-power lasers, considerable heat is generated, and the packaging strategy is an important aspect of the design to address thermal management. Several of our customer engagements have specific requests

	for the packaging approach. BluGlass is offering a flexible approach in this regard that has resonated well with customers.
Reliability	Laser diodes are required to perform with stable performance for long periods of time, and as such evidence of their performance of operation over time is needed. As such, laser diodes undergo reliability testing. Reliability testing involves subjecting the laser device to electrical and thermal stress to simulate how it would operate in the field, but at an accelerated pace. The reliability of the device is a quantitative measure of how stable the device is in terms of optical and electrical performance over time during operation. Typically, customers would require reliability or lifetime testing results as evidence of how long the devices would be expected to operate with stable performance.
RPCVD	RPCVD is a thin film deposition technology similar to MOCVD. RPCVD works in a similar way to MOCVD, where a mixture of gases is introduced into the reaction chamber for deposition of thin films on a heated substrate. While MOCVD uses thermal decomposition of ammonia (NH_3) to provide active nitrogen, RPCVD uses a nitrogen (N_2) plasma source. The nitrogen plasma generation is not dependent on high temperature to provide a source of reactive nitrogen atoms. This allows for the growth of GaN to be carried out at much lower temperatures than those used in MOCVD while maintaining the critical crystalline quality necessary for high performance devices. RPCVD is also an inherently low hydrogen growth process. The combination of low growth temperature and low hydrogen present significant advantages for the growth of certain layers and devices.
Single-mode laser	A single mode laser contains one output beam mode, while a multi-mode laser contains many modes. A key feature of a single mode laser is that the beam is of high quality, however the power is generally lower than what can be achieved in a multimode laser. Single mode lasers can present some additional challenges during manufacturing compared to multimode lasers. Single mode lasers are used in applications where the requirement of high beam quality outweighs the requirement of high output powers.
TO-9 Can	 TO-9 Cans are an industry standard individually packaged laser diode component, designed for standard integration into many customer laser systems.
Visible lasers	Visible lasers emit light in the visible wavelength spectrum from ~400 nm to 700 nm wavelengths.

This announcement has been approved for release by the board.

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About BluGlass

Developing leading-edge semiconductor manufacturing technology and devices for more than a decade**, BluGlass Limited (ASX:BLG)** is a provider to the global GaN photonics industries, delivering cutting-edge, custom **laser diode** and LED development across the industrial, defence, display, and scientific markets.

Listed on the ASX, we are an Australian public company established to power the smarter, cleaner, more efficient photonics of tomorrow with our proprietary low temperature, low hydrogen, **remote plasma chemical vapour deposition** (RPCVD) manufacturing technology.

Backed by an extensive network of supply-chain partners, BluGlass is developing a suite of laser diode products, from small batch custom lasers through to high-volume and off the shelf products.