

UNITED STATES
SECURITIES AND EXCHANGE COMMISSION
Washington, D.C. 20549

FORM 10-K

ANNUAL REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934

For the fiscal year ended December 31, 2021

TRANSITION REPORT PURSUANT TO SECTION 13 OR 15 (D) OF THE SECURITIES EXCHANGE ACT OF 1934

For the transition period from _____ to _____

Commission file number: 001-40766

Lightwave Logic, Inc.

(Exact name of registrant as specified in its charter)

Nevada

(State or other jurisdiction of
incorporation or organization)

82-0497368

(I.R.S. Employer
Identification No.)

369 Inverness Parkway, Suite 350, Englewood, CO

(Address of principal executive offices)

80112

(Zip Code)

(Registrant's Telephone Number, including Area Code): **720-340-4949**

Securities registered pursuant to Section 12(b) of the Act:

Title of each class registered	Trading Symbols	Name of each exchange on which registered
Common Stock, \$0.001 par value per share	LWLG	The NASDAQ Stock Market

Securities registered pursuant to section 12(g) of the Act: None

Indicate by check mark if the Registrant is a well-known seasoned issuer, as defined in Rule 405 of the Securities Act. Yes No

Indicate by check mark if the Registrant is not required to file reports pursuant to Section 13 or 15(d) of the Act. Yes No

Indicate by check mark whether the registrant (1) has filed all reports required to be filed by Section 13 or 15(d) of the Securities Exchange Act of 1934 during the preceding 12 months (or for such shorter period that the registrant was required to file such reports), and (2) has been subject to such filing requirements for the past 90 days. Yes No

Indicate by check mark whether the registrant has submitted electronically every Interactive Data File required to be submitted pursuant to Rule 405 of Regulation S-T (§ 232.405 of this chapter) during the preceding 12 months (or for such shorter period that the registrant was required to submit such files). Yes No

Indicate by check mark whether the registrant is a large accelerated filer, an accelerated filer, a non-accelerated filer, smaller reporting company, or an emerging growth company. See the definitions of "large accelerated filer," "accelerated filer," "smaller reporting company," and "emerging growth company" in Rule 12b-2 of the Exchange Act.

Large accelerated filer
Non-accelerated filer

Accelerated filer
Smaller reporting company
Emerging growth company

If an emerging growth company, indicate by check mark if the registrant has elected not to use the extended transition period for complying with any new or revised financial accounting standards provided pursuant to Section 13(a) of the Exchange Act.

Indicate by check mark whether the registrant has filed a report on and attestation to its management's assessment of the effectiveness of its internal control over financial reporting under Section 404(b) of the Sarbanes-Oxley Act (15 U.S.C. 7262(b)) by the registered public accounting firm that prepared or issued its audit report.

Indicate by check mark whether the registrant is a shell company (as defined in Rule 12b-2 of the Exchange Act of 1934). Yes No

The aggregate market value of the voting and non-voting common equity held by non-affiliates of the registrant was approximately \$1,542,324,261 as of June 30, 2021.

As of February 28, 2022, there were 110,978,886 shares outstanding of the registrant's common stock, \$0.001 par value.

Documents incorporated by reference. Portions of the registrant's Definitive Proxy Statement for the registrant's 2022 Annual Meeting of Shareholders are incorporated by reference in Part III of this report. The Definitive Proxy Statement or an amendment to this Form 10-K will be filed with the Securities and Exchange Commission within 120 days after the registrant's fiscal year end.

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Forward-Looking Statements

This report on Form 10-K contains forward-looking statements. Forward-looking statements involve risks and uncertainties, such as statements about our plans, objectives, expectations, assumptions or future events. In some cases, you can identify forward-looking statements by terminology such as "anticipate," "estimate," "plan," "project," "continuing," "ongoing," "expect," "we believe," "we intend," "may," "should," "will," "could" and similar expressions denoting uncertainty or an action that may, will or is expected to occur in the future. These statements involve estimates, assumptions, known and unknown risks, uncertainties and other factors that could cause actual results to differ materially from any future results, performances or achievements expressed or implied by the forward-looking statements. You should not place undue reliance on these forward-looking statements.

Factors that are known to us that could cause a different result than projected by the forward-looking statement, include, but are not limited to:

- inability to generate revenue or to manage growth;
- lack of available funding;
- lack of a market for or market acceptance of our products;
- competition from third parties;
- general economic and business conditions;
- intellectual property rights of third parties;
- changes in the price of our stock and dilution;
- regulatory constraints and potential legal liability;
- ability to maintain effective internal controls;
- security breaches, cybersecurity attacks and other significant disruptions in our information technology systems;
- changes in technology and methods of marketing;
- delays in completing various engineering and manufacturing programs;
- changes in customer order patterns and qualification of new customers;
- changes in product mix;
- success in technological advances and delivering technological innovations;
- shortages in components;
- production delays due to performance quality issues with outsourced components;
- the novel coronavirus ("COVID-19") and its potential impact on our business;
- those events and factors described by us in Item 1.A "Risk Factors";
- other risks to which our Company is subject; and
- other factors beyond the Company's control.

Any forward-looking statement made by us in this report on Form 10-K is based only on information currently available to us and speaks only as of the date on which it is made. We undertake no obligation to publicly update any forward-looking statement, whether written or oral, that may be made from time to time, whether as a result of new information, future developments or otherwise.

PART I

Item 1. Business.

Overview

Lightwave Logic, Inc. is a development stage company moving toward commercialization of next generation electro-optic photonic devices made on its P²IC™ technology platform which we have detailed as: 1) Polymer Stack™, 2) Polymer Plus™, and Polymer Slot™. Our polymer technology platform uses in-house proprietary high-activity and high-stability organic polymers. Electro-optical devices convert data from electric signals into optical signals for multiple applications.

Our differentiation at the device level is in higher speed, lower power consumption, simplicity of manufacturing and reliability. We have demonstrated higher speed and lower power consumption in packaged devices, and during 2021, we continue to make advances in techniques to translate material properties to efficient, reliable devices. We are currently focused on testing and demonstrating the simplicity of manufacturability and reliability of our devices, including in conjunction with the silicon photonics manufacturing ecosystem. In 2021 we discussed the addition of silicon-based foundry partners to help scale in volume our polymer modulator devices. Silicon-based foundries are large semiconductor fabrication plants developed for the electronics IC business, that are now engaging with silicon photonics to increase their wafer throughput. Partnering with silicon-based foundries not only demonstrates that our polymer technology can be transferred into standard production lines using standard equipment, and also allows us to

efficiently utilize our capital.

Our extremely strong patent portfolio allows us to optimize our business model in three areas: 1) Traditional focus on product development, 2) Patent licensing, 3) Technology transfer to foundries.

We are initially targeting applications in data communications and telecommunications markets and are exploring other applications that include automotive/LIDAR, sensing, displays etc., for our polymer technology platform.

Unless the context otherwise requires, all references to the "Company," "we," "our" or "us" and other similar terms means Lightwave Logic, Inc. Also, this Form 10-K Annual Report includes the names of various government agencies and the trade names of other companies. Unless specifically stated otherwise, the use or display by us of such other parties' names and trade names in this report is not intended to and does not imply a relationship with, or endorsement or sponsorship of us by, any of these other parties.

Materials Development

Our Company designs and synthesizes organic chromophores for use in its own proprietary *electro-optic polymer systems* and photonic device designs. A polymer system is not solely a material, but also encompasses various technical enhancements necessary for its implementation. These include host polymers, poling methodologies, and molecular spacer systems that are customized to achieve specific optical properties. Our organic electro-optic polymer systems compounds are mixed into solution form that allows for thin film application. Our proprietary electro-optic polymers are designed at the molecular level for potentially superior performance, stability and cost-efficiency. We believe they have the potential to replace more expensive, higher power consuming, slower-performance materials and devices used in fiber-optic communication networks.

Our patented and patent pending molecular architectures are based on a well-understood chemical and quantum mechanical occurrence known as *aromaticity*. Aromaticity provides a high degree of molecular stability that enables our core molecular structures to maintain stability under a broad range of operating conditions.

We expect our patented and patent-pending optical materials along with trade secrets and licensed materials, to be the core of and the enabling technology for future generations of optical devices, modules, sub-systems and systems that we will develop or potentially out-license to electro-optic device manufacturers. Our Company contemplates future applications that may address the needs of semiconductor companies, optical network companies, Web 2.0 media companies, high performance computing companies, telecommunications companies, aerospace companies, and government agencies.

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Device Design and Development

Electro-optic Modulators

Our Company designs its own proprietary electro-optical modulation devices. Electro-optical modulators convert data from electric signals into optical signals that can then be transmitted over high-speed fiber-optic cables. Our modulators are electro-optic, meaning they work because the optical properties of the polymers are affected by electric fields applied by means of electrodes. Modulators are key components that are used in fiber optic telecommunications, data communications, and data centers networks etc., to convey the high data flows that have been driven by applications such as pictures, video streaming, movies etc., that are being transmitted through the Internet. Electro-optical modulators are expected to continue to be an essential element as the appetite and hunger for data increases every year.

Polymer Photonic Integrated Circuits (P²IC™)

Our Company also designs its own proprietary polymer photonic integrated circuits (otherwise termed a polymer PIC). A polymer PIC is a photonic device that integrates several photonic functions on a single chip. We believe that our technology can enable the ultra-miniaturization needed to increase the number of photonic functions residing on a semiconductor chip to create a progression like what was seen in the computer integrated circuits, commonly referred to as Moore's Law. One type of integration is to combine several instances of the same photonic functions such as a plurality of modulators to create a 4 channel polymer PIC. In this case, the number of photonic components would increase by a factor of 4. Another type is to combine different types of devices including from different technology bases such as the combination of a semiconductor laser with a polymer modulator. Our P²IC™ platform encompasses both these types of architecture.

Current photonic technology today is struggling to reach faster device speeds. Our modulator devices, enabled by our electro-optic polymer material systems, work at extremely high frequencies (wide bandwidths) and possess inherent advantages over current crystalline electro-optic material contained in most modulator devices such as lithium niobate (LiNbO₃), indium phosphide (InP), silicon (Si), and gallium arsenide (GaAs). Our advanced electro-optic polymer platform is creating a new class of modulators such as the Polymer Stack™ and associated PIC platforms that can address higher data rates in a lower cost, lower power consuming manner, with much simpler modulation techniques.

Our electro-optic polymers can be integrated with other materials platforms because they can be applied as a thin film coating in a fabrication clean room such as may be found in semiconductor foundries. This approach we call Polymer Plus™. Our polymers are unique in that they are stable enough to seamlessly integrate into existing CMOS, Indium Phosphide (InP), Gallium Arsenide (GaAs), and other semiconductor manufacturing lines. Of particular relevance are the integrated silicon photonics platforms that combine optical and electronic functions. These include a miniaturized modulator for ultra-small footprint applications in which we term the Polymer Slot™. This design is based on a slot modulator fabricated into semiconductor wafers that include both silicon and indium phosphide.

Our company has a fabrication facility in Colorado to apply standard fabrication processes to our electro-optic polymers which create modulator devices. While our internal fabrication facility is capable of manufacturing modulator devices, we have partnered with commercial silicon-based fabrication companies that are called foundries who can scale our technology with volume quickly and efficiently. The process recipe for fabrication plants or foundries is called a 'process development kit' or PDK. We are currently working with commercial foundries to implement our electro-optic polymers into accepted PDKs by the foundries. Our work with the foundries is being focused with the Polymer Plus™ and the Polymer Slot™ polymer modulators.

Glossary

Glossary of select technology terms to provide you with a better understanding our Company's technology and devices:

Electro-optic devices - Electro-optic devices convert data from electric signals into optical signals for use in communications systems and in optical interconnects for high-speed data transfer.

Electro-optic material - Electro-optic material is the core active ingredient in high-speed fiber-optic telecommunication systems. Electro-optic materials are materials that are engineered at the molecular level. Molecular level engineering is commonly referred to as "nanotechnology."

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Electro-optic modulators - Electro-optic (E/O) modulators are electro-optic devices that perform electric-to-optic conversions within the infrastructure of the internet. Data centers may also benefit from this technology through devices that could significantly increase bandwidth and speed while decreasing costs. Polymer E/O modulators can be

designed and fabricated with multiple structures such as Ridge waveguide and slot waveguide. The waveguides allow the light to be efficiently coupled into and out of the modulators, and provide a basis for integrating modulators together.

Photonic Devices - Photonic devices are components for creating, manipulating or detecting light. This can include modulators, laser diodes, light-emitting diodes, solar and photovoltaic cells, displays and optical amplifiers. Other examples are devices for modulating a beam of light and for combining and separating beams of light of different wavelength.

Polymers - Polymers, also known as plastics, are large carbon-based molecules that bond many small molecules together to form a long chain. Polymer materials can be engineered and optimized using nanotechnology to create a system in which unique surface, electrical, chemical and electro-optic characteristics can be controlled. Materials based on polymers are used in a multitude of industrial and consumer products, from automotive parts to home appliances and furniture, as well as scientific and medical equipment.

Our Business Opportunity

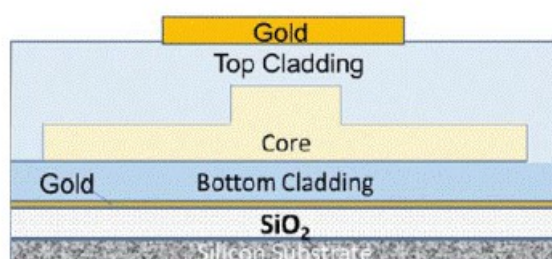
Lightwave Logic, Inc. is developing next generation proprietary photonic devices that are based on our advanced electro-optical polymer material systems. Current legacy technology is based on inorganic crystalline materials, which has allowed for the proliferation of data over fiber optic cables. However, there are inherent molecular deficiencies that have prevented this technology from scaling down in price and up in functionality, especially in terms of \$/Gbps. This is primarily due to a closed valence structure that does not allow for the molecular improvements. The valence or valency of an element is a measure of its combining power with other atoms when it forms chemical compounds or molecules. Also, the physical properties of a crystal do not allow for its implementation into highly miniaturized slot structures that are in simple terms the pathways that light travels through in the device.

Organic polymer materials on the other hand, have free electrons that allow for limitless potential to combine with other molecular structures, which allows for multiple options and combinations to improving performance characteristics. Importantly, because they can be applied to optical structures in thin-film liquid form, it is possible to imbue electro-optic ability to highly miniaturized slot structures. Organic polymer materials are also vastly cheaper to manufacture in comparison to growing exotic crystals that are prone to contamination and further must be sliced into thin wafers. Our Company believes that the combination of less expensive manufacturing cost, ease of application, and better scalability, together with a lower cost of ownership due to marked less heat dissipation (requiring less cooling), will create enormous demand for our products.

Many companies' early attempts at developing commercially reliable organic polymers were stymied due to the difficulty of creating organic molecules that could remain electro-optically active after being subjected to the high heat of semiconductor manufacturing temperatures (such as silicon CMOS, InP, GaAs etc.). These early attempts also encountered difficulty synthesizing materials that could withstand photochemical bleaching (loss of sensitivity to specific frequencies) and material degradation due to high operating temperatures.

Over the last several years, our Company has made various scientific breakthroughs that have allowed for the synthesis of proprietary organic polymer materials that can withstand extremely high process temperatures of 175⁰C. Additionally, these materials have demonstrated photochemical stability, even after being subjected to tensor light for over 4,000 hours and exhibited little electro optic degradation even after 2,500 hours of continuous exposure to temperatures at 110⁰C – exceeding typical commercial operating temperatures of approximately 85⁰C, as found in data center applications. After successfully achieving material test results that either met or exceeded commercial requirements (subsequently confirmed by an outside entity), in late 2016, the Company began production of its first photonic prototype device, a *ridge waveguide modulator* which is called a Polymer Stack™.

Our First Product – The Ridge Waveguide Modulator



A ridge waveguide modulator is a type of modulator where the waveguide is fabricated within a layer of our electro-optic polymer system. Various cladding materials and electrodes are layered over the core polymer. The polymer materials are then part of an integrated photonics platform that can house other photonic devices, such as lasers, waveguides etc.

In April 2017 we achieved bandwidth suitable for 25Gbps data rates in an all-organic polymer ridge waveguide intensity modulator prototype, a significant improvement over our initial 10Gbps device modulator prototype that was announced in 2016. This breakthrough was significant because a 25Gbps data rate is important to the optical networking industry because this data rate is a major node to achieve 100 Gbps (using 4 channels of 25 Gbps). In July 2017 we advanced our high-speed modulation performance to satisfy 28Gbps data rates for QSFP28 standards and 100Gbps data center applications.

In September 2017 we achieved outstanding performance of our ridge waveguide Mach-Zehnder modulators ahead of schedule, with bandwidth performance levels that will enable 50Gbps modulation in fiber-optic communications. This important achievement will allow users to utilize arrays of 4 x 50Gbps polymer modulators using PAM-4 encoding to access 400Gbps data rate systems. Pulse-Amplitude Modulation (PAM-4) is an encoding scheme that can double the amount of data that can be transmitted.

We are now optimizing our high-performance modulators against typical specifications that are required by the fiber communications industry. Furthermore, we are packaging our modulators with our packaging partner so that potential customers can evaluate our high-performance modulators in their systems. One of the most under-evaluated processes of developing high speed devices onto a new and novel technology platform is robustness and reliability. We have already made extensive progress with our polymer materials on this front, and now we are integrating our robust polymer materials onto an integrated photonics platform to provide customers with a more miniaturized, higher performance solution for their data rich systems.

We have also shown that with standard simulation and modeling of our devices, there is a potential to scale the high-speed performance beyond that of 100Gbps, thus providing a technology platform for even greater data rates in the future. This means that our technology platform using polymers is both scalable in high performance as well as scalable in miniaturization and low cost, something that the fiber communications industry has been searching for a long time.

While our initial focus is to address data communications and telecommunications network applications along with cloud computing/data center needs, we believe that in the future we will have additional opportunities to address other applications such as: backplane optical interconnects, photovoltaic cells, medical applications, satellite reconnaissance, navigation systems, radar applications, optical filters, spatial light modulators; and all-optical switches.

Electro-Optic Polymer Production – Our Approach vs. the BLA Approach

Our core material expertise relates to the production of high-performance, high-stability electro-optic polymers for high-speed (wide bandwidth) telecommunication and data communications applications. More specifically, it lies in a less mainstream, yet firmly established, scientific phenomenon called aromaticity. Aromaticity causes a high degree of molecular stability. It is a molecular arrangement wherein atoms combine into multi-membered rings and share their electrons among each other. Aromatic compounds are stable because the electronic charge distributes evenly over a great area preventing hostile moieties, such as oxygen and free radicals, from finding an opening to attack.

Previous and Current Competitive Organic Electro-Optic Polymer Efforts

For the past several decades, diverse corporate interests, including, to our knowledge, IBM, Lockheed Martin, DuPont, AT&T Bell Labs, Honeywell, Motorola, HP, 3M, and others in addition to numerous universities and U.S. Government Agencies, have attempted to produce high-performance, high-stability electro-optic polymers for high-speed (wide bandwidth) telecommunication applications. These efforts were largely unsuccessful due, in our opinion, to the industry's singular adherence to an industry pervasive engineering model known as the Bond Length Alternation ("BLA") theory model, which none of our patented molecular designs rely upon. The BLA model, like all other current industry-standard molecular designs, consists of molecular designs containing long strings of atoms called polyene chains. Longer polyene chains provide higher electro-optic performance, but are also more susceptible to environmental threats, which result in unacceptably low-performing, thermally unstable electro-optic polymers.

As a result, high frequency modulators engineered with electro-optic polymers designed on the BLA model or any other polyene chain design models are unstable over typical operating temperature ranges, and often exhibit performance degradation within days, hours or even minutes. Similarly, lower frequency modulators exhibit comparable failings, but to a lesser extent. These flaws, in most cases, have prevented commercial quality polymer-based modulators from entering the commercial marketplace. The thermal stability of these devices does not generally meet the minimum Telcordia GR-468 operating temperature range (-40 degrees Celsius to +85 degrees Celsius) much less the harsher MILSPEC 883D (military specification) range of -55 degrees Celsius to 150 degrees Celsius. While many new applications do not require full military specifications for polymers, many potential customers prefer to see polymer operate at or near these conditions to convey confidence in the material system. We understand from initial conversations with data center architects and designers that the temperature specifications that our materials achieve are compliant with their equipment design needs.

We are aware of other academic and commercial development efforts—some by larger companies with vastly more financial resources than we possess. However, we believe that no one yet has developed organic polymer materials that have demonstrated the combination of thermal stability and photochemical stability that can meet or exceed commercial specifications.

Our Electro-Optic Photonic P²IC™ Device Approach

Our electro-optic devices are built around our proprietary organic polymer material systems that we believe will enable better performance than the current embedded legacy technology built around inorganic materials. We also believe that the inherent flexibility of being able to apply our organic polymer materials in liquid thin-film form will accelerate the move toward ultra-miniaturization of Polymer Photonic Integrated Circuits (P²IC™) by increasing the number of photonic circuits on a single chip. Polymer photonics (previously referred in industry as silicon organic hybrid (SOH)) is the application of polymers on to a platform such as silicon where there are both active and passive photonic component designs. In polymer photonics, polymer devices such as modulators, waveguides, and multiplexers can be fabricated on to a silicon platform that acts as a package as well as a base for mounting lasers (which are needed to source the light).

Our initial device, a ridge waveguide modulator, though highly miniaturized utilizes conventional design and fabrication techniques in the industry. Our future devices will utilize silicon photonics (SiP) technology, which can support highly miniaturized slot waveguides structures etched in large format, low cost, and less expensive silicon wafers coated with our organic electro-optic polymers. The low-cost structure compares well to compound semiconductor technologies such as GaAs (Gallium arsenide) and InP (Indium Phosphide), which suffer from small format wafers that do not allow the economies of scale in high volume fabrication plants. The degree of miniaturization possible of the slot modulator using SiP is not technically feasible to accomplish with inorganic crystalline materials. Although this may not always remain the case, presently there are nearly insurmountable technical difficulties that are inherent to a crystalline molecule.

Although we believe that our polymers will be the key differentiating factor in Polymer photonic devices, we do not currently possess the technical skills and instrumentation necessary to fabricate and test PICs at this dramatically reduced scale and intend to seek an external partner to assist with development.

Our Intellectual Property

Our research and development efforts over the last 10 years have yielded our Company an extensive patent portfolio as well as critical trade secrets, unpatented technology and proprietary knowledge related to our optical polymer materials. Our intellectual property portfolio has expanded significantly over the last year as we are developing our P²IC™ into prototypes. We actively filed technical utility patents over the past few years, and are currently in the process of readying a number of other inventions for formal filings in 2022. We expect to continue innovating with our P²IC platform for the next couple of years. We had a number of patents issued over the past few months indicating that our technology is being recognized as being unique.

Also in 2018, we acquired the Polymer Technology Intellectual Property Assets of BrPhotonics Productos Optoelectrónicos S.A., a Brazilian corporation, which significantly advanced our patent portfolio of electro-optic polymer technology with 15 polymer chemistry materials, devices, packaging and subsystems patents and further strengthened our design capabilities to solidify our market position as we prepare to enter the 400Gbps integrated photonics marketplace with a highly competitive, scalable alternative to installed legacy systems.

In total, our patent portfolio currently consists of 59 granted patents that include 47 from the US, 1 from Canada, 5 from the EU, 2 from Japan and 2 from China.

Our materials patent portfolio has also strengthened significantly with the filing of additional new patent applications on our core Perkinamine™ molecular compounds as well as recent, innovative inventions that are expected to protect our P²IC polymer PIC platform from potential competition.

Included in our patent portfolio are the following nonlinear optic chromophore designs:

- Stable Free Radical Chromophores, processes for preparing the same
- Stable Free Radical Chromophores, processes for preparing the same
- Tricyclic Spacer Systems for Nonlinear Optical Devices
- Anti-Aromatic Chromophore Architectures
- Heterocyclical Anti-Aromatic Chromophore Architectures
- Heterocyclical Chromophore Architectures
- Heterocyclical Chromophore Architectures with Novel Electronic Acceptor Systems

- Multi-fiber/port hermetic capsule sealed by metallization and method

Our strategic plan is to utilize our core proprietary technology and leverage our proprietary optical materials to be the core of and the enabling technology for future generations of optical devices, modules, sub-systems and systems that we will develop or potentially out-license to electro-optic device manufacturers. Our Company contemplates future applications that may address the needs of semiconductor companies, automotive/LiDAR companies, sensing companies, aerospace companies and government agencies.

We rely on a combination of patents, patent applications, trademarks, trade secrets and contractual provisions to protect our technologies. Further, employees are required to surrender any inventions or intellectual property developed as part of their employment agreements. We also have a policy of requiring prospective business partners to enter into non-disclosure agreements (NDAs) before disclosure of any of our confidential or proprietary information. Our Company can make no assurances that we will be able to effectively protect our technologies and know-how or that third parties will not be able to develop similar technologies and know-how independently.

The anti-aromatic nature of these structures dramatically improves the "zwitterionic-aromatic push-pull" of the systems, providing for low energy charge transfer. Low energy charge transfer is important for the production of extremely high electro-optic character.

Heterocyclical Steric Hindering System This patent describes a nitrogenous heterocyclical structure for the integration of steric hindering groups that are necessary for the nanoscale material integration. Due to the [pi]-orbital configuration of the nitrogen bridge, this structure has been demonstrated not to interfere with the conductive nature of the electronic conductive pathway and thus is non-disruptive to the electro-optic character of the core molecular construction. The quantum mechanical design of the system is designed to establish complete molecular planarity (flatness) for optimal performance.

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Totally Integrated Material Engineering System This patent covers material integration structures under a design strategy known as Totally Integrated Material Engineering. These integration structures provide for the "wrapping" of the core molecule in sterically hindering groups that maximally protect the molecule from environmental threats and maximally protect it from microscopic aggregation (which is a major cause of performance degradation and optical loss) within a minimal molecular volume. These structures also provide for the integration of polymerizable groups for integration of materials into a highly stable cross-linked material matrix.

Recent Significant Events and Milestones Achieved

During February and March 2018, we moved our Newark, Delaware synthetic laboratory and our Longmont, Colorado optical testing laboratory and corporate headquarters to office, laboratory and research and development space located at 369 Inverness Parkway, Suite 350, Englewood, Colorado. The 13,420 square feet Englewood facility includes fully functional 1,000 square feet of class 1,000 cleanroom, 500 square feet of class 10,000 cleanroom, chemistry laboratories, and analytic laboratories. The Englewood facility streamlines all of our Company's research and development workflow for greater operational efficiencies.

During March 2018, our Company, together with our packaging partner, successfully demonstrated packaged polymer modulators designed for 50Gbps, which we believe will allow us to scale our P²IC™ platform with our Mach-Zehnder ridge waveguide modulator design as well as other photonics devices competitively in the 100Gbps and 400Gbps datacom and telecommunications applications market. We are currently fine-tuning the performance parameters of these prototypes in preparation for customer evaluations.

During June 2018, our Company Acquired the Polymer Technology Intellectual Property Assets of BrPhotonics Productos Optoelectrónicos S.A., a Brazilian corporation, which significantly advanced our patent portfolio of electro-optic polymer technology with 15 polymer chemistry materials, devices, packaging and subsystems patent and further strengthened our design capabilities to solidify our market position as we prepare to enter the 400Gbps integrated photonics marketplace with a highly competitive, scalable alternative to installed legacy systems.

Also, during June 2018, our Company promoted polymer PICs and Solidified Polymer PICs as Part of the Photonics Roadmap at the World Technology Mapping Forum in Enschede, Netherlands, which includes our Company's technology of polymers and polymer PICs that have the potential to drive not only 400Gbps aggregate data rate solutions, but also 800Gbps and beyond.

In August 2018 we announced the completion (ahead of schedule) of our fully equipped on-site fabrication facility, where we are expanding our high-speed test and design capabilities. We also announced the continuation of the building of our internal expertise with the hiring of world-class technical personnel with 100Gbps experience.

In February 2019 we announced a major breakthrough in our development of clean technology polymer materials that target the insatiable demand for fast and efficient data communications in the multi-billion-dollar telecom and data markets supporting Internet, 5G and IoT (Internet of Things) webscale services. The improved thermally stable polymer has more than double the electro-optic response of our previous materials, enabling optical device performance of well over 100 GHz with extremely low power requirements. This addition to the family of Perkinamine™ polymers will hold back run-away consumption of resources and energy needed to support ever-growing data consumption demands. We continue to conduct testing of the material and assessment of associated manufacturing processes and device structures prior to release to full development.

In March 2019 we created an Advisory Board comprised of three world-class leaders in the photonics industry: Dr. Craig Ciesla, Dr. Christoph S. Harder, and Mr. Andreas Umbach. The Advisory Board is working closely with our Company leadership to enhance our Company's product positioning and promote our polymer modulator made on our proprietary *Faster by Design*™ polymer P²IC™ platform. The mission of the Advisory Board is initially to increase our Company's outreach into the datacenter interconnect market and later to support expansion into other billion-dollar markets. The Advisory Board members have each been chosen for their combination of deep technical expertise, breadth of experience and industry relationships in the fields of fiber optics communications, polymer and semiconductor materials. Each of the Advisory Board members has experience at both innovators like Lightwave Logic and large industry leaders of the type most likely to adopt game-changing polymer-based products. In addition, they possess operational experience with semiconductor and polymer businesses.

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Also, in March 2019, our Company received the "Best Achievement in PIC Platform" award for our 100 GHz polymer platform from the PIC International Conference. The award recognizes innovative advances in the development and application of key materials systems driving today's photonic integrated circuits (PICs) and providing a steppingstone to future devices.

During the second quarter of 2019, our Company promoted its polymers at CoInnovate in May and the World Technology Mapping Forum in June. CoInnovate is a meeting of semiconductor industry experts. The World Technology Mapping Forum is a group authoring a photonics roadmap out to 2030.

In September 2019 at the prestigious European Conference on Communications (ECOC) in Dublin, Ireland, we showed measured material response over frequency and the resulting optical data bits stream on our clean technology polymer materials, the newest addition to our family of Perkinamine™ polymers, that meet and exceed of our near-term target speed of 80 GHz. We also released data demonstrating stability under elevated temperatures in the activated (poled to create data carrying capability) state.

In October 2019, we reported that energy-saving polymer technology is highlighted in the recently published Integrated Photonics Systems Roadmap - International (IPSR-I). The roadmap validates the need for low-voltage, high-speed technologies such as ours.

In May 2020, we announced that our latest electro-optic polymer material has exceeded target performance metrics at 1310 nanometers (nm), a wavelength commonly used in high-volume datacenter fiber optics. This material demonstrates an attractive combination at 1310 nm of high electro-optic coefficient, low optical loss and good thermal stability at 85⁰ Celsius. The material is expected to enable modulators with 80 GHz bandwidth and low drive power, and has an electro-optic coefficient of 200 pm/V, an industry measure of how responsive a material is to an applied electrical signal. This metric, otherwise known as r33, is very important in lowering power consumption when the material is used in modulator devices. This technology is applicable to shorter reach datacenter operators, for whom decreasing power consumption is imperative to the bottom line of a facility. We considered this a truly historic moment—not only in our Company’s history, but in our industry—as we have demonstrated a polymer material that provides the basis for a world-class solution at the 1310 nm wavelength, something which other companies have spent decades attempting to achieve.

In July 2020, we announced the official launch of our new corporate website www.lightwavelogic.com, reflecting ongoing efforts to provide up-to-date information for investors and potential strategic partners. The revamped website offers a clean, modern design integrated with helpful tools and investor relations resources, including a new corporate explainer video, to illustrate the target markets and advantages of Lightwave Logic’s proprietary electro-optic polymers.

In August 2020, we announced the addition of Dr. Franky So, a leading authority in the OLED industry, to our Advisory Board. Dr. So is the Walter and Ida Freeman Distinguished Professor in the Department of Materials Science and Engineering at North Carolina State University. Previously, he was the Head of Materials and Device research for OLEDs at OSRAM Opto Semiconductors, as well as Motorola’s corporate research lab in the 1990s. Dr. So was an early researcher in electro-optic (EO) polymer modulators at Hoechst Celanese. As a member of the Company’s advisory board, Dr. So will work closely with management to enhance Lightwave’s product positioning for, as well as the promotion of, its polymer modulators made on its proprietary platform. In addition, he will provide technical support and advisory services to the Lightwave materials and device teams.

On October 7, 2020 we announced the receipt of U.S. Patent number 10,754,093 that improves both the performance and reliability of our high-speed, low-power electro-optic polymer modulators intended for datacenter and telecommunications applications. The patent allows multi-layered electro-optic polymer modulators to perform more efficiently through the design of custom interfaces. These interfaces are designed into the cladding layers that allow optical transmission, electrical conductivity, material integrity, as well as a prevention of solvents affecting adjacent polymer materials. The net impact of all of this allows for our Company’s modulators to improve performance across the board, enabling higher reliability in the fiber optic communications environment.

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On October 15, 2020, we announced that our proprietary polymer technologies are compatible with currently available integrated photonics platforms. Our proprietary electro-optic materials are currently in the prototyping phase and are fabricated onto standard silicon wafers, and this Polymer Plus™ advancement, driven by the feedback our Company received from potential customers to-date, has allowed our materials to be suitable for additive integration to integrated photonics platforms such as silicon photonics, as well as indium phosphide and other standard platforms – therefore enabling simpler integration by customers. We believe this breakthrough allows a polymer modulator to enhance the performance of existing integrated photonics solutions in the marketplace, enabling higher speed and lower power consumption on foundry-fabricated photonics designs. Since our technology is additive to existing platforms such as silicon photonics, our electro-optic polymers are not actually competing with integrated photonic platforms, but rather enabling them to be more competitive in the marketplace, and it further validates our EO polymer platform as ideally suited to enable optical networking more efficiently than ever.

On October 21, 2020, we announced that we have optimized a robust, photo-stable organic polymer material for use in our next-generation modulators intended to be trialed with potential customers under NDA. Our materials show high tolerance to high-intensity infrared light, common in a fiber optic communications environment and increasingly important as higher density of devices access the network, directly resulting in higher intensity infrared light levels. Our preliminary results suggest that our recently developed electro-optic polymer material, designed based on potential customer input, displays unrivaled light tolerance (also known as photostability) compared to any organic commercial solution in use today. Our results meet both our current internal criteria and address potential customer feedback.

On November 2, 2020, we disclosed results on our polymer material stability testing including further results for electro-optic efficiency for our Company’s materials that operate both at 1550nm as well as 1310nm. We demonstrated test materials results for electro-optic efficiency to 4000hrs, improvement in sensitivity to oxygen as part of a broadband exposure test, and stability for polymers exposed to 1310nm light at 100mW.

On November 20, 2020 we announced the receipt of U.S. Patent number 10,591,755 that details an important invention that allows users of electro-optic polymer modulators to not only operate the devices with high speed and low power directly from CMOS IC chips, but gives them the opportunity to avoid the expense, physical footprint and power consumption of high-speed modulator driver ICs. Furthermore, this patent strengthens our freedom of manufacturing, and directly enables our modulators to become more competitive in the marketplace.

On December 16, 2020 we announced the development of a new sealant for our future Chip-on-Board (COB) packaged polymer platform. The sealant, which blocks oxygen and other atmospheric gases, is a key step in our Company’s development towards a polymer modulator without a package, an important enabling technology for the industry. We plan to develop the sealant for commercial implementation in our future modulators. Recent results suggest that our electro-optic polymer sealant material displays encouraging barrier properties and is expected to translate to significant improvement in bare chip robustness against atmospheric gases, as compared to existing EO polymer commercial solutions in use today. While the initial measurements are highly promising, our Company plans to continue development work to further optimize the sealant material and barrier performance towards the chip-on-board goal.

On January 13, 2021, we announced the receipt of U.S. Patent number 10,886,694 that details an invention that allows electro-optic polymer modulators to be packaged in a hermetic environment using well-known, high-volume and low-cost fabrication processes that are available in a typical semiconductor fabrication foundry – improving suitability for mass production. Further, the design of this capsule package can improve both the reliability and the coupling interface between fiber optic cables and their laser sources for arrayed photonic integrated circuit solutions. The package can also interpose signals from an underlying circuit board to the polymer modulators, lasers, and other components for data transfer. The hermetic capsule is built from a semiconductor base that contains electrical and optical circuits and components. A hermetic capsule chamber is created by the design of a semiconductor lid that is sealed to the semiconductor base platform by a metallization process. Using standardized fabrication techniques we can now create a package that achieves the performance, reliability, cost, and volume requirements that has been a challenge for the photonics industry for years.

On May 11, 2021, we announced the receipt of U.S. Patent number 10,989,871 that details an invention that allows for improved protective polymer layers in modulators when designed into advanced integrated photonic platforms, better positioning them for high-volume manufacturing processes. The protective layers will enhance electro-optic polymer devices’ performance through higher reliability, better optical performance and enable the use of standardized manufacturing processes best suited for mass-production.

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On June 7, 2021, we announced that our company’s common stock was added to the Solactive EPIC Core Photonics EUR Index NTR as part of the index’s semi-annual additions. The index includes global public companies with a common theme of optoelectronics, photonics, and optical technologies in general that range from components, modules, manufacturers, and optical network system companies. This inclusion broadens our exposure to the capital markets community, as well as credibility with potential partners and customers.

On June 16, 2021, we announced test results from new modulators fabricated in 2021, which exceeded bandwidth design targets and achieved triple the data rate as compared to competing devices in use today. The breakthrough new devices demonstrated 3dB electro-optical with electrical bandwidths that exceed 100GHz – with measurements

coming close to our Company's state-of-the-art 110GHz test equipment capability. We expect this advancement to have a profound impact on the traffic flow on the internet.

On June 24, 2021, we announced the receipt of U.S. patent number 11,042,051 that details a breakthrough new device design that enables mass-volume manufacturing when designed into advanced integrated photonic platforms. The device design enhances reliability, improves optical mode control and most important, lowers by consumption through the use of direct-drive, low-voltage operation. The patent is entitled, "Direct drive region-less polymer modulator methods of fabricating and materials therefor" and is expected to open the opportunity for low power consumption electro-optic polymers to be developed into large foundry PDKs (process development kits) and be ready for mass volume commercialization. The patent emphasizes our technology platform using fabrication techniques that would naturally fit into foundry PDKs.

On August 4, 2021, we announced that we developed improved thermal design properties for electro-optic polymers used in our Polymer Plus™ and Polymer Slot™ modulators, enabling the speed, flexibility and stability needed for high-volume silicon foundry processes. We successfully created a 2x improvement in r33, while allowing higher stability during poling and post-poling. This provides better thermal performance and enables greater design flexibility in high-volume silicon foundry PDK (process development kit) processes.

On August 9, 2021, we announced the receipt of U.S. patent number 11,067,748 entitled "Guide Transition Device and Method" that covers a new invention that enables enhanced optical routing architectures for polymer-based integrated photonics that can be scaled with partner foundries. This new invention will enable innovative, highly scalable optical routing architectures for integrated photonic platforms. The patent provides novel optical waveguide transition designs using two planes of optical waveguides that are expected to be critical for optical signal routing and optical switching, opening the opportunity for high speed, energy efficient electro-optic polymers to be implemented into foundry PDKs (process development kits) to improve the performance of integrated photonic circuits. This breakthrough technology opens the door for advanced integrated photonics architectural design. We believe the simplicity of the design is ideal for production in foundries and will best position our Company to enable increased data traffic on the internet while using less power.

On September 1, 2021, our Company's common shares began trading on the Nasdaq Capital Market ("Nasdaq"). The Company's Nasdaq listing will help to expand our potential shareholder base, improve liquidity, elevate our public profile within the industry and should ultimately enhance shareholder value.

On September 15, 2021, we announced the receipt of the 2021 Industry Award for Optical Integration from the European Conference on Optical Communications (ECOC), a premier industry exhibition that was held in Bordeaux from September 13-15, 2021. ECOC created the fiber communication industry awards in six categories to put the spotlight on innovation happening within the industry. The awards recognize and highlight key industry achievements in advancing optical components, photonic integration, optical transport and data center innovation. The awards are selected from top industry players, representing significant innovation in photonics integration at our prestigious exhibition.

On September 16, 2021, we announced the achievement of world-record performance for a polymer modulator, as demonstrated in an optical transmission experiment by ETH Zurich, using our Company's proprietary, advanced Perkinamine™ chromophores and Polariton Technologies Ltd.'s newest plasmonic EO modulator, a silicon-photonics-based plasmonic racetrack modulator offering energy-efficient, low-loss, and high-speed modulation in a compact footprint. The groundbreaking results were presented as a post-deadline paper at the prestigious European Conference on Optical Communications (ECOC) industry exhibition and conference in Bordeaux on September 16, 2021. Polariton's plasmonic modulator transmitted 220 Gbit/s OOK and 408 Gbit/s 8PAM. Transmission of an optical signal was conducted over 100 m using a low-voltage electrical drive of 0.6Vp, an on-chip loss of 1 dB, and an optical 3 dB bandwidth of beyond 110 GHz.

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On January 3, 2022, we announced the publication of our patent application 20210405504A1 by the United States Patent and Trademark Office (USPTO) – entitled '*Nonlinear Optical Chromophores Having a Diamondoid Group Attached Thereto, Methods of Preparing the Same, and Uses Thereof*' – which significantly improves the overall stability and performance of our electro-optic polymers. The Company's electro-optic chromophores are designed to have one or more diamondoid molecular groups attached to the chromophore. When such chromophores are dispersed in a host polymer matrix, the electro-optic materials result in improved macroscopic electro-optic properties, increased poling efficiency, increased loading as well as increased stability of these materials after poling. The impact of this technology is that it will accelerate the path for very high-speed, low-power electro-optic polymers to be implemented into large foundry process development kits ("PDKs") to boost performance of integrated photonic circuits.

On January 3, 2022, we announced that we enhanced our Company's Foundry Process Development Kit Offering with the addition of Optical Grating Couplers. This expanded design tool kit will enable silicon foundries to implement PDKs and fabricate modulators and optical gratings in a single fab run, further enhancing modulator efficacy. We are continuing to work on additional design tool kit components to enable an expedited commercialization process through a more simplified manufacturing process for our foundry partners.

On January 3, 2022, we announced that we appointed respected industry leader Dr. Craig Ciesla to our Board of Directors and that retired director Dr. Joseph A. Miller transitioned to our Company's Advisory Board. Dr. Ciesla is currently the Vice President, Head of the Advanced Platforms and Devices Group at Illumina, a leading provider of DNA sequencing and array technologies. There he leads a team driving innovation in sequencing platforms, microfluidics, electronics, and nanofabrication. Prior to Illumina, he was Vice President of Engineering at Kaiam, where he was responsible for the development and production of 100G transceivers for the data-center market. He was also the founding CEO of Tactus Technology, an innovator in the user interface industry, where he was the co-inventor of Tactus' polymer morphing screen technology. Before Tactus he had a variety of roles at Intel, JDSU (now Lumentum), Bookham (now Oclaro) and Ignis Optics developing a wide range of products in the fiber-optics market. He started his career at Toshiba Research Europe, where he performed early terahertz images of skin cancer. Dr. Ciesla holds a BSc (Hons.) in Applied Physics and Ph.D. in Physics from Heriot-Watt University in Edinburgh.

On February 10, 2022, we announced breakthrough photostability results on our electro-optic polymer modulators that are compatible with high-volume silicon foundry processes. The improved photostability of our polymers are expected to minimize any optical losses and provide a more robust platform for silicon foundries. This breakthrough photostability performance is incredibly important as we optimize our polymers for high-volume silicon foundry processes.

As we move forward to diligently meet our goals, we continue to work closely with our packaging and foundry partners for the 50Gbaud and 100 Gbaud prototypes, and we are advancing our reliability and characterization efforts to support our prototyping. We partnered with silicon-based foundries in 2021 so that we can scale commercial volumes of electro-optic polymer modulator devices using large silicon wafers, and we are currently working to have our fabrication processes accepted into foundry PDKs (process development kits). These are the recipes that foundries use to manufacture devices in their fabrication plants.

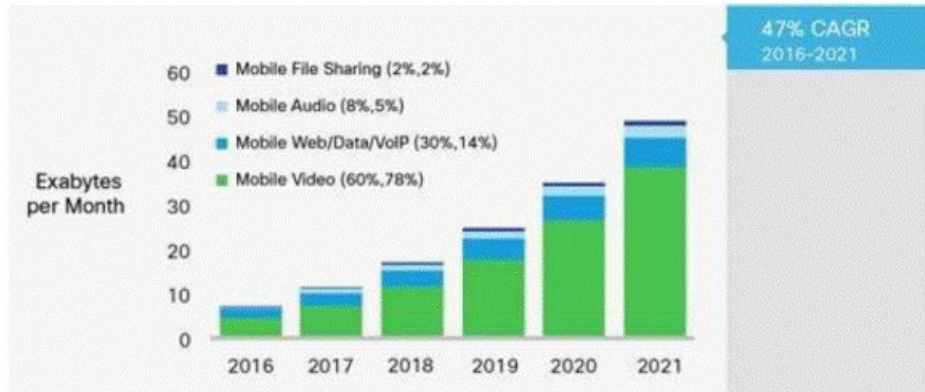
We are actively engaged with test equipment manufacturers of the most advanced test equipment to test our state-of-the-art polymer devices. We continue to engage with multiple industry bodies to promote our roadmap. We continue to fine tune our business model with target markets, customers, and technical specifications. Our business model includes the licensing of our strong IP and Patent portfolio, as well as technology transfer to entities such as foundries. Discussions with prospective customers are validating that our modulators are ideally suited for the datacenter and telecommunications markets that are over 10km in length. Details and feedback of what these prospective customers are seeking from a prototype are delivered to our technical team.

The Global Photonic Device Market

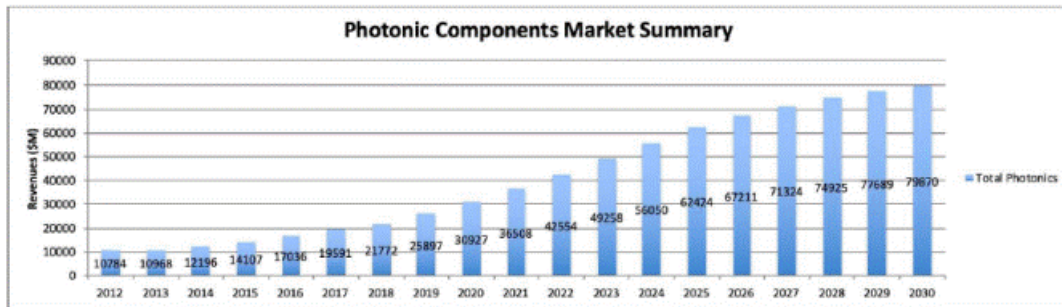
General Overview

Lightwave Logic has been reviewing the latest market data as well as its own internal data for its business strategy, and below we detail the global market dynamics both in terms of data traffic as well as how PIC based technologies will grow in the fiber communications segment of the market.

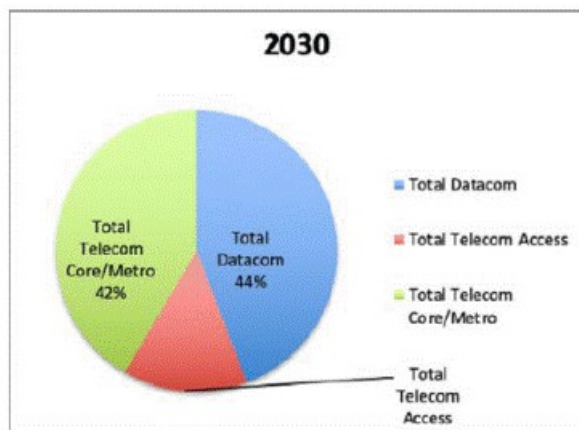
As we have already seen with products such as smart phones, lap top computers, and personal digital assistants (PDAs), Internet traffic, and especially mobile internet traffic is one of the important metrics that is being used to show activity in fiber communications, and particularly telecommunications as well as data communications (which includes datacenters and high-performance computing). Internet Protocol (IP) traffic has typically been used to gauge the amount of data that is being used on the internet as shown in the graph below (sourced from Cisco VNI in 2019). The metric is Exabytes per month. An Exabyte is 1E18 which is 1000 Petabytes, or 1000,000 Terabytes or a billion Gigabytes of data. As seen from the graph which has a strong growth of 47% CAGR (2016-2021) of mobile internet traffic, with the majority mobile traffic being driven by mobile video with things such as Youtube etc. The traffic rates are fast approaching the metric of Zetta which is 1E21 bytes of data. Some estimates are discussing the further metric of Yotta which is 1E24 bytes of data over the next decade, which is also expected to be driven for the most part by mobile video.



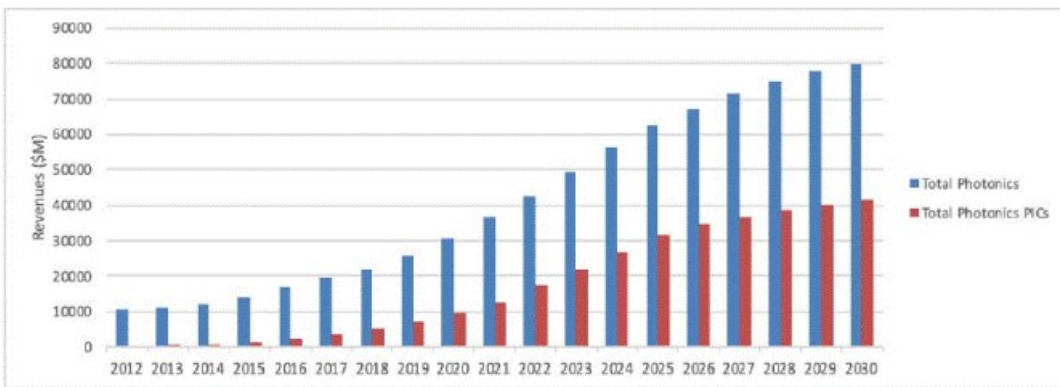
Within the overall market trends of IP traffic growth and in particular mobile video, the internet will need to be able to support high volumes of data traffic. In order to do this, the fiber-optic infrastructure that allows data to be communicated between network nodes such as datacenters, within datacenters, and optical network switches etc., has to be upgraded. Today, fiber-optic networks are a combination of long, medium and short optical interconnects that range from 3 meters (or 1yard) to over 1000km depending on application in the optical network. Optical components, typically known as photonics components are used to build the fiber-optic infrastructure and consist of things such as: laser diodes, photodetectors, multipliers, modulators, transceivers etc. These are known as discrete components, while a mix of these components that are integrated or connected on a single substrate (such as silicon, InP, GaAs etc.) are called PICs (Photonic Integrated Components). All of these components are packaged and put into modules that make up the photonics market. The summary photonics market has been reviewed in 2020 and is shown below. The summary photonics market is forecast to grow to \$80B by 2030 with a 17% CAGR (2020-30) that includes both discrete and PIC photonic components. The summary photonics components market is forecasted to reach \$42B in 2022.



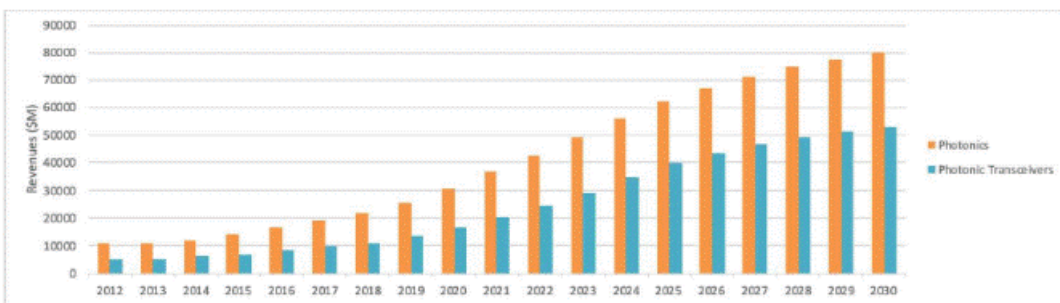
Within the summary photonics components market, three major segments exist: Telecom core/metro, Telecom access, and Datacom. The Telecom core/metro segment is forecast to grow to \$33B by 2030 with a 13% CAGR (20-30) or 42% of the market, and the Datacom segment is forecast to grow to \$35B by 2030 with 22% CAGR (20-30) or 44% of the market. As can be seen from the graph below, the growth of the Telecom core/metro and Datacom segments are forecasted to be very strong over the next decade and provide the engine for growth in the overall global photonics components market.



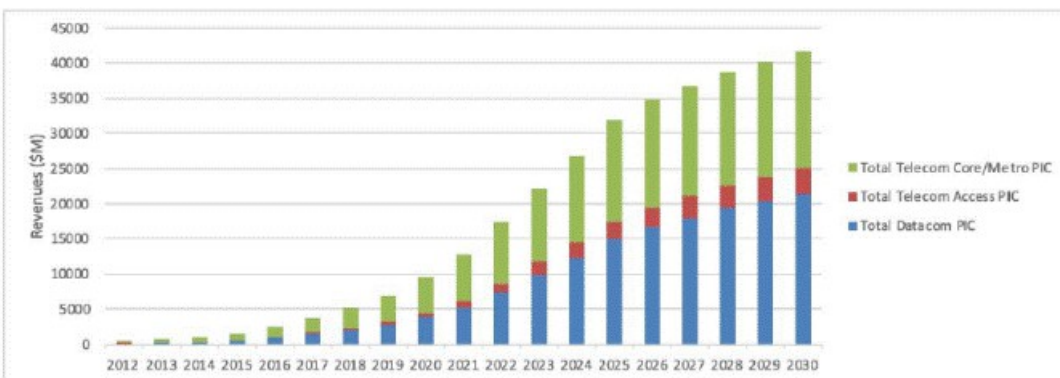
One of the key metrics that is needed for any overall market analysis is how photonics components will grow over the next decade from a PIC perspective. This is important as the trend to integrate photonics components is beginning to accelerate. The trend has been driven by customer applications that require smaller photonic component solutions, lower power, high data rates, larger buildings for longer interconnect lengths, and more economic in terms of \$/Gbps. PIC technologies, i.e. those technologies that include integrated photonics are forecasted to grow to ~\$41B by 2030 with 29% CAGR (20-30). These technologies include InP which is the current incumbent, GaAs, and other newer integrated technology solutions such as SiP (silicon photonics), polymer photonics, and dielectric photonics. The forecast of ~\$41B is approximately 52% of the summary photonics components market by 2030, which represents commercial acceptance for PIC based technologies over the next decade. This also means while PIC based technologies are quickly approaching ~\$20B in the next couple of years, PIC based technologies are forecasted to grow significantly over the next decade.



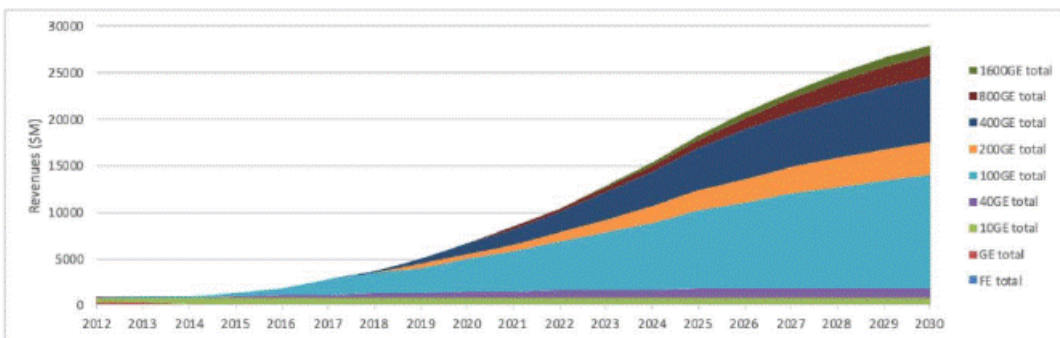
While the rise of PIC based technologies is exciting, what also is exciting in the photonics component market is the rise of fiber-optic transceivers. Transceivers are small boxes located at the end of each fiber-optic link that house photonics components and PIC components which send and receive data. While the global overall photonic components market is expected to reach \$80B by 2030, the photonics transceivers sub-segment is forecasted to grow to \$53B by this time. This represents that transceivers will accelerate to 66% of the global overall photonics market by 2030 and become a major driver for optical networking over the next decade.



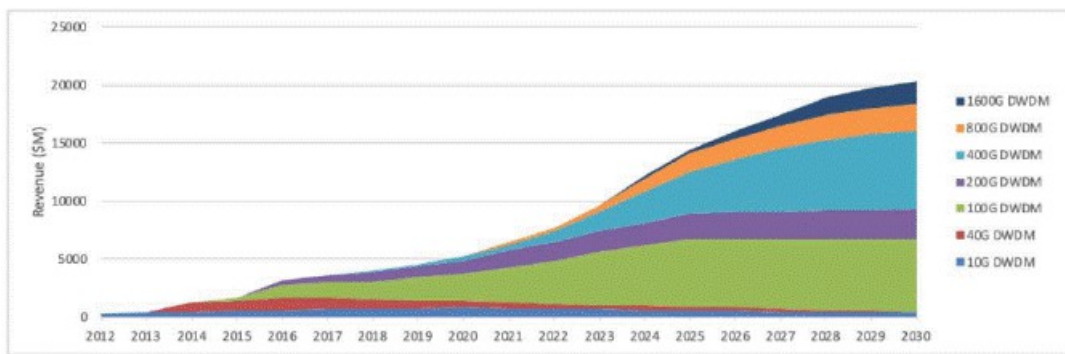
The market for PIC based technologies is expected to grow significantly in telecom core/metro over the next decade. Of the three application markets, the telecom core/metro and datacom markets are expected to be the driver for PIC based technologies. While PIC based technologies are expected to grow to \$41B by 2030, the datacom PIC forecast is expected to reach \$21B by 2030 with 29% CAGR (20-30), and the telecom core/metro is forecast to reach \$16B by 2030 with 28% CAGR (20-30).



Two of the key market segments in fiber optic transceivers are Ethernet and DWDM. Within the Ethernet market segment, there are a range of datarates that are utilized. Over the next decade, the dominance of 1GE (1Gbps) and 10GE (10Gbps) will be replaced by significant growth of 100GE (100Gbps) and 400GE (400Gbps). Ethernet based fiber optic transceivers are expected to grow to \$28B by 2030 with 27% CAGR (20-30). The Ethernet revenues will be driven by 100GE and 400GE platforms. Also, during the next decade increasing datarates of 800GE and 1600GE will be implemented into the optical network with forecasted revenues in the \$5B range.

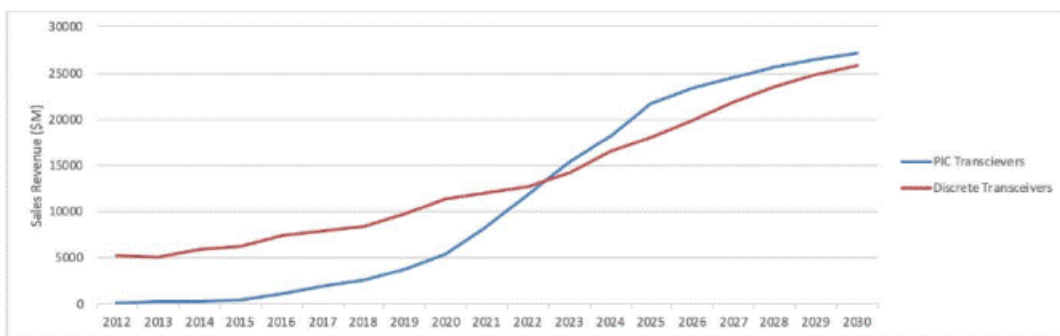


DWDM fiber optic transceivers are expected to reach \$20B by 2030 with 27% CAGR (20-30). Like the Ethernet transceiver market, the DWDM transceiver market will also be driven in revenue by the 100G and 400G datarate platforms. The 100G and 400G DWDM markets are expected to reach \$6B and \$7B by 2030 respectively. DWDM will also benefit from increased datarates of 800G and 1600G by 2030, also in the \$5B forecasted revenue range.



Fiber optic transceivers are typically pluggable form-factors such as SFF, SFP, CFP, and QSFP etc. Over the next decade new smaller pluggable transceiver modules will emerge such as QSFP-DD and OSFP which cater to data rates of 100G and beyond. While transceiver modules will trend to smaller footprints, lower power consumption and higher data rates, a new trend of co-packaging is expected to emerge. With co-packaging, transceiver modules are designed to be in the center of printed circuit boards and line cards as opposed to plugged in from the outside of the system. This may allow for innovation in optical switch, optical router designs at the system level. Even though the form factor of optical switches and optical routers are expected to evolve, the underlying drive for high speed photonic components, and those components that are PIC based is expected to increase over the next decade. Our electro-optic polymer technology is the engine for both fiber optic transceivers both in pluggable form-factors as well as co-packaging form-factors.

The graph below shows the PIC transceiver forecast to 2030. PIC transceivers are forecast to reach \$27B by 2030 growing from ~\$9B in 2019. What is more interesting is that by about 2023, PIC transceivers are expected to surpass discrete photonic component transceivers from a revenue standpoint. This means that the trend to integrate photonics components inside a transceiver is gaining acceptance, driven by the customer interest for smaller, denser, and higher performance metrics of transceivers. This trend is ideal for our polymer based integrated photonics platform to have a huge impact in the market segment over the next decade.



As the Company is developing polymer based photonic devices such as fiber-optic modulators, these devices translate electric signals into optical signals and allow laser-based technology to operate effectively at 50Gbps, 100Gbps, and beyond. Lasers with modulators are used in fiber communication systems to transfer data over fiber-optic networks today and are expected to be a key driver in photonics components for PIC based technological solutions over the next decade. Optical data transfer using lasers and modulators is significantly faster and more efficient than transfer technologies using only electric signals, permitting more cost-effective use of bandwidth for broadband Internet and voice services.

Our Target Markets

Cloud computing and data centers

Big data is a general term used to describe the voluminous amount of unstructured and semi-structured data a Company creates – data that would take too much time and cost too much money to load into a relational database for analysis. Companies are looking to cloud computing in their data centers to access all the data. Inherent speed and bandwidth limits of traditional solutions and the potential of organic polymer devices offer an opportunity to increase the bandwidth, reduce costs and improve speed of access.

Datacenters have grown to enormous sizes with hundreds of thousands and even millions of servers in a single datacenter. The number of so-called "hyperscale" datacenters are expected to continue to increase in number. Due to their size, a single "datacenter" may consist of multiple large warehouse-size buildings on a campus or even several locations distributed around a metropolitan area. Data centers are confronted with the problem of moving vast amounts of data not only around a single data center building, but also between buildings in distributed data center architecture. Links within a single datacenter building may be shorter than 500 meters, though some will require optics capable of 2 km. Between datacenter buildings, there is an increasing need for high performance interconnects over 10km in reach.

Our modulators are suitable for single-mode fiber optic links. We believe that our single mode modulator solutions will be competitive at 500m to 10km link distances, but it will be ideally suited at greater than 10km link distances.

Telecommunications/Data Communications

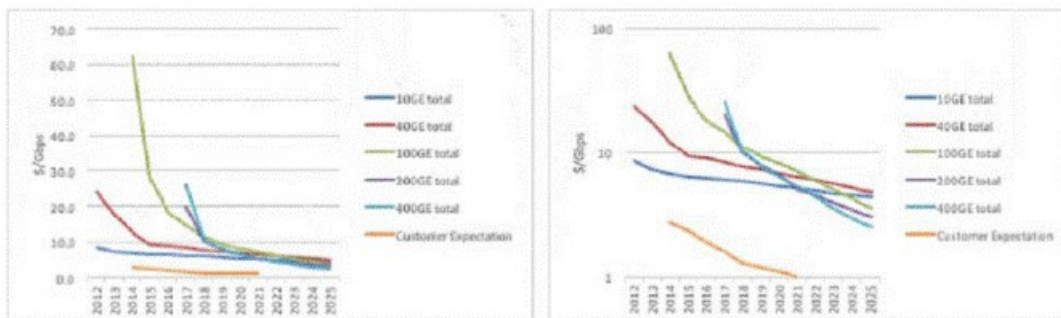
The telecommunications industry has evolved from transporting traditional analogue voice data over copper wire into the movement of digital voice and data. Telecommunication companies are faced with the enormous increasing challenges to keep up with the resulting tremendous explosion in demand for bandwidth. The metropolitan network is especially under stress now and into the near future. Telecommunications companies provide services to some data center customers for the inter-data center connections discussed above. 5G mobile upgrade, autonomous driving and IoT are expected to increase the need for data stored and processed close to the end user in edge data centers. This application similarly requires optics capable of very high speeds and greater than 10 km reach.

Industry issues of scaling

The key issues facing the fiber-optic communications industry are the economic progress and scalability of any PIC based technological platform. The polymer platform is unique in that it is truly scalable. Scalable means being able to scale up for high speed data rates, while simultaneously being able to scale down in cost. This allows a competitive cost per data rate or cost per Gbps metric to be achieved.

Fiber optic datacenter and high-performance computing customers want to achieve the metric of \$1/Gbps @ 400Gbps (this essentially means a single mode fiber optic link that has a total cost of \$400 and operates with a data rate of 400Gbps → which also means that each transceiver at each end of the fiber optic link must be able to be priced at \$200),

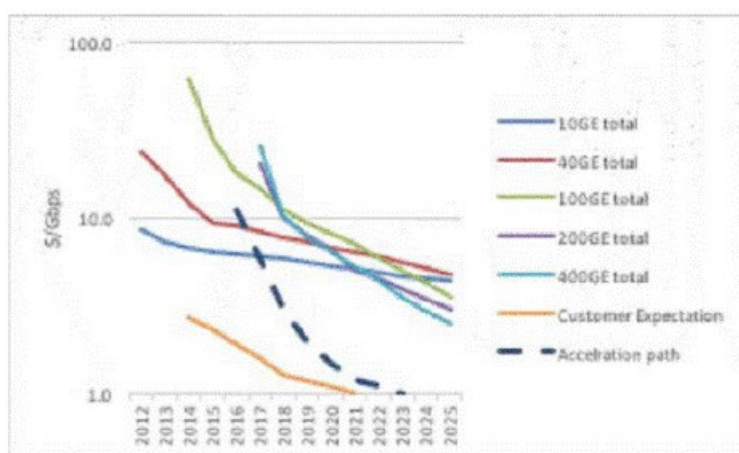
but as industry tries to match this target, it is already falling behind as can be seen in the Figure below which plots generic typical PIC based technology:



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In the above figures that forecast \$/Gbps to 2025 (where the left-hand graph is a linear vertical scale, and the right-hand graph is a log scale), it can be seen that the orange curve plots the customer expectation, while the other color curves show \$/Gbps improvement over time for various high-speed data rate transceivers using PIC based technologies. A gap is appearing between what customer expect and what the technologists can produce.

Polymers play an important role in PICs over the next decade as they can reduce or close the gap between customer expectations and technical performance through effective scaling increase of high performance with low cost. This is shown below how polymers have the potential to scale to the needs of the customers over the next 5 years.



Some of the things needed to achieve the scaling performance of polymers in integrated photonics platforms is within sight today:

1. Increased r_{33} (which leads to very low V_{π} in modulator devices) and we are currently optimizing our polymers for this.
2. Increase temperature stability so that the polymers can operate at broader temperature ranges effectively, where we have made significant progress over the past few years.
3. Low optical loss in waveguides and active/passive devices for improved optical budget metrics which is currently an ongoing development program at our Company.
4. Higher levels of hermeticity for lower cost packaging of optical sub-assemblies within a transceiver module, where our advanced designs are being implemented into polymer-based packages.

Scalability in terms of cost reduction and high volume manufacturing can be enhanced by:

1. Leverage of commercial silicon photonics manufacturing capacity through the use of silicon-based foundries. Our Polymer Plus™ platform seeks to be additive to standard silicon photonics circuits.
2. Reduction of optical packaging costs by integration at the chip level of multiple modulators and also with other optical devices. Our P2IC™ platform seeks to address device integration.

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Business Strategy

Our business strategy anticipates that our revenue stream will be derived from one or some combination of the following: (i) technology licensing for specific product application; (ii) joint venture relationships with significant industry leaders; and (iii) the production and direct sale of our own electro-optic device components. Our objective is to be a leading provider of proprietary technology and know-how in the electro-optic device market. In order to meet this objective, we intend to:

- Further the development of proprietary organic electro-optic polymer material systems
- Develop photonic devices based on our P²IC™ technology
- Continue to develop proprietary intellectual property
- Grow our commercial device development capabilities
- Partner with silicon-based foundries who can scale volume quickly
- Grow our product reliability and quality assurance capabilities
- Grow our optoelectronic packaging and testing capabilities
- Grow our commercial material manufacturing capabilities
- Maintain/develop strategic relationships with major telecommunications and data communications companies to further the awareness and commercialization of our

- technology platform
- Continue to add high-level personnel with industrial and manufacturing experience in key areas of our materials and device development programs.

Create Organic Polymer-Enabled Electro-Optic Modulators

We intend to utilize our proprietary optical polymer technology to create an initial portfolio of commercial electro-optic polymer product devices with applications for various markets, including telecommunications, data communications and data centers. These product devices will be part of our proprietary photonics integrated circuit (PIC) technology platform.

We expect our initial modulator products will operate at data rates at least 50 Gbaud (capable of 50 Gbps with standard data encoding of NRZ and 100 Gbps with more complex PAM-4 encoding). Our devices are highly linear, enabling the performance required to take advantage of the more advanced complex encoding schemes. We are currently developing our polymer technology to operate at the next industry node of 100Gbaud.

Our Research and Development Process

Our research and development process consist of the following steps:

- We develop novel polymer materials utilizing our patented and patent pending technology to meet certain performance specifications. We then develop methods to synthesize larger quantities of such material.
- We conduct a full battery of tests at the completion of the synthesis of each new polymer material to evaluate its characteristics. We also create development strategies to optimize materials to meet specifications for specific applications. We model and simulate each new polymer material so that we can further understand how to optimize the material for device operation.
- We integrate data from the material characterization and test results to fabricate devices. We analyze device-testing results to refine and improve fabrication processes and methods. In addition, we investigate alternative material and design variations to possibly create more efficient fabrication processes.
- We create an initial device design using simulation software. Following device fabrication, we run a series of optical and electronic tests on the device.
- We are developing PDKs with commercial silicon-based foundries so that our technology can transfer seamlessly to larger silicon wafer fabrication plants, and scale in volume quickly.

We have and expect to continue to make significant operating and capital expenditures for research and development. Our research and development expenses were \$12,476,040 and \$4,590,545 for the years ended December 31, 2021 and 2020, respectively.

Our Proprietary Products in Development

As part of a two-pronged marketing strategy, our Company is developing several optical devices, which are in various stages of development and that utilize our polymer optical materials. They include:

Ridge Waveguide Modulator, Polymer Stack™

Our ridge electro-optic waveguide modulator was designed and fabricated in our in-house laboratory. The fabrication of our first in-house device is significant to our entire device program and is an important starting point for modulators that are being developed for target markets. We have multiple generations of new materials that we will soon be optimizing for this specific design. In September 2017 we announced that our initial alpha prototype ridge waveguide modulator, enabled by our P²IC™ polymer system, demonstrated bandwidth performance levels that will enable 50 Gbaud modulation in fiber-optic communications. This device demonstrated true amplitude (intensity) modulation in a Mach-Zehnder modulator structure incorporating our polymer waveguides. This important achievement will allow users to utilize arrays of 4 x 50 Gbaud (4x 100 Gbps) polymer modulators using PAM-4 encoding to access 400 Gbps data rate systems. These ridge waveguide modulators are currently being packaged with our partner into prototype packages.

These prototype packages will enable potential customers to evaluate the performance at 50 Gbaud. Once a potential customer generates technical feedback on our prototype, we expect to be asked to optimize the performance to their specifications. Assuming this is successful, we expect to enter a qualification phase where our prototypes will be evaluated more fully.

In parallel, we are developing modulators for scalability to higher data rates above 50 Gbaud. In September 2018, we showed in conference presentations the potential of our polymer modulator platform to operate at over 100 GHz bandwidth. This preliminary result corresponds to 100 Gbaud data rates using a simple NRZ data encoding scheme or 200 Gbps with PAM-4 encoding. With 4 channel arrays in our P²IC™ platform, the Company thus has the potential to address both 400 Gbps and 800 Gbps markets. While customers may start the engagement at 50 Gbaud, we believe potential customers recognize that scalability to higher speeds is an important differentiator of the polymer technology.

We believe the ridge waveguide modulator Polymer Stack™ represents our first commercially viable device and targets the fiber optics communications market. We have completed internal market analysis and are initially targeting interconnect reach distances of greater than 10km. In these markets, the system network companies are looking to implement modulator-based transceivers that can handle aggregated data rates 100 Gbps and above. The market opportunity for greater than 10km is worth over \$1B over the next decade.

Ridge Waveguide Modulator, Polymer Plus™

Using the ridge waveguide design, we are developing a more compact modulator to be implemented directly with existing integrated photonics platforms such as silicon photonics and Indium Phosphide. As our electro-optic polymers are applied in liquid form, they can be deposited as a thin film coating in a fabrication clean room such as may be found in semiconductor foundries. This approach we call Polymer Plus™. The advantage of this approach is that it allows existing semiconductor integrated photonics platforms such as silicon photonics and indium phosphide to be upgraded with higher speed modulation functionality with the use of polymers in a straight-forward and simple approach. Further, our polymers are unique in that they are stable enough to seamlessly integrate into existing CMOS, Indium Phosphide (InP), Gallium Arsenide (GaAs), and other semiconductor manufacturing lines.

A large majority of commercial silicon photonics platforms utilize large silicon photonics foundries such as those that manufacture IC products for a number of applications such as communications, computing, consumer, etc. In order to seamlessly integrate our polymer materials to upgrade for example, silicon photonics designs, partnering with a silicon foundry is necessary.

Advanced Modulator Structures

As part of supporting further improvement and scalability of our platform, we continue to explore more advanced device structures. Our functional polymer photonics slot waveguide modulator utilizes an existing modulator structure with one of our proprietary electro-optic polymer material systems as the enabling material layer and is functional as an operating prototype device.

Preliminary testing and initial data on our polymer photonics slot waveguide modulators demonstrated several promising characteristics. The tested polymer photonic chip had a 1-millimeter square footprint, enabling the possibility of sophisticated integrated optical circuits on a single silicon substrate. In addition, the waveguide structure was approximately 1/20 the length of a typical inorganic-based silicon photonics modulator waveguide.

With the combination of our proprietary electro-optic polymer material and the extremely high optical field concentration in the slot waveguide modulator which is called Polymer Slot™, the test modulators demonstrated less than 2.2 volts to operate. Initial speeds exceeded 30-35 GHz in the telecom, 1550 nanometer frequency band. This is equivalent to 4 x 10Gbps, inorganic, lithium niobate modulators that would require approximately 12-16 volts to move the same amount of information.

We are continuing our collaborative development of our polymer photonic slot waveguide modulators (Polymer Slot™) with a partner that has advanced device design capabilities. We are now designing Polymer Slot™ modulators to operate at data rates greater than 50 Gbaud.

Our Long-Term Device Development Goal - Multichannel Polymer Photonic Integrated Circuit (P²IC™)

Our P²IC™ platform is positioned to address markets with aggregated data rates of 100 Gbaud, 400 Gbaud, 800 Gbaud and beyond. Our P²IC™ platform will contain a number of photonic devices that may include, over and above polymer-based modulators, photonic devices such as lasers, multiplexers, demultiplexers, detectors, fiber couplers.

While our polymer-based ridge waveguide and slot modulators are currently under development to be commercially viable products, our long-term device development goal is to produce a platform for the 400 Gbps and beyond transceiver market. This has been stated in our photonics product roadmap that is publicly available on our website. The roadmap shows a progression in speed from 50 Gbaud based ridge waveguide modulators to 100 Gbaud based ridge waveguide modulators. The roadmap shows a progression in integration in which the modulators are arrayed to create a flexible, multichannel P²IC™ platform that spans 100 Gbps, 400 Gbps, 800 Gbps, and a scaling philosophy that will grow to 1.6 Tbps aggregated data-rate markets.

We showed bandwidths of polymer-based modulator devices at a major international conference (ECOC – European Conference on Optical Communications 2018) with bandwidths that exceeded 100GHz. We noted that to achieve 100Gbaud, the polymer-based modulator only needs to achieve 80GHz bandwidth. During ECOC 2019, we showed environmental stability. We continue to develop our polymer materials and device designs to optimize additional metrics. We are now optimizing the device parameters for very low voltage operation.

Other Potential Applications for Our Products

We believe that there are myriad potential applications for our organic polymer materials and devices outside of our initial focus of data communications, telecommunications and data centers. These potential applications encompass areas as diverse as military, space, optical computing, and life sciences. We believe that as viable organic polymer materials gain acceptance, their increased flexibility, functionality and low cost will create new applications that may not yet be technically feasible. Two such future applications with revolutionary potential are:

All-Optical Switches

An all-optical switch is one that enables signals in optical fibers or networks to be selectively switched from one fiber or circuit to another. Many device designs have been developed and commercialized in today's telecom networks to effect optical switching by using mechanical or electrical control elements to accomplish the switching event. Future networks will require all-optical switches that can be more rapidly activated with a low energy and short duration optical (light) control pulse.

Multi-Channel Optical Modem

The availability of low cost electro-optic modulators will enable low cost multichannel optical modems that will use many wavelengths in parallel and employ high efficiency modulation techniques such as QAM (quadrature amplitude modulation). Such modems would enable an order of magnitude increase in the Internet capacity of legacy fiber. Our Company is in the early feasibility stage of such a multichannel optical modem.

Our Past Government Program Participation

Our Company has been a participant in several vital government sponsored research and development programs with various government agencies that protect the interests of our country. The following is a list of some of the various divisions of government agencies that have provided us with advisory, financial and/or materials support in the pursuit of high-speed electro-optic materials. We are not currently partnered with, strategically related to, or financially supported by any governmental agency at this time, however, we may explore future opportunities as our Company grows and gains the additional resources and personnel necessary to support these efforts. Our previous relationships included:

- National Reconnaissance Office (NRO)
- Properties Branch of the Army Research Laboratory on the Aberdeen Proving Grounds in Aberdeen, Maryland.
- Defense Advance Research Project Agency (DARPA)
- Naval Air Warfare Center Weapons Division in China Lake, California
- Air Force Research Laboratory at Wright-Patterson Air Force Base in Dayton, Ohio

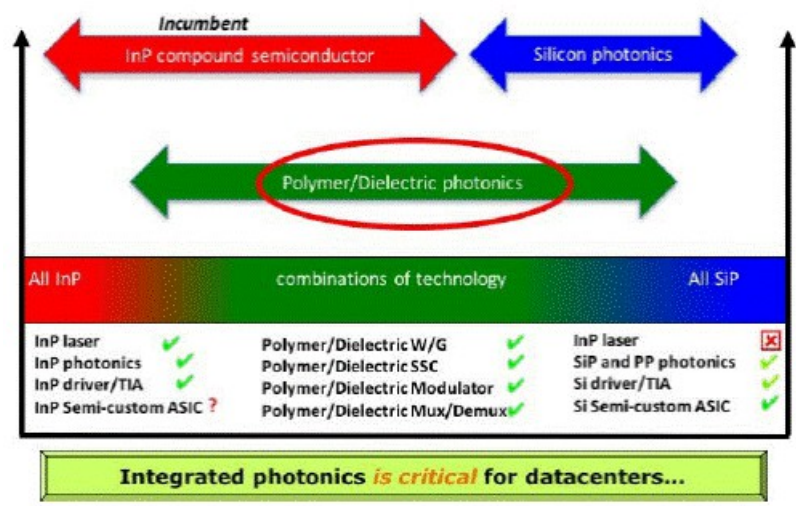
Our Competition

Competitive Technologies - PIC Based Technologies

PIC technologies have historically been driven using III-V compound semiconductors, namely InP, although GaAs remains a strong PIC platform, and is expected to strengthen via the VCSEL based 3D sensing applications. Indium Phosphide has been used since the 1980s as the first PIC platform with laser modulator chips where both the laser and modulator were fabricated monolithically. Since the 1980s, there have been InP based transmitters, receivers, and other functional elements that all support the fiber-communications industry. In fact, over the past 3 decades, the fiber communications industry has driven the increased performance, miniaturization and simplicity in packaging for PIC based technologies. Also, back in the 1980s, 'optoelectronics' was the key word to describe having both electronic and photonic functions or devices on a single chip. This was known in early publications as an optoelectronics integrated circuit (OEIC). Today optoelectronics is synonymous with 'photonics', and hence the common-place use of 'photonics integrated circuits' for PICs.

In the below figure, it can be seen in red that the incumbent technology for PICs is InP. InP is capable of providing a number of devices and opportunities in both electronics as well as photonics. InP main weakness from a function standpoint is that although it can provide HFETs, JFETs, bipolar electronic devices, it has not been able to successfully penetrate LSI, or VLSI with digital IC circuitry. Chips such as ASICs are not practically available with the InP platform – mostly due to advancement in electronic

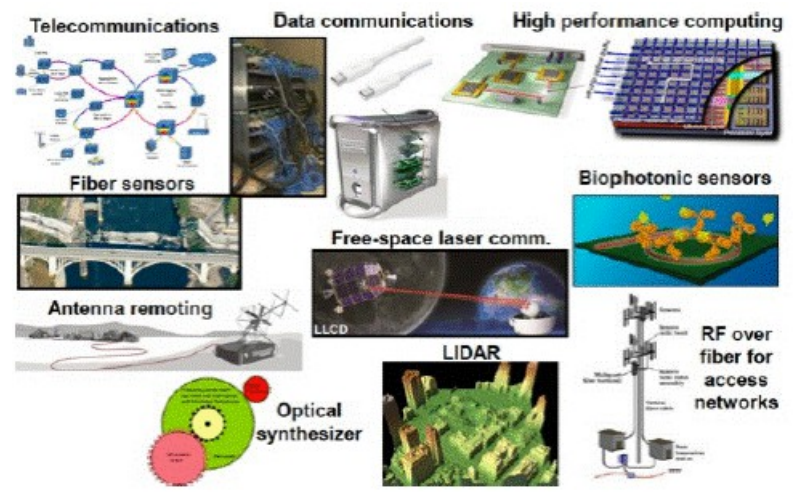
transistor design, and also through limited maturity in large format wafer manufacturing. Today the majority of InP fabrication is based on 4" or 100mm wafers, and only in the past year have folks been seriously looking at 6" or 150mm InP wafer infrastructure. From the photonics standpoint, there are very good reasons why InP is the incumbent technology – it provides world class performance in lasers, modulators, simple electronics such as drivers and TIAs (transimpedance amplifiers), as well as highly performing active and passive devices such as SOAs, waveguides, spot-size converters, and mux/demux blocks such as AWG and Eschelle gratings.



Over the past decade, the rise of silicon-based photonics has accelerated quickly (as can be seen in blue in the Figure). Silicon has a huge history in electronics, and it's been said by many that if the existing infrastructure could be utilized effectively, then the cost of producing photonics with similar fabrication, design, testing, and simulation tools, would become competitive with the current incumbent technology: InP. As can be seen by the figure, silicon is capable of handling many photonics devices in addition to all electronic functionality with CMOS and BiCMOS based technologies. The only photonic device that remains impossible (at least for the time being) is the emitter or laser where light is generated. This has spawned a new segment for silicon photonics (SiP) where engineers and scientists have developed creative ways to implement InP into device, wafer, and epi-designs that are silicon based. These solutions are typically referred to as heterogeneous solutions or Hybrid PICs where both InP and silicon are utilized to create PIC platforms with emitter or laser-based functionality.

While the red area of the Figure represents the incumbent technology InP, the blue areas, Silicon Photonics, the middle areas that are shaded green represent PIC based technologies that can utilize either III-V compound semiconductor platforms such as InP, GaAs, even GaN, as well as silicon platforms such as silicon wafers, and various combinations of silicon-based materials such as SOI (silicon on insulator), SiGe etc. The green areas are represented by both polymers and dielectric materials that can be deposited onto either silicon or III-V material wafers. These combinations of technology allow flexibility in PIC designs where both polymers and dielectrics can provide a multitude of active and passive photonic devices such as: waveguides (W/G), spot size converters (SSC), modulators (such as Mach Zehnder and slot types), multipliers and demultipliers (Mux/Demux variants such as AWGs, MMI, and Echelle gratings). The interesting part of the polymer and dielectric technology is that combinations of active and passive devices can be mixed and matched with either III-V compound devices as well as silicon based, heterogeneous based devices to design more effective and efficient PICs. For polymers, very low voltage can be utilized for low cost, low power consumption, very high-speed modulators that can be deposited onto a semiconductor platform. For dielectric photonics, very low temperature sensitivity mux/demux devices (such as athermal designs) can be deposited onto a semiconductor platform. As can be seen from the Figure, polymer and dielectric technology suffers from that the fact that high density ICs and laser-based emitters are not available but could be integrated with the appropriate designs for the PIC with III-V compound semiconductors and/or silicon based technology that have both DSP/ASIC type circuits and laser emitters.

PIC technologies have a number various and broad applications as can be seen by the Figure below. In this Figure applications range from fiber optic communications, automotive/LIDAR for self-driving vehicles, sensing, internet of things, bio-photonics, healthcare, industrial, military, high performance computing etc.



PIC technologies are based upon semiconductor wafers (such as III-V compound semiconductors – InP, GaAs etc.) as well as silicon wafers (which can be tailored to become SiGe heterogeneous, SOI, etc.). As these platforms are semiconductor based, the wafers are processed in fabs or fabrication facilities to produce devices. As a general rule, silicon has the largest wafers with 8" (200mm) and 12" (300mm) format discs. GaAs typically is running 3" (75mm), 4" (100mm) and 6" (150mm) wafers in production fabs or fabrication plants around the world. There is an expectation that GaAs will eventually move to 8" (200mm) wafers in the next 5 years. InP is in production today on 2" (50mm), 3" (75mm) and 4" (100mm) wafers with an expectation to move to 6" (150mm) in the next 5 years. Heterogeneous solutions with silicon photonics that utilize materials such as SiGe and InP are typically 8" (200mm) and 12" (300mm) format wafers. Polymer photonics can be deposited on either III-V compound semiconductor wafers as well as silicon wafers which

makes it suitable for the next generation of PIC based technological platforms for the fiber communications industry.

The supply chain for the PIC industry starts with the wafer development and continues through epitaxial growth, device fabrication, optical sub-assembly, module or transceiver builds, and sub-systems which are implemented into optical networking applications. Within these supply chain segments, a number of combinations of technology can be utilized. For example, CMOS IC circuits can be fabricated onto silicon wafers together with silicon photonics, heterogeneous solutions, that could have the advantage of polymer active devices, and dielectric passive devices on board. InP may be combined with polymer photonics to house on-board or on-wafer emitters to source light for the optical signaling with modulators. Included in the wafers can be combinations of electrical and optical circuitry. Electrical circuitry is usually set up as both as single as well as multilevel interconnects. Optical circuitry is usually set up as a waveguide or optical layer as part of the device fabrication design. PICs can interconnect electrical devices with photonic devices, and also increase chip functionality through the use of electrical and optical active and passive device solutions. Polymer technologies can provide active device function through for example Mach Zehnder modulators, as well as providing passive device function with waveguides, multipliers, and demultipliers.

Competitors

The markets we are targeting for our electro-optic polymer technology are intensely competitive. Among the largest fiber-optic component manufactures are II-VI, Lumentum, Molex, Broadcom, Intel, and Ciena. Additionally, large inorganic modulator component manufacturers include Sumitomo Osaka Cement, Fujitsu, and ThorLabs. These companies are heavily invested in the production of crystalline-based electro-optic modulator technologies, as well as the development of novel manufacturing techniques and modulator designs.

Our Plan to Compete

We believe that as our organic polymer technology gains industry acceptance, we will be poised to obtain a significant portion of the component manufacturing market. Electro-optic polymers demonstrate several advantages over other technologies, such as inorganic-based technologies, due to their reduced manufacturing and processing costs, higher performance and lower power requirements. Our patented organic polymers and future electro-optic photonic devices have demonstrated significant stability advantages over our known competitor's materials.

We believe the principal competitive factors in our target markets are:

- The ability to develop and commercialize highly stable optical polymer-based materials and optical devices in commercial quantities.
- The ability to obtain appropriate patent and proprietary rights protection.
- The ability to create commercial silicon-based PDKs for our electro-optic polymers
- Lower cost, high production yield for these products.
- The ability to enable integration and implement advanced technologies.
- Strong sales and marketing, and distribution channels for access to products.

We believe that our current business planning will position our Company to compete adequately with respect to these factors. Our future success is difficult to predict because we are an early stage company with all of our potential products still in development.

Many of our existing and potential competitors have substantially greater research and product development capabilities and financial, scientific, marketing and human resources than we do. As a result, these competitors may:

- Succeed in developing products that are equal to or superior to our potential products or that achieve greater market acceptance than our potential products.
- Devote greater resources to developing, marketing or selling their products.
- Respond quickly to new or emerging technologies or scientific advances and changes in customer requirements, which could render our technologies or potential products obsolete.
- Introduce products that make the continued development of our potential products uneconomical.
- Obtain patents that block or otherwise inhibit our ability to develop and commercialize our potential products.
- Withstand price competition more successfully than we can.
- Establish cooperative relationships among themselves or with third parties that enhance their ability to address the needs of our prospective customers.
- Take advantage of acquisition or other opportunities more readily than we can.

Employees and Human Capital

We currently have 19 full-time employees, and we retain several independent contractors on an as-needed basis. Based on our current development plan we expect to add 5 additional full-time employees in 2022.

People

As a technology and innovation-driven company, we depend on a highly skilled workforce. Attracting, developing, advancing and retaining the best talent is critical for us to execute our strategy and grow our business. Individuals with technical, engineering, chemistry and other science backgrounds, experience, or interests are particularly important for us to succeed. We strive to advance a diverse, equitable and inclusive work environment.

Technical Team

Our team is composed of world-class technologists, including materials scientists, design engineers, device engineers, synthetic organic chemists, test and material engineers and technicians.

Diversity, Inclusion and Equity

We recognize and view equity as key to our success. We work to create a culture of diversity and inclusion so that all of our employees feel they are respected and treated equally, regardless of gender, race, ethnicity, age, disability, sexual orientation, gender identity, cultural background or religious belief. We strive to provide our employees a diverse, equitable, and inclusive work environment.

Compensation and benefits

Our total rewards package includes market-competitive pay, stock option grants and bonuses, healthcare benefits, retirement savings plans, life insurance, disability insurance, paid time off and family leave, and flexible work schedules.

The principal purposes of our equity incentive plan is to attract and retain employees who will contribute to our Company's long range success, to provide incentives that align the interests of our employees with those of our shareholders, and to promote the success of our Company's business.

Health and Safety

We are committed to providing a healthy environment and safe workplace by operating in accordance with established health and safety protocols within our facility and maintaining a strong health and safety compliance program. We prioritize, manage, and carefully track safety performance at our facility and integrate sound safety practices in every aspect of our operations. We regularly conduct self-assessments to examine our safety culture and processes. In response to the COVID-19 pandemic and related mitigation measures, and in conjunction with federal and statewide mandates, we implemented certain changes in an effort to protect our employees from COVID-related exposures. For example, we implemented social distancing in the workplace, extensive cleaning and sanitation processes for both research and development areas and office spaces, and broad work-from-home initiatives for employees in our administrative functions.

Available Information

We maintain a website at www.lightwavelogic.com. We make available on our website under "Investors" – "Financial and Filings," free of charge, our annual reports on Form 10-K, quarterly reports on Form 10-Q, current reports on Form 8-K, and amendments to those reports as soon as reasonably practicable after we electronically file or furnish such material with the SEC. References to our website in this report are provided as a convenience, and the information on our website is not, and shall not be deemed to be a part of this report or incorporated into any other filings we make with the SEC. The SEC maintains an Internet site (www.sec.gov) that contains reports, proxy and information statements, and other information regarding issuers that file electronically with the SEC. In addition, we make available on our website under "Investors" – "Corporate Governance", free of charge, our Audit Committee Charter, Compensation Committee Charter, Nominating And Corporate Governance Committee Charter, Operations Committee Charter and Code of Ethics and Business Conduct. In addition, the foregoing information is available in print, without charge, to any stockholder who requests these materials from us.

Item 1A. Risk Factors.

Investing in our common stock is risky. In addition to the other information contained in this annual report, you should consider carefully the following risk factors in evaluating our business and us. If any of the following events actually occur, our business, operating results, prospects or financial condition could be materially and adversely affected. This could cause the trading price of our common stock to decline and you may lose all or part of your investment. The risks described below are not the only ones that we face. Additional risks not presently known to us or that we currently deem immaterial may also significantly impair our business operations and could result in a complete loss of your investment.

We have incurred substantial operating losses since our inception and will continue to incur substantial operating losses for the foreseeable future.

Since our inception, we have been engaged primarily in the research and development of our electro-optic polymer materials technologies and potential products. As a result of these activities, we incurred significant losses and experienced negative cash flow since our inception. We incurred a net loss of \$18,631,381 for the year ended December 31, 2021 and \$6,715,564 for the year ended December 31, 2020. We anticipate that we will continue to incur operating losses through at least 2022.

We may not be able to generate significant revenue either through customer contracts for our potential products or technologies or through development contracts from the U.S. government or government subcontractors. We expect to continue to make significant operating and capital expenditures for research and development and to improve and expand production, sales, marketing and administrative systems and processes. As a result, we will need to generate significant revenue to achieve profitability. We cannot assure you that we will ever achieve profitability.

We are subject to the risks frequently experienced by early stage companies.

The likelihood of our success must be considered in light of the risks frequently encountered by early stage companies, especially those formed to develop and market new technologies. These risks include our potential inability to:

- Establish product sales and marketing capabilities;
- Establish and maintain markets for our potential products;
- Identify, attract, retain and motivate qualified personnel;
- Continue to develop and upgrade our technologies to keep pace with changes in technology and the growth of markets using polymer based materials;
- Develop expanded product production facilities, along with silicon-based foundry and other outside contractor relationships;
- Maintain our reputation and build trust with customers;
- Scale up from small pilot or prototype quantities to large quantities of product on a consistent basis;
- Contract for or develop the internal skills needed to master large volume production of our products; and
- Fund the capital expenditures required to develop volume production due to the limits of our available financial resources.

If we fail to effectively manage our growth, and effectively transition from our focus on research and development activities to commercially successful products, our business could suffer.

Failure to manage growth of operations could harm our business. To date, a large number of our activities and resources have been directed at the research and development of our technologies and development of potential related products including work in association with external partners. The transition from a focus on research and development to being a vendor of products requires effective planning and management. Additionally, growth arising from the expected synergies from future acquisitions will require effective planning and management. Future expansion will be expensive and will likely strain management and other resources.

In order to effectively manage growth, we must:

- Continue to develop an effective planning and management process to implement our business strategy;
- Hire, train and integrate new personnel in all areas of our business;
- Expand our facilities and increase capital investments; and
- Continue to successfully Partner with silicon-based foundries.

We cannot assure you that we will be able to accomplish these tasks effectively or otherwise effectively manage our growth.

We will require additional capital to continue to fund our operations and if we do not obtain additional capital, we may be required to substantially limit our operations.

Our business does not presently generate the cash needed to finance our current and anticipated operations. Based on our current operating plan and budgeted cash requirements, we believe that we have sufficient funds to finance our operations through December 2023; however, we will need to obtain additional future financing after that time to finance our operations until such time that we can conduct profitable revenue-generating activities. We expect that we will need to seek additional funding through public or private financings, including equity financings, and through other arrangements, including collaborative arrangements. Poor financial results, unanticipated expenses or unanticipated opportunities could require additional financing sooner than we expect. Other than with respect to the purchase agreement for \$33 million (the "**Purchase Agreement**") we entered into with Lincoln Park Capital Fund, LLC ("**Lincoln Park**") on October 4, 2021, we have no plans or arrangements with respect to the possible acquisition of additional financing, and such financing may be unavailable when we need it or may not be available on acceptable terms. We currently have a remaining amount of \$13,448,832 that is available to our Company pursuant to the Purchase Agreement.

Our forecast of the period of time through which our financial resources will be adequate to support our operations is a forward-looking statement and involves risks and uncertainties, and actual results could vary as a result of a number of factors, including the factors discussed elsewhere in this annual report. We have based this estimate on assumptions that may prove to be wrong, and we could use our available capital resources sooner than we currently expect.

Additional financing may not be available to us, due to, among other things, our Company not having a sufficient credit history, income stream, profit level, asset base eligible to be collateralized, or market for its securities. If we raise additional funds by issuing equity or convertible debt securities, the percentage ownership of our existing shareholders may be reduced, and these securities may have rights superior to those of our common stock. If adequate funds are not available to satisfy our long-term capital requirements, or if planned revenues are not generated, we may be required to substantially limit our operations.

We are entering new markets, and if we fail to accurately predict growth in these new markets, we may suffer substantial losses.

We are devoting significant resources to develop next generation proprietary photonic devices that are based on our advanced electro-optical polymer material systems for future applications in data communications and telecommunications markets and we are exploring other applications that include automotive/LIDAR, sensing, displays etc. We expect to continue to develop products for these markets and to seek to identify new markets. These markets change rapidly, and we cannot assure you that they will grow or that we will be able to accurately forecast market demand, or lack thereof, in time to respond appropriately. Our investment of resources to develop products for these markets may either be insufficient to meet actual demand or result in expenses that are excessive in light of actual sales volumes. Failure to predict growth and demand accurately in new markets may cause us to suffer substantial losses. In addition, as we enter new markets, there is a significant risk that:

- The market may not accept the price and/or performance of our products;
- There may be issued patents we are not aware of that could block our entry into the market or could result in excessive litigation; and
- The time required for us to achieve market acceptance of our products may exceed our capital resources that would require additional investment.

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Our plan to develop relationships with strategic partners may not be successful.

Part of our business strategy is to maintain and develop strategic relationships with private firms, such as packaging companies and silicone based foundries, and to a lesser extent, government agencies and academic institutions, to conduct research and development and testing of our products and technologies. For these efforts to be successful, we must identify partners whose competencies complement ours. We must also successfully enter into agreements with them on terms attractive to us, and integrate and coordinate their resources and capabilities with our own. We may be unsuccessful in entering into agreements with acceptable partners or negotiating favorable terms in these agreements. Also, we may be unsuccessful in integrating the resources or capabilities of these partners. In addition, our strategic partners may prove difficult to work with or less skilled than we originally expected. If we are unsuccessful in our collaborative efforts, our ability to develop and market products could be severely limited.

The failure to establish and maintain collaborative relationships may have a materially adverse affect on our business.

We are initially targeting applications in data communications and telecommunications markets and are exploring other applications that include automotive/LIDAR, sensing, displays etc. Our ability to generate revenues depends significantly on the extent to which potential customers and other potential industry partners develop, promote and sell systems that incorporate our products, which, of course, we cannot control. Any failure by potential customers and other potential industry partners to successfully develop and market systems that incorporate our products could adversely affect our sales. The extent to which potential customers and other industry partners develop, promote and sell systems incorporating our products is based on a number of factors that are largely beyond our ability to control.

We may participate in joint ventures that expose us to operational and financial risk.

We may participate in one or more joint ventures for the purpose of assisting us in carrying out our business expansion, especially with respect to new product and/or market development. We may experience with our joint venture partner(s) issues relating to disparate communication, culture, strategy, and resources. Further, our joint venture partner(s) may have economic or business interests or goals that are inconsistent with ours, exercise their rights in a way that prohibits us from acting in a manner which we would like, or they may be unable or unwilling to fulfill their obligations under the joint venture or other agreements. We cannot assure you that the actions or decisions of our joint venture partners will not affect our operations in a way that hinders our corporate objectives or reduces any anticipated cost savings or revenue enhancement resulting from these ventures.

If we fail to develop and introduce new or enhanced products on a timely basis, our ability to attract and retain customers could be impaired and our competitive position could be harmed.

We plan to operate in a dynamic environment characterized by rapidly changing technologies and industry standards and technological obsolescence. To compete successfully, we must design, develop, market and sell products that provide increasingly higher levels of performance and reliability and meet the cost expectations of our customers. The introduction of new products by our competitors, the market acceptance of products based on new or alternative technologies, or the emergence of new industry standards could render our anticipated products obsolete. Our failure to anticipate or timely develop products or technologies in response to technological shifts could adversely affect our operations. In particular, we may experience difficulties with product design, manufacturing, marketing or certification that could delay or prevent our development, introduction or marketing of products. If we fail to introduce products that meet the needs of our customers or penetrate new markets in a timely fashion our Company will be adversely affected.

Our future growth will suffer if we do not achieve sufficient market acceptance of our organic nonlinear optical material products or our proprietary photonic devices.

We expect our patented and patent-pending optical materials along with trade secrets and licensed materials, to be the core of and the enabling technology for future generations of optical devices, modules, sub-systems and systems that we will develop or potentially out-license to electro-optic device manufacturers. All of our potential products are still in the development stage, and we do not know when a market for these products will develop, if at all. Our success depends, in part, upon our ability to gain market acceptance of our products. To be accepted, our products must meet the technical and performance requirements of our potential customers. OEMs, suppliers or government agencies may not accept polymer-based products. In addition, even if we achieve some degree of market acceptance for our potential products in one industry, we may not achieve market acceptance in other industries for which we are developing products.

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Achieving market acceptance for our products will require marketing efforts and the expenditure of financial and other resources to create product awareness and demand by customers. We may be unable to offer products that compete effectively due to our limited resources and operating history. Also, certain large corporations may be predisposed against doing business with a company of our limited size and operating history. Failure to achieve broad acceptance of our products by customers and to compete effectively would harm our operating results.

Our potential customers require our products to undergo a lengthy and expensive qualification process, which does not assure product sales.

Prior to purchasing our products, our potential customers will require that our products undergo extensive qualification processes. These qualification processes may continue for several months or more. However, qualification of a product by a customer does not assure any sales of the product to that customer. Even after successful qualification and sales of a product to a customer, a subsequent revision to the product, changes in our customer's manufacturing process or our selection of a new supplier may require a new qualification process, which may result in additional delays. Also, once one of our products is qualified, it could take several additional months or more before a customer commences volume production of components or devices that incorporate our products. Despite these uncertainties, we are devoting substantial resources, including design, engineering, sales, marketing and management efforts, to qualifying our products with customers in anticipation of sales. If we are unsuccessful or delayed in qualifying any of our products with a customer, sales of our products to a customer may be precluded or delayed, which may impede our growth and cause our business to suffer.

Obtaining a sales contract with a potential customer does not guarantee that a potential customer will not decide to cancel or change its product plans, which could cause us to generate no revenue from a product and adversely affect our results of operations.

Even after we secure a sales contract with a potential customer, we may experience delays in generating revenue from our products as a result of a lengthy development cycle that may be required. Potential customers will likely take a considerable amount of time to evaluate our products; it could take 12 to 24 months from early engagement by our sales team to actual product sales. The delays inherent in these lengthy sales cycles increase the risk that a customer will decide to cancel, curtail, reduce or delay its product plans, causing us to lose anticipated sales. In addition, any delay or cancellation of a customer's plans could materially and adversely affect our financial results, as we may have incurred significant expense and generated no revenue. Finally, our customers' failure to successfully market and sell their products could reduce demand for our products and materially and adversely affect our business, financial condition and results of operations. If we were unable to generate revenue after incurring substantial expenses to develop any of our products, our business would suffer.

Many of our products will have long sales cycles, which may cause us to expend resources without an acceptable financial return and which makes it difficult to plan our expenses and forecast our revenue.

Many of our products will have long sales cycles that involve numerous steps, including initial customer contacts, specification writing, engineering design, prototype fabrication, pilot testing, regulatory approvals (if needed), sales and marketing and commercial manufacture. During this time, we may expend substantial financial resources and management time and effort without any assurance that product sales will result. The anticipated long sales cycle for some of our products makes it difficult to predict the quarter in which sales may occur. Delays in sales may cause us to expend resources without an acceptable financial return and make it difficult to plan expenses and forecast revenues.

Successful commercialization of our current and future products will require us to maintain a high level of technical expertise.

Technology in our target markets is undergoing rapid change. To succeed in our target markets, we will have to establish and maintain a leadership position in the technology supporting those markets. Accordingly, our success will depend on our ability to:

- Accurately predict the needs of our target customers and develop, in a timely manner, the technology required to support those needs;
- Provide products that are not only technologically sophisticated but are also available at a price acceptable to customers and competitive with comparable products;
- Establish and effectively defend our intellectual property; and
- Enter into relationships with other companies that have developed complementary technology into which our products may be integrated.

We cannot assure you that we will be able to achieve any of these objectives.

One of our significant target markets is the telecommunications market, which historically has not accepted polymer modulators.

One of our significant target markets is the telecommunications market, which demands high reliability optical components. Historically, polymer modulators have not been accepted into this market even though polymer modulators have achieved Telcordia™ based specifications. It is clear that the telecommunications market is demanding higher and higher data rates for its optical components, and may again decide that polymer based modulators are not suitable even if higher data rates, high reliability, and low power consumption are demonstrated.

Another of our significant target markets is the data communications (datacenter and/or high performance computing) market, which may be subject to heavy competition from other PIC based technologies such as silicon photonics and Indium Phosphide.

Another of our significant target markets is the data communications (datacenter and/or high performance computing) market, which may be subject to heavy competition from other PIC based technologies such as silicon photonics and Indium Phosphide. As the demands for high performance, low cost (\$/Gbps) is implemented into next generation architectures, polymer modulators and polymer based PIC products may be subject to significant competition. Furthermore, there is a potential that technologies such as silicon photonics and Indium Phosphide might reach the metric of \$1/Gbps at 400Gbps before ours. Customers may then be less willing to purchase new technology such as ours or invest in new technology development such as ours for next generation systems.

Our inability to successfully acquire and integrate other businesses, assets, products or technologies could harm our business and cause us to fail at achieving our anticipated growth.

We may grow our business through strategic acquisitions and investments, such as our acquisition of BrPhotonics' polymer business, and we are actively evaluating acquisitions and strategic investments in businesses, products or technologies that we believe could complement or expand our product offering, create and/or expand a client base, enhance our technical capabilities or otherwise offer growth or cost-saving opportunities. From time to time, we may enter into letters of intent with companies with which we are negotiating potential acquisitions or investments or as to which we are conducting due diligence. Although we are currently not a party to any binding material definitive agreement with respect to potential investments in, or acquisitions of, complementary businesses, products or technologies, we may enter into these types of arrangements in the future, which could materially decrease the amount of our available cash or require us to seek additional equity or debt financing. We have limited experience in successfully acquiring and integrating businesses, products and technologies. We may not be successful in negotiating the terms of any potential acquisition, conducting thorough due diligence, financing the acquisition or effectively integrating the acquired business, product or technology into our existing business and operations. Our due diligence may fail to identify all of the problems, liabilities or other shortcomings or challenges of an acquired business, product or technology, including issues related to intellectual property, product quality or product architecture, regulatory compliance practices, revenue recognition or other accounting practices, or employee or customer issues.

Additionally, in connection with any acquisitions we complete, we may not achieve the synergies or other benefits we expected to achieve, and we may incur write-downs, impairment charges or unforeseen liabilities that could negatively affect our operating results or financial position or could otherwise harm our business. If we finance acquisitions using existing cash, the reduction of our available cash could cause us to face liquidity issues or cause other unanticipated problems in the future. If we finance acquisitions by issuing convertible debt or equity securities, the ownership interest of our existing stockholders may be diluted, which could adversely affect the market price of

our stock. Further, contemplating or completing an acquisition and integrating an acquired business, product or technology could divert management and employee time and resources from other matters, which could harm our business, financial condition and operating results.

Our operations and financial results could be adversely impacted by the COVID-19 pandemic, which has at times negatively impacted our stock price and could curtail our ability to raise necessary funds in the near-term on terms that are acceptable to us, and may negatively impact our business, results of operations, particularly with respect to our research and development, and financial position.

The COVID-19 pandemic continues to have a significant impact around the world, prompting governments and businesses to take certain measures in response, such as the imposition of travel restrictions, temporary closures of businesses, quarantine and shelter-in-place orders, and adoption of remote working. While the extent of the impact of the COVID-19 pandemic on our business and financial results remains uncertain, a continued and prolonged public health crisis such as the COVID-19 pandemic would have a negative impact on our business, results of operations, particularly with respect to our research and development, and financial condition. The COVID-19 pandemic has resulted in significant volatility and substantial declines in the stock markets, which has negatively impacted our stock price at times which in turn has negatively impacted our ability to raise significant funds in during those times on terms that are acceptable to us. It is unknown the potential impact in the long-term in the event of a prolonged disruption or recession. In addition, the COVID-19 pandemic could impact the conduct of our research and development due to the slowdown or stoppage of modulator and materials development at our laboratory facility. Given the dynamic nature of these circumstances, the duration of any business disruption or potential impact of the COVID-19 pandemic to our business is difficult to predict.

The extent to which the COVID-19 pandemic will adversely impact our business, financial condition and results of operations is highly uncertain and cannot be predicted.

The COVID-19 pandemic has created significant worldwide uncertainty, volatility and economic disruption. The extent to which COVID-19 will adversely impact our business, financial condition and results of operations is dependent upon numerous factors, many of which are highly uncertain, rapidly changing and uncontrollable. These factors include, but are not limited to: (i) the duration and scope of the pandemic; (ii) governmental, business and individual actions that have been and continue to be taken in response to the pandemic, including travel restrictions, quarantines, social distancing, work-from-home and shelter-in-place orders and shut-downs; (iii) the impact on U.S. and global economies and the timing and rate of economic recovery; (iv) potential adverse effects on the financial markets and access to capital; (v) potential goodwill or other impairment charges; (vi) increased cybersecurity risks as a result of pervasive remote working conditions; (vii) our ability to effectively carry out our operations due to any adverse impacts on the health and safety of our employees and their families; and (viii) the ability of our collaborative partners to timely satisfy their collaborative obligations to us.

We may incur debt in the future that might be secured with our intellectual property as collateral, which could subject our Company to the risk of loss of all of our intellectual property.

We currently have no debt to service. If we incur debt in the future, we may be required to secure the debt with our intellectual property, including all of our patents and patents pending. In the event we default on the debt, we could incur the loss of all of our intellectual property, which would materially and adversely affect our Company and cause you to lose your entire investment in our Company.

Our failure to compete successfully could harm our business.

The markets that we are targeting for our proprietary electro-optic polymer systems and photonic devices are intensely competitive. Most of our present and potential competitors have or may have substantially greater research and product development capabilities, financial, scientific, marketing, manufacturing and human resources, name recognition and experience than we have. As a result, these competitors may:

- succeed in developing products that are equal to or superior to our potential products or that will achieve greater market acceptance than our potential products;
- devote greater resources to developing, marketing or selling their products;
- respond more quickly to new or emerging technologies or scientific advances and changes in customer requirements, which could render our technologies or potential products obsolete;
- introduce products that make the continued development of our potential products uneconomical;
- obtain patents that block or otherwise inhibit our ability to develop and commercialize our potential products;
- withstand price competition more successfully than we can;
- establish cooperative relationships among themselves or with third parties that enhance their ability to address the needs of our prospective customers.

Our failure to compete successfully against these existing or future competitors could harm our business.

We may be unable to obtain effective intellectual property protection for our potential products and technology.

Our intellectual property, or any intellectual property that we have or may acquire, license or develop in the future, may not provide meaningful competitive advantages. Our patents and patent applications, including those we license, may be challenged by competitors, and the rights granted under such patents or patent applications may not provide meaningful proprietary protection. For example, numerous patents held by third parties relate to polymer materials and electro-optic devices. These patents could be used as a basis to challenge the validity or limit the scope of our patents or patent applications. A successful challenge to the validity or limitation of the scope of our patents or patent applications could limit our ability to commercialize our polymer materials technology and, consequently, reduce our revenues.

Moreover, competitors may infringe our patents or those that we license, or successfully avoid these patents through design innovation. To combat infringement or unauthorized use, we may need to resort to litigation, which can be expensive and time-consuming and may not succeed in protecting our proprietary rights. In addition, in an infringement proceeding a court may decide that our patents or other intellectual property rights are not valid or are unenforceable, or may refuse to stop the other party from using the intellectual property at issue on the ground that it is non-infringing. Policing unauthorized use of our intellectual property is difficult and expensive, and we may not be able to, or have the resources to, prevent misappropriation of our proprietary rights, particularly in countries where the laws may not protect these rights as fully as the laws of the United States.

We also rely on the law of trade secrets to protect unpatented technology and know-how. We try to protect this technology and know-how by limiting access to those employees, contractors and strategic partners with a need to know this information and by entering into confidentiality agreements with these parties. Any of these parties could breach the agreements and disclose our trade secrets or confidential information to our competitors, or these competitors might learn of the information in other ways. Disclosure of any trade secret not protected by a patent could materially harm our business.

We may be subject to patent infringement claims, which could result in substantial costs and liability and prevent us from commercializing our potential products.

Third parties may claim that our potential products or related technologies infringe their patents. Any patent infringement claims brought against us may cause us to incur significant expenses, divert the attention of our management and key personnel from other business concerns and, if successfully asserted against us, require us to pay substantial damages. In addition, as a result of a patent infringement suit, we may be forced to stop or delay developing, manufacturing or selling potential products that are claimed to infringe a patent covering a third party's intellectual property unless that party grants us rights to use its intellectual property. We may be unable to obtain these rights on terms

acceptable to us, if at all. Even if we are able to obtain rights to a third party's patented intellectual property, these rights may be non-exclusive, and therefore our competitors may obtain access to the same intellectual property. Ultimately, we may be unable to commercialize our potential products or may have to cease some of our business operations as a result of patent infringement claims, which could severely harm our business.

If our potential products infringe the intellectual property rights of others, we may be required to indemnify customers for any damages they suffer. Third parties may assert infringement claims against our current or potential customers. These claims may require us to initiate or defend protracted and costly litigation on behalf of customers, regardless of the merits of these claims. If any of these claims succeed, we may be forced to pay damages on behalf of these customers or may be required to obtain licenses for the products they use. If we cannot obtain all necessary licenses on commercially reasonable terms, we may be unable to continue selling such products.

Our technology may be subject to government rights.

We may have obligations to government agencies in connection with the technology that we have developed, including the right to require that a compulsory license be granted to one or more third parties selected by certain government agencies. It may be difficult to monitor whether these third parties will limit their use of our technology to these licensed uses, and we could incur substantial expenses to enforce our rights to our licensed technology in the event of misuse.

The loss of certain of our key personnel, or any inability to attract and retain additional personnel, could impair our ability to attain our business objectives.

Our future success depends to a significant extent on the continued service of our key management personnel, particularly Dr. Michael Lebby, our Chief Executive Officer and James S. Marcelli our President, Chief Operating Officer, Secretary and Principal Financial Officer. Accordingly, the loss of the services of either of these persons would adversely affect our business and our ability to timely commercialize our products, and impede the attainment of our business objectives.

Our future success will also depend on our ability to attract, retain and motivate highly skilled personnel to assist us with product development and commercialization. Competition for highly educated qualified personnel in the polymer industry is intense. If we fail to hire and retain a sufficient number of qualified management, engineering, sales and technical personnel, we will not be able to attain our business objectives.

If we fail to develop and maintain the quality of our manufacturing processes, our operating results would be harmed.

The manufacture of our potential products is a multi-stage process that requires the use of high-quality materials and advanced manufacturing technologies. Also, polymer-related device development and manufacturing must occur in a highly controlled, clean environment to minimize particles and other yield and quality-limiting contaminants. In spite of stringent quality controls, weaknesses in process control or minute impurities in materials may cause a substantial percentage of a product in a lot to be defective. If we are not able to develop and continue to improve on our manufacturing processes or to maintain stringent quality controls, or if contamination problems arise, our operating results would be harmed.

The complexity of our anticipated products may lead to errors, defects and bugs, which could result in the necessity to redesign products and could negatively impact our reputation with customers.

Products as complex as those we intend to market might contain errors, defects and bugs when first introduced or as new versions are released. Delivery of products with production defects or reliability, quality or compatibility problems could significantly delay or hinder market acceptance of our products or result in a costly recall and could damage our reputation and adversely affect our ability to sell our products. If our products experience defects, we may need to undertake a redesign of the product, a process that may result in significant additional expenses.

We may also be required to make significant expenditures of capital and resources to resolve such problems. There is no assurance that problems will not be found in new products after commencement of commercial production, despite testing by our suppliers, our customers and us.

If we decide to make commercial quantities of products at our facilities, we will be required to make significant capital expenditures to increase capacity.

We lack the internal ability to manufacture products at a level beyond the stage of early commercial introduction. To the extent we do not have an outside vendor to manufacture our products, we will have to increase our internal production capacity and we will be required to expand our existing facilities or to lease new facilities or to acquire entities with additional production capacities. These activities would require us to make significant capital investments and may require us to seek additional equity or debt financing. We cannot assure you that such financing would be available to us when needed on acceptable terms, or at all. Further, we cannot assure you that any increased demand for our potential products would continue for a sufficient period of time to recoup our capital investments associated with increasing our internal production capacity.

In addition, we do not have experience manufacturing our potential products in large quantities. In the event of significant demand for our potential products, large-scale production might prove more difficult or costly than we anticipate and lead to quality control issues and production delays.

We may not be able to manufacture products at competitive prices.

To date, we have produced limited quantities of products for research, development, demonstration and prototype purposes. The cost per unit for these products currently exceeds the price at which we could expect to profitably sell them. If we cannot substantially lower our cost of production as we move into sales of products in commercial quantities, our financial results will be harmed.

We may be unable to export our potential products or technology to other countries, convey information about our technology to citizens of other countries or sell certain products commercially, if the products or technology are subject to United States export or other regulations.

We are developing certain polymer-based products that we believe the United States government and other governments may be interested in using for military and information gathering or antiterrorism activities. United States government export regulations may restrict us from selling or exporting these potential products into other countries, exporting our technology to those countries, conveying information about our technology to citizens of other countries or selling these potential products to commercial customers. We may be unable to obtain export licenses for products or technology, if they become necessary. We currently cannot assess whether national security concerns would affect our potential products and, if so, what procedures and policies we would have to adopt to comply with applicable existing or future regulations.

We are subject to regulatory compliance related to our operations.

We are subject to various U.S. governmental regulations related to occupational safety and health, labor and business practices. Failure to comply with current or future regulations could result in the imposition of substantial fines, suspension of production, alterations of our production processes, cessation of operations, or other actions, which could harm our business.

We may incur liability arising from the use of hazardous materials.

Our business and our facilities are subject to a number of federal, state and local laws and regulations relating to the generation, handling, treatment, storage and disposal of certain toxic or hazardous materials and waste products that we use or generate in our operations. Many of these environmental laws and regulations subject current or previous owners or occupiers of land to liability for the costs of investigation, removal or remediation of hazardous materials. In addition, these laws and regulations typically impose liability regardless of whether the owner or occupier knew of, or was responsible for, the presence of any hazardous materials and regardless of whether the actions that led to the presence were taken in compliance with the law. In our business, we use hazardous materials that are stored on site. We use various chemicals in our manufacturing process that may be toxic and covered by various environmental controls. An unaffiliated waste hauler transports the waste created by use of these materials off-site. Many environmental laws and regulations require generators of waste to take remedial actions at an off-site disposal location even if the disposal was conducted lawfully. The requirements of these laws and regulations are complex, change frequently and could become more stringent in the future. Failure to comply with current or future environmental laws and regulations could result in the imposition of substantial fines, suspension of production, alteration of our production processes, cessation of operations or other actions, which could severely harm our business.

Our data and information systems and network infrastructure may be subject to hacking or other cyber security threats. If our security measures are breached and an unauthorized party obtains access to our proprietary business information, our information systems may be perceived as being insecure, which could harm our business and reputation, and our proprietary business information could be misappropriated which could have an adverse effect on our business and results of operations.

Our Company stores and transmits its proprietary information on its computer systems. Despite our security measures, our information systems and network infrastructure may be vulnerable to cyber-attacks or could be breached due to an employee error or other disruption that could result in unauthorized disclosure of sensitive information that has the potential to significantly interfere with our business operations. Breaches of our security measures could expose us to a risk of loss or misuse of this information, litigation and potential liability. Since techniques used to obtain unauthorized access or to sabotage information systems change frequently and generally are not recognized until launched against a target, we may be unable to anticipate these techniques or to implement adequate preventive measures in advance of such an attack on our systems. In addition, we use third party vendors to store our proprietary information who use cyber or "Cloud" storage of information as part of their service or product offerings, and despite our attempts to validate the security of such services, our proprietary information may be misappropriated by other parties. In the event of an actual or perceived breach of our security, or the security of one of our vendors, the market perception of the effectiveness of our security measures could be harmed and we could suffer damage to our reputation or our business. Additionally, misappropriation of our proprietary business information could prove competitively harmful to our business.

We conduct significantly all of our research and development activities at our Englewood, CO facility, and circumstances beyond our control may result in considerable business interruptions.

We conduct significantly all of our research and development activities at our Englewood, CO facility. Our operations are vulnerable to interruption by fire, earthquake, floods or other natural disaster, quarantines or other disruptions associated with infectious diseases, national catastrophe, terrorist activities, war, disruptions in our computing and communications infrastructure due to power loss, telecommunications failure, human error, physical or electronic security breaches and computer viruses, and other events beyond our control. We do not have a detailed disaster recovery plan. Additionally, presently, the novel strain of coronavirus known as COVID-19 has the potential to interrupt some, if not all, of our research and development activities.

We could be negatively affected as a result of a proxy contest and the actions of activist stockholders.

A proxy contest with respect to election of our directors, or other activist stockholder activities, could adversely affect our business because: (1) responding to a proxy contest and other actions by activist stockholders can be costly and time-consuming, disruptive to our operations and divert the attention of management and our employees; (2) perceived uncertainties as to our future direction caused by activist activities may result in the loss of potential business opportunities, and may make it more difficult to attract and retain qualified personnel and business partners; and (3) if individuals are elected to our Board of Directors with a specific agenda, it may adversely affect our ability to effectively and timely implement our strategic plans.

The requirements of being a public company are a strain on our systems and resources, are a diversion to management's attention and are costly.

As a public company, we are subject to the reporting requirements of the Securities Exchange Act of 1934 ("**Exchange Act**") the Sarbanes-Oxley Act of 2002 ("**Sarbanes-Oxley Act**"), the Dodd-Frank Wall Street Reform and Consumer Protection Act ("**Dodd-Frank Act**"), and the rules and regulations of The NASDAQ Stock Market. The requirements of these rules and regulations increase our legal, accounting and financial compliance costs, make some activities more difficult, time-consuming and costly and may also place undue strain on our personnel, systems and resources.

The Exchange Act requires, among other things, that we file annual, quarterly and current reports with respect to our business and operating results. The Sarbanes-Oxley Act requires, among other things, that we maintain effective disclosure controls and procedures and internal control over financial reporting. We are continuing the costly process of implementing and testing our systems to report our results as a public company, to continue to manage our growth and to implement internal controls. We are and will continue to be required to implement and maintain various other control and business systems related to our equity, finance, treasury, information technology, other recordkeeping systems and other operations. As a result of this implementation and maintenance, management's attention may be diverted from other business concerns, which could adversely affect our business. Furthermore, we rely on third-party software and system providers for ensuring our reporting obligations and effective internal controls, and to the extent these third parties fail to provide adequate service including as a result of any inability to scale to handle our growth and the imposition of these increased reporting and internal controls and procedures, we could incur material costs for upgrading or switching systems and our business could be materially affected.

In addition, changing laws, regulations and standards relating to corporate governance and public disclosure are creating uncertainty for public companies, increasing legal and financial compliance costs and making some activities more time consuming. These laws, regulations and standards are subject to varying interpretations, in many cases due to their lack of specificity, and, as a result, their application in practice may evolve over time as new guidance is provided by regulatory and governing bodies. This could result in continuing uncertainty regarding compliance matters and higher costs necessitated by ongoing revisions to disclosure and governance practices. We intend to invest resources to comply with evolving laws, regulations and standards, and this investment may result in increased general and administrative expenses and a diversion of management's time and attention from revenue-generating activities to compliance activities. If our efforts to comply with new laws, regulations and standards differ from the activities intended by regulatory or governing bodies due to ambiguities related to their application and practice, regulatory authorities may initiate legal proceedings against us and our business may be adversely affected.

In addition, we expect these laws, rules and regulations to make it more difficult and more expensive for us to obtain director and officer liability insurance, and we may be required to incur substantial costs to maintain appropriate levels of coverage. These factors could also make it more difficult for us to attract and retain qualified members of our board of directors, particularly to serve on our audit committee, and qualified executive officers.

As a result of being a public company, our business and financial condition are more visible, which we believe may result in threatened or actual litigation, including by competitors and other third parties. If such claims are successful, our business and operating results could be adversely affected, and even if the claims do not result in litigation or are resolved in our favor, these claims, and the time and resources necessary to resolve them, could divert the time and resources of our management and adversely affect our business and operating results.

If we fail to maintain an effective system of disclosure controls and internal control over financial reporting, our ability to produce timely and accurate financial statements or comply with applicable regulations could be impaired.

As a public company, we are subject to the reporting requirements of the Securities Exchange Act of 1934 (Exchange Act) the Sarbanes-Oxley Act of 2002 (Sarbanes-Oxley Act), the Dodd-Frank Wall Street Reform and Consumer Protection Act (Dodd-Frank Act), and the rules and regulations of The NASDAQ Stock Market. We expect that compliance with these rules and regulations will continue to increase our legal, accounting and financial compliance costs, make some activities more difficult, time consuming and costly, and place significant strain on our personnel, systems and resources.

The Sarbanes-Oxley Act requires, among other things, that we assess the effectiveness of our internal control over financial reporting annually and the effectiveness of our disclosure controls and procedures quarterly. In particular, Section 404 of the Sarbanes-Oxley Act, (Section 404), requires us to perform system and process evaluation and testing of our internal control over financial reporting to allow management to report on, and our independent registered public accounting firm to attest to, the effectiveness of our internal control over financial reporting. Our compliance with applicable provisions of Section 404 requires that we incur substantial accounting expense and expend significant management time on compliance-related issues as we implement additional corporate governance practices and comply with reporting requirements. Moreover, if we are not able to comply with the requirements of Section 404 applicable to us in a timely manner, or if we or our independent registered public accounting firm identifies deficiencies in our internal control over financial reporting that are deemed to be material weaknesses, the market price of our stock could decline and we could be subject to sanctions or investigations by the SEC or other regulatory authorities, stockholder or other third-party litigation, all of which would require additional financial and management resources.

Furthermore, investor perceptions of our Company may suffer if deficiencies are found, and this could cause a decline in the market price of our stock or hinder our ability to raise capital. Irrespective of compliance with Section 404, any failure of our internal control over financial reporting could have a material adverse effect on our stated operating results and harm our reputation. If we are unable to continue to implement and maintain these requirements effectively or efficiently, it could harm our operations, financial reporting, or financial results and could result in an adverse opinion on our internal controls from our independent registered public accounting firm.

The exercise of options and warrants and other issuances of shares of common stock or securities convertible into common stock will dilute your interest.

Our Board may determine from time to time that it needs to raise additional capital by issuing additional shares of our common stock or other securities and we are not restricted from issuing additional common stock, including securities that are convertible into or exchangeable for, or that represent the right to receive, shares of our common stock. Because our decision to issue securities in any future offering will depend on market conditions and other factors beyond our control, we cannot predict or estimate the amount, timing, or nature of any future offerings, or the prices at which such offerings may be affected. Additional equity offerings may dilute the holdings of existing stockholders or reduce the market price of our common stock.

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As of December 31, 2021, we have outstanding options and warrants to purchase an aggregate of 7,886,248 shares of our common stock at exercise prices ranging from \$0.51 - \$16.81 per share with a weighted average exercise price of \$1.02 per share. The exercise of options and warrants at prices below the market price of our common stock could adversely affect the price of shares of our common stock. Additional dilution may result from the issuance of shares of our capital stock in connection with any collaboration (although none are contemplated at this time) or in connection with other financing efforts, including pursuant to the Purchase Agreement with Lincoln Park. Any issuance of our common stock that is not made solely to then-existing stockholders proportionate to their interests, such as in the case of a stock dividend or stock split, will result in dilution to each stockholder by reducing his, her or its percentage ownership of the total outstanding shares. Moreover, if we issue options or warrants to purchase our common stock in the future and those options or warrants are exercised or we issue restricted stock, stockholders may experience further dilution. Holders of shares of our common stock have no preemptive rights that entitle them to purchase their pro rata share of any offering of shares of any class or series.

The trading price of our common stock has been, and may continue to be, volatile, and the value of our common stock may decline. This volatility, as well as general market conditions, may cause our stock price to fluctuate greatly and even potentially expose us to litigation.

Our common stock may be subject to continued volatility. During the past 52 weeks, the share price for our common stock ranged from a low of \$1.05 to high of \$20.30. We cannot assure you that the market price for our common stock will be less volatile or will remain at its current level. A decrease in the market price for our shares could result in substantial losses for investors. The market price of our common stock may be significantly affected by one or more of the following factors, many of which are beyond our control, including:

- our Company's ability to execute on its business plan;
- the status of particular development programs and the timing of performance under specific development agreements;
- actual or anticipated demand for our potential products and technologies;
- amount and timing of our costs related to our development and marketing efforts or other initiatives and expansion of our operations;
- changes in anticipated commercial deployment of our products and financial results;
- our ability to enter into, renegotiate or renew key agreements or strategic relationships,
- our ability to develop expanded product production facilities, along with silicon-based foundry and other outside contractor relationships;
- issuance of new or updated research or reports by securities analysts;
- the use by investors or analysts of third-party data regarding our business that may not reflect our operations;
- fluctuations in the valuation of companies perceived by investors to be comparable to us;
- share price and volume fluctuations attributable to inconsistent trading volume levels of our shares;
- large trades, block trades or short selling of our common stock,
- actual or anticipated changes in our competitive position relative to our industry competitors;
- announcements or implementation by our competitors of technological innovations or new products;
- changes in laws or regulations applicable to our products or industry;
- additions or departures of key personnel;
- capital-raising activities or commitments;
- product shortages requiring suppliers to allocate minimum quantities;
- the commencement or conclusion of legal proceedings that involve us;
- costs related to possible future acquisitions of technologies or businesses;
- economic conditions specific to our industry, as well as general economic and market conditions; or
- other events or factors, including those resulting from civil unrest, war, foreign invasions, terrorism, or public health crises (e.g. Covid-19), or responses to such events.

Furthermore, the stock markets frequently experience extreme price and volume fluctuations that affect the market prices of equity securities of many companies. These fluctuations often have been unrelated or disproportionate to the operating performance of those companies. These broad market and industry fluctuations, as well as general economic, political, and market conditions such as recessions, elections, interest rate changes, or international currency fluctuations, may negatively impact the market price of our common stock. As a result of such fluctuations, you may not realize any return on your investment in us and may lose some or all of your investment. In the past, companies that have experienced volatility in the market price of their stock have been subject to securities class action litigation or derivative litigation.

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A sale of a substantial number of shares of our common stock may cause the price of our common stock to decline and may impair our ability to raise capital in the future.

Our common stock is traded on The NASDAQ Capital Market and, despite certain increases of trading volume from time to time, there have been periods when the market for our common stock could be considered "thinly-traded," meaning that the number of persons interested in purchasing our common stock at or near bid prices at any given time may be relatively small. Finance transactions or option/warrant exercises resulting in a large amount of newly issued shares that become readily tradable, or other events that cause current stockholders to sell shares, could place downward pressure on the trading price of our stock the trading price of our stock could decline. Additionally, we believe a significant portion of our shares are held by shareholders that accumulated their shares during a time when our shares prices were significantly less than our current share prices. If these shareholders, some of which hold a substantial number of shares of our common stock, decide to sell some or all of their shares at once without regard to the impact of their sales on the market price of our stock, the trading price of our stock could decline. In addition, the lack of a robust resale market may require a stockholder who desires to sell a large number of shares of common stock to sell the shares in increments over time to mitigate any adverse impact of the sales on the market price of our stock.

If our existing stockholders sell, or the market perceives that our stockholders intend to sell, substantial amounts of our common stock in the public market, including shares issued upon the exercise of outstanding options or warrants or pursuant to the Purchase Agreement with Lincoln Park, the market price of our common stock could decline. Sales of a substantial number of shares of our common stock may make it more difficult for us to sell equity or equity-related securities in the future at a time and price that we deem reasonable or appropriate. We may become involved in securities class action litigation that could divert management's attention and harm our business.

Our common stock will be subject to potential delisting if we do not maintain the listing requirements of the Nasdaq Capital Market.

Our common stock commenced trading on The NASDAQ Capital Market on September 1, 2021. We cannot assure you that that an active trading market for our common stock will continue to be sustained. Nasdaq has rules for continued listing, including, without limitation, minimum market capitalization and other requirements. Failure to maintain our listing, or de-listing from Nasdaq, would make it more difficult for stockholders to dispose of our securities and more difficult to obtain accurate price quotations on our securities. This could have an adverse effect on the price of our common stock. Our ability to issue additional securities for financing or other purposes, or otherwise to arrange for any financing we may need in the future, may also be materially and adversely affected if our common stock and/or other securities are not traded on a national securities exchange.

If securities or industry analysts do not publish research or reports about our business, or if they change their recommendations regarding our stock adversely, our stock price and trading volume could decline.

The trading market for most companies' securities depends in part on the research and reports that securities or industry analysts publish about them or their business. We currently have no independent research analysts that cover our stock and we may not obtain research coverage by securities and industry analysts until our products are commercialized and we obtain revenues, and there is no assurances that we will ever obtain independent research analysts coverage. If no securities or industry analysts commence coverage of us, the trading price for our common stock could be negatively affected. In the event any analyst who covers us downgrades our securities, the price of our securities would likely decline. If one or more of these analysts ceases to cover us or fails to publish regular reports on us, interest in the purchase of our securities could decrease, which could cause the price of our common stock and its trading volume to decline.

Our board of directors has the authority, without stockholder approval, to issue preferred stock with terms that may not be beneficial to existing common stockholders and with the ability to affect adversely stockholder voting power and perpetuate their control over us.

Our articles of incorporation, as amended, allow us to issue shares of preferred stock without any vote or further action by our stockholders. Our board of directors has the authority to fix and determine the relative rights and preferences of preferred stock. Our board of directors also has the authority to issue preferred stock without further stockholder approval, including large blocks of preferred stock. As a result, our board of directors could authorize the issuance of a series of preferred stock that would grant to holders thereof the preferred right to our assets upon liquidation, the right to receive dividend payments before dividends are distributed to the holders of common stock or other preferred stockholders and the right to the redemption of the shares, together with a premium, prior to the redemption of our common stock or existing preferred stock, if any.

Preferred stock could be used to dilute a potential hostile acquirer. Accordingly, any future issuance of preferred stock or any rights to purchase preferred stock may have the effect of making it more difficult for a third party to acquire control of us. This may delay, defer or prevent a change of control or an unsolicited acquisition proposal. The issuance of preferred stock also could decrease the amount of earnings attributable to, and assets available for distribution to, the holders of our common stock and could adversely affect the rights and powers, including voting rights, of the holders of our common stock and preferred stock.

Our articles of incorporation and bylaws, and certain provisions of Nevada corporate law, as well as certain of our contracts, contain provisions that could delay or prevent a change in control even if the change in control would be beneficial to our stockholders.

Nevada law, as well as our articles of incorporation, as amended, and bylaws, contain anti-takeover provisions that could delay or prevent a change in control of our Company, even if the change in control would be beneficial to our stockholders. These provisions could lower the price that future investors might be willing to pay for shares of our common stock. These anti-takeover provisions:

- authorize our board of directors to create and issue, without stockholder approval, preferred stock, thereby increasing the number of outstanding shares, which can deter or prevent a takeover attempt;
- prohibit cumulative voting in the election of directors, which would otherwise allow less than a majority of stockholders to elect director candidates;
- empower our board of directors to fill any vacancy on our board of directors, whether such vacancy occurs as a result of an increase in the number of directors or otherwise;
- provide that our board of directors be divided into three classes, with approximately one-third of the directors to be elected each year;
- provide that our board of directors is expressly authorized to adopt, amend or repeal our bylaws; and
- provide that our directors will be elected by a plurality of the votes cast in the election of directors.

Nevada Revised Statutes, the terms of our employee stock option agreements and other contractual provisions may also discourage, delay or prevent a change in control of our Company. Nevada Revised Statutes sections 78.378 to 78.3793 provide state regulation over the acquisition of a controlling interest in certain Nevada corporations unless the articles of incorporation or bylaws of the corporation provide that the provisions of these sections do not apply. Our articles of incorporation, as amended, and bylaws do not state that these provisions do not apply. The statute creates a number of restrictions on the ability of a person or entity to acquire control of a Nevada company by setting down certain rules of conduct and voting restrictions in any acquisition attempt, among other things. The statute contains certain limitations and it may not apply to our Company. Our 2016 Equity Incentive Plan includes change-in-control provisions that allow us to grant options that may become vested immediately upon a change in control. Our board of directors also has the power to adopt a stockholder rights plan that could delay or prevent a change in control of our Company even if the change in control is generally beneficial to our stockholders. These plans, sometimes called "poison pills," are oftentimes criticized by institutional investors or their advisors and could affect our rating by such investors or advisors. If our board of directors adopts such a plan, it might have the effect of reducing the price that new investors are willing to pay for shares of our common stock.

Together, these charter, statutory and contractual provisions could make the removal of our management and directors more difficult and may discourage transactions that otherwise could involve payment of a premium over prevailing market prices for our common stock. Furthermore, the existence of the foregoing provisions, as well as the significant common stock beneficially owned by our founders, executive officers, and members of our board of directors, could limit the price that investors might be willing to pay in the future for shares of our common stock. They could also deter potential acquirers of our Company, thereby reducing the likelihood that you could receive a premium for your common stock in an acquisition.

Item 1B. Unresolved Staff Comments.

None.

Item 2. Properties.

Our principal executive offices and research and development facility is located at 369 Inverness Parkway, Suite 350, Englewood, Colorado. The 13,420 square feet facility includes fully functional 1,000 square feet of class 1,000 cleanroom, 500 square feet of class 10,000 cleanroom, chemistry laboratories, and analytic laboratories, and serves as our office, laboratory and research and development space. Our annual base rent during 2022 is expected to be approximately \$207,563.

Item 3. Legal Proceedings.

We are not a party to any litigation of a material nature, nor are we aware of any threatened litigation of a material nature.

Item 4. Mine Safety Disclosures.

Not Applicable.

PART II**Item 5. Market For Registrant's Common Equity, Related Stockholder Matters and Issuer Purchases Of Equity Securities.****Market Information**

Our common stock has traded on the Nasdaq Capital Market under the symbol "LWLG" since September 1, 2021. Prior to that time, our common stock traded on the OTCQX and OTCQB under the symbol "LWLG." While our common stock was trading on the OTCQX and OTCQB, any over-the-counter market quotations reflected inter-dealer prices, without retail mark-up, mark-down or commission and may not necessarily represented actual transactions.

Holders

As of February 28, 2022, there were approximately 80 holders of our common stock. This does not include persons who hold our Common Stock in nominee or "street name" accounts through brokers or banks.

Dividends

No cash dividends have been declared or paid on our common stock to date and we currently intend to use all available funds to fund the development and growth of our business.

Securities Authorized for Issuance under Equity Compensation Plans

Equity Compensation Plans as of December 31, 2021.

Equity Compensation Plan Information			
Plan category	Number of securities to be issued upon exercise of outstanding options, warrants and rights (a)	Weighted-average exercise price of outstanding options, warrants and rights (b)	Number of securities remaining available for future issuance under equity compensation plans (excluding securities reflected in column (a)) (c)
Equity compensation plans approved by security holders ⁽¹⁾	6,748,248	\$1.05	3,210,250
Equity compensation plans not approved by security holders ⁽²⁾	1,138,000	\$0.85	0
Total	7,886,248	\$1.02	3,210,250

1. Reflects shares of common stock to be issued pursuant to our 2016 Equity Incentive Plan and our 2007 Employee Stock Plan, both of which are for the benefit of our directors, officers, employees and consultants. We have reserved 8,000,000 shares of common stock for such persons pursuant to our 2016 Equity Incentive Plan. We terminated our 2007 Employee Stock Plan in June 2016 and no additional awards are made under that plan.
2. Comprised of common stock purchase warrants we issued for services.

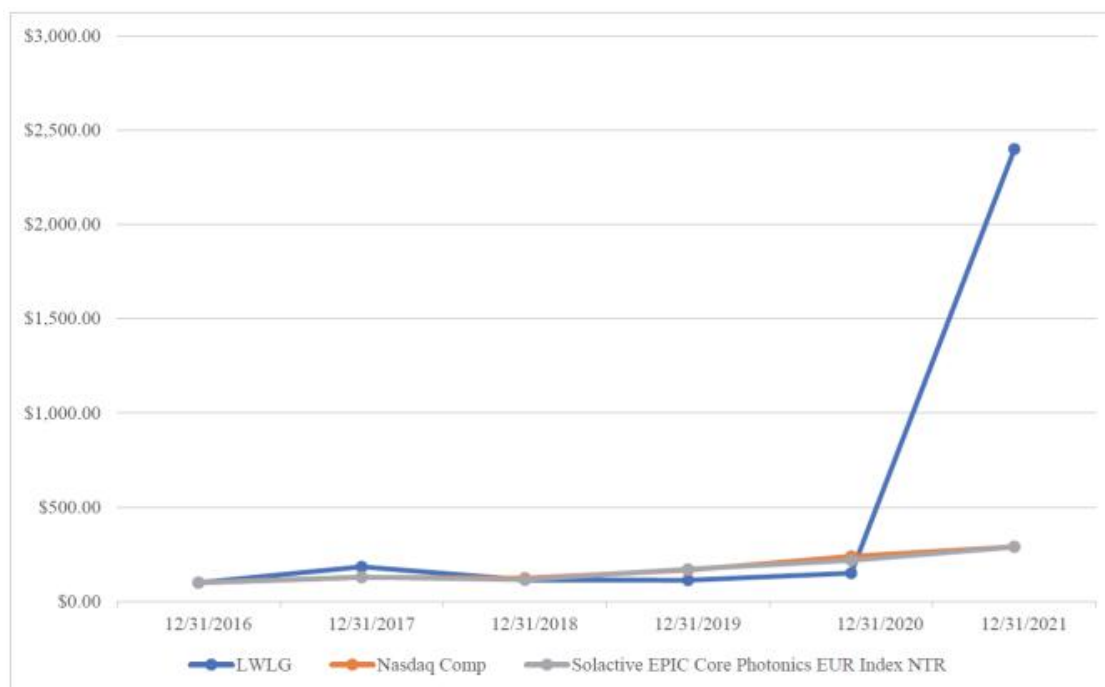
Stock Performance Graph

The following performance graph and related information shall not be deemed "soliciting material" or to be "filed" with the Securities and Exchange Commission, nor shall such information be incorporated by reference into any future filing under the Securities Act or the Exchange Act except to the extent we specifically incorporate it by reference into such filing. Our stock price performance shown in the graph below is not indicative of future stock price performance.

The graph set forth below compares the cumulative total stockholder return on our common stock between December 31, 2016 and December 31, 2021, with the cumulative total return of (a) the NASDAQ Composite Index and (b) Solactive EPIC Core Photonics EUR Index NTR, over the same period. This graph assumes the investment of \$100 on December 31, 2016 in our common stock, the NASDAQ Composite Index and the Solactive EPIC Core Photonics EUR Index NTR and assumes the reinvestment of dividends, if any. The graph assumes our closing sales price on December 30, 2016 of \$0.62 per share as the initial value of our common stock.

The comparisons shown in the graph below are based upon historical data. The stock price performance shown in the graph below is not necessarily indicative of, nor is it intended to forecast, the potential future performance of our common stock. Information used in the graph was obtained from the NASDAQ Stock Market LLC and Solactive AG, financial data providers and sources believed to be reliable. Neither the NASDAQ Stock Market LLC nor Solactive AG are responsible for any errors or omissions in such

information.



	12/31/2016	12/31/2017	12/31/2018	12/31/2019	12/31/2020	12/31/2021
Lightwave Logic, Inc.	\$100.0	\$183.87	\$114.51	\$112.90	\$149.99	\$2,399.99
NASDAQ Composite Index	\$100.0	\$128.24	\$123.26	\$166.68	\$239.42	\$ 290.63
Solactive EPIC Core Photonics EUR Index NTR	\$100.0	\$128.96	\$115.81	\$171.10	\$218.09	\$ 289.21

Recent Sales of Unregistered Securities

During the period covered by this report, our Company has sold the following securities without registering the securities under the Securities Act:

Date	Security
June 25, 2021	Common Stock — 150,000 shares of Common Stock at \$.63 per share pursuant to a warrant exercise.
June 30, 2021	Common Stock — 25,000 shares of Common Stock at \$.64 per share pursuant to a warrant exercise.
June 30, 2021	Common Stock — 25,000 shares of Common Stock at \$.67 per share pursuant to a warrant exercise.
July 23, 2021	Common Stock — 12,000 shares of Common Stock at \$.75 per share pursuant to a warrant exercise.
Aug. 30, 2021	Common Stock — 165,000 shares of Common Stock at \$.64 per share pursuant to a warrant exercise.
Sept. 30, 2021	Common Stock — 250,000 shares of Common Stock at \$.62 per share pursuant to a warrant exercise.
Nov. 19, 2021	Common Stock — 25,000 shares of Common Stock at \$.64 per share pursuant to a warrant exercise.
Nov. 19, 2021	Common Stock — 25,000 shares of Common Stock at \$.67 per share pursuant to a warrant exercise.

No underwriters were utilized, and no commissions or fees were paid with respect to any of the above transactions. These persons were the only offerees in connection with these transactions. We relied on Section 4(a)(2) and Rule 506 of Regulation D of the Securities Act since the transaction does not involve any public offering.

Purchases of Equity Securities by the Issuer or Affiliated Purchasers

None.

Item 6. RESERVED.

Item 7. MANAGEMENT'S DISCUSSION AND ANALYSIS OF FINANCIAL CONDITION AND RESULTS OF OPERATIONS.

The following management's discussion and analysis of financial condition and results of operations provides information that management believes is relevant to an assessment and understanding of our plans and financial condition. The following selected financial information is derived from our historical financial statements and should be read in conjunction with such financial statements and notes thereto set forth elsewhere herein and the "Forward-Looking Statements" explanation included herein.

COVID-19

The COVID-19 pandemic has had and continues to have a significant impact on local, state, national and global economies. The actions taken by governments, as well as businesses and individuals, to limit the spread of the disease has significantly disrupted the Company's normal activities. Numerous businesses, including some of our contractors, collaborative partners and suppliers, have either shut down or are operating on a limited basis with employees working from home, some employees have been furloughed or laid off and social distancing has been mandated through stay-at-home orders, and continues with the Governor of Colorado's Executive Order, Safer-at Home, as amended. The Company expects these actions to have a significant impact on the Company's results of operations, particularly with respect to research and development, and financial position. The full extent of the impact to the Company due to the impact of the COVID-19 pandemic cannot be currently determined. The extent to which the COVID-19 pandemic will impact the Company will depend on future developments, which are highly uncertain and cannot be reasonably predicted, including the duration of the outbreak, the increase or reduction in governmental restrictions to businesses and individuals, the potential for a resurgence of the virus and other factors. The longer the COVID-19 pandemic continues, the greater the potential negative financial effect on the Company.

Overview

Lightwave Logic, Inc. is a development stage company moving toward commercialization of next generation electro-optic photonic devices made on its P²IC™ technology platform which we have detailed as: 1) Polymer Stack™, 2) Polymer Plus™, and Polymer Slot™. Our polymer technology platform uses in-house proprietary high-activity and high-stability organic polymers. Electro-optical devices convert data from electric signals into optical signals for multiple applications.

Our differentiation at the device level is in higher speed, lower power consumption, simplicity of manufacturing and reliability. We have demonstrated higher speed and lower power consumption in packaged devices, and during 2021, we continue to make advances in techniques to translate material properties to efficient, reliable devices. We are currently focused on testing and demonstrating the simplicity of manufacturability and reliability of our devices, including in conjunction with the silicon photonics manufacturing ecosystem. In 2021 we discussed the addition of silicon-based foundry partners to help scale in volume our polymer modulator devices. Silicon-based foundries are large semiconductor fabrication plants developed for the electronics IC business, that are now engaging with silicon photonics to increase their wafer throughput. Partnering with silicon-based foundries not only demonstrates that our polymer technology can be transferred into standard production lines using standard equipment, and also allows us to efficiently utilize our capital.

Our extremely strong patent portfolio allows us to optimize our business model in three areas: 1) Traditional focus on product development, 2) Patent licensing, 3) Technology transfer to foundries.

We are initially targeting applications in data communications and telecommunications markets and are exploring other applications that include automotive/LIDAR, sensing, displays etc., for our polymer technology platform.

Business Strategy

Our business strategy anticipates that our revenue stream will be derived from one or some combination of the following: (i) technology licensing for specific product application; (ii) joint venture relationships with significant industry leaders; and (iii) the production and direct sale of our own electro-optic device components. Our objective is to be a leading provider of proprietary technology and know-how in the electro-optic device market. In order to meet this objective, we intend to:

- Further the development of proprietary organic electro-optic polymer material systems
- Develop photonic devices based on our P²IC™ technology
- Continue to develop proprietary intellectual property
- Grow our commercial device development capabilities
- Partner with silicon-based foundries who can scale volume quickly
- Grow our product reliability and quality assurance capabilities
- Grow our optoelectronic packaging and testing capabilities
- Grow our commercial material manufacturing capabilities
- Maintain/develop strategic relationships with major telecommunications and data communications companies to further the awareness and commercialization of our technology platform
- Continue to add high-level personnel with industrial and manufacturing experience in key areas of our materials and device development programs.

Create Organic Polymer-Enabled Electro-Optic Modulators

We intend to utilize our proprietary optical polymer technology to create an initial portfolio of commercial electro-optic polymer product devices with applications for various markets, including telecommunications, data communications and data centers. These product devices will be part of our proprietary photonics integrated circuit (PIC) technology platform.

We expect our initial modulator products will operate at data rates at least 50 Gbaud (capable of 50 Gbps with standard data encoding of NRZ and 100 Gbps with more complex PAM-4 encoding). Our devices are highly linear, enabling the performance required to take advantage of the more advance complex encoding schemes. We are currently developing our polymer technology to operate at the next industry node of 100Gbaud.

Capital Requirements

As a development stage company, we do not generate revenues. We have incurred substantial net losses since inception. We have satisfied our capital requirements since inception primarily through the issuance and sale of our common stock.

Results of Operations

The following is a discussion and analysis of the Company's results of operations for the year ended December 31, 2021 compared with the year ended December 31, 2020. For the discussion related to the results of operations for the year ended December 31, 2020 compared with the year ended December 31, 2019, refer to the Company's Annual Report on Form 10-K for the year ended December 31, 2020, which was filed with the Securities and Exchange Commission on March 31, 2021.

Comparison of year ended December 31, 2021 to year ended December 31, 2020

Revenues

As a development stage company, we had no revenues during the year ended December 31, 2021 and December 31, 2020. Our Company is in various stages of photonic device and materials development and evaluation with potential customers and strategic partners. Our Company expects to obtain a revenue stream from technology licensing agreements, technology transfer agreements and the production and direct sale of its own electro-optic device components.

Operating Expenses

	<u>For the Year Ending December 31, 2021</u>	<u>For the Year Ending December 31, 2020</u>	<u>Change from Prior Year</u>	<u>Percent Change from Prior Year</u>
Research and development	\$ 12,476,040	\$ 4,590,545	\$ 7,885,495	172%
General and administrative	4,520,403	2,009,429	2,510,974	125%

Research and development expenses increased for the year ended December 31, 2021, as compared to the year ended December 31, 2020, primarily due to the research and development expense for cashless option exercises and increases in research and development salary expenses, prototype device development expenses, non-cash stock option and warrant amortization, laboratory and wafer fabrication materials and supplies, operations committee fees, depreciation and research and development travel expenses. The research and development expense for cashless option exercises for the year ended December 31, 2021 were \$3,490,324. There was no expense for cashless option exercises for the year ended December 31, 2020. Research and development salary expenses increased by \$3,300,257 in the year ended December 31, 2021, compared to the same period in 2020 primarily for additional salary expenses. Prototype device development expenses increased by \$368,483 in the year ended December 31, 2021, compared to the same period in 2020. Non-cash stock option and warrant amortization expenses increased by \$349,059 in the year ended December 31, 2021, compared to the same period in 2020. Laboratory and wafer fabrication materials and supplies increased by \$128,481 in the year ended December 31, 2021, compared to the same period in 2020. Depreciation expenses increased by \$92,404 in the year ended December 31, 2021, compared to the same period in 2020. Research and development travel expenses increased by \$41,741 in the year ended December 31, 2021, compared to the same period in 2020.

We expect to continue to incur substantial research and development expense developing and commercializing our photonic devices, and electro-optic materials platform. These expenses will increase as a result of accelerated development effort to support commercialization of our non-linear optical polymer materials technology; to build photonic device prototypes; working with semiconductor foundries; hiring additional technical and support personnel; engaging senior technical advisors; pursuing other potential business opportunities and collaborations; customer testing and evaluation; and incurring related operating expenses.

General and administrative expenses increased for the year ended December 31, 2021, as compared to the year ended December 31, 2020, primarily due to general and administrative salary expenses, general and administrative expense for cashless option exercises and increases in investor expenses, general and administrative consulting fees, non-cash stock option amortization, legal fees, general and administrative travel expenses and director and officer insurance. General and administrative salary expenses increased by \$2,015,959 in the year ended December 31, 2021, compared to the same period in 2020 primarily for additional salary expenses. The general and administrative expense for cashless option exercises for the year ended December 31, 2021 were \$182,501. There was no expense for cashless option exercises for the year ended December 31, 2020. Investor expenses increased by \$108,341 in the year ended December 31, 2021, compared to the same period in 2020 primarily for the expenses to uplist the Company to the Nasdaq Capital Market. Compensation consulting expenses increased by \$53,500 in the year ended December 31, 2021, compared to the same period in 2020. Non-cash stock option amortization expenses increased by \$49,739 in the year ended December 31, 2021, compared to the same period in 2020. Legal expenses increased by \$44,718 in the year ended December 31, 2021, compared to the same period in 2020 primarily for the expenses to uplist the Company to the Nasdaq Capital Market. General and administrative travel expenses increased by \$33,260 in the year ended December 31, 2021, compared to the same period in 2020. Director and officer insurance increased by \$32,390 in the year ended December 31, 2021, compared to the same period in 2020.

Other Income (Expense)

	For the Year Ending <u>December 31, 2021</u>	For the Year Ending <u>December 31, 2020</u>	Change from <u>Prior Year</u>	Percent Change from <u>Prior Year</u>
Other Income/(Expense)	\$ (1,634,938)	\$ (115,590)	\$ (1,519,348)	1314%

Other income (expenses) increased for the year ended December 31, 2021, as compared to the year ended December 31, 2020, primarily due to an increase in commitment fee in the amount of \$1,943,098 associated with the purchase of shares by an institutional investor for sale under a stock purchase agreement offset by the Paycheck Protection Program loan forgiveness January 22, 2021 in the amount of \$410,700.

Net Loss

	For the Year Ending <u>December 31, 2021</u>	For the Year Ending <u>December 31, 2020</u>	Change from <u>Prior Year</u>	Percent Change from <u>Prior Year</u>
Net Loss	\$ 18,631,381	\$ 6,715,564	\$ 11,915,817	177%

Net loss was \$18,631,381 and \$6,715,564 for the year ended December 31, 2021 and 2020, respectively, for an increase of \$11,915,817, due primarily to salary expenses, the expense for cashless option exercises and increases in commitment fee, non-cash stock option and warrant amortization, prototype device development expenses, laboratory and wafer fabrication materials and supplies, investor expenses, operations committee fees, depreciation, compensation consulting fees, travel expenses, legal expenses and director and officer insurance.

Significant Accounting Policies

Our Company's accounting policies are more fully described in Note 1 of Notes to Financial Statements. As disclosed in Note 1 of Notes to Financial Statements, the preparation of financial statements in conformity with accounting principles generally accepted in the United States requires management to make estimates and assumptions that affect the amounts reported in the financial statements and accompanying disclosures. Although these estimates are based on our management's best knowledge of current events and actions our Company may undertake in the future, actual results could differ from the estimates.

Liquidity and Capital Resources

Our primary source of operating cash inflows was proceeds from the sale of common stock to an institutional investor (Lincoln Park) pursuant to purchase agreements with the institutional investor as described in Note 9 to the Financial Statements and proceeds received pursuant to the exercise of options and warrants.

All of the registered shares under the January 21, 2019 purchase agreement with the institutional investor have been issued as of June 30, 2021. On July 2, 2021, our Company filed a \$100 million universal shelf registration statement which became effective on July 9, 2021, and on October 4, 2021, our Company entered into a new purchase agreement (the "**Purchase Agreement**") with the institutional investor to sell up to \$33 million of common stock over a 36-month period, with \$13,448,832 remaining on the Purchase Agreement as of the date of this filing.

During the year ended December 31, 2021, we received \$30,350,674 in proceeds pursuant to the purchase agreements with the institutional investor and \$2,379,225 in proceeds pursuant to the exercise of options and warrants. During 2020, we received \$5,173,300 in proceeds pursuant to the January 21, 2019 purchase agreement with the

institutional investor and \$1,658,442 in proceeds from exercise of warrants. Additionally, on April 24, 2020, we received \$410,700 in loan funding from the Paycheck Protection Program, as described in Note 7 to the Financial Statements. The loan was forgiven by the Small Business Administration in its entirety on January 22, 2021.

During the year ended December 31, 2021, our primary sources of cash outflows from operations included payroll, payroll taxes related to cashless option exercise, rent, utilities, payments to vendors and third-party service providers. During the year ended December 31, 2020, our primary sources of cash outflows from operations included payroll, rent, utilities, payments to vendors and third-party service providers.

Sources and Uses of Cash

Our future expenditures and capital requirements will depend on numerous factors, including: the progress of our research and development efforts; the rate at which we can, directly or through arrangements with original equipment manufacturers, introduce and sell products incorporating our polymer materials technology; the costs of filing, prosecuting, defending and enforcing any patent claims and other intellectual property rights; market acceptance of our products and competing technological developments; and our ability to establish cooperative development, joint venture and licensing arrangements. We expect that we will incur approximately \$1,015,000 of expenditures per month over the next 12 months. We expect our Lincoln Park financing (described below) to provide us with sufficient funds to maintain our operations over that period of time. Our current cash position enables us to finance our operations through December 2023 before we will be required to replenish our cash reserves pursuant to the Lincoln Park financing. Our cash requirements are expected to increase at a rate consistent with our Company's path to revenue growth as we expand our activities and operations with the objective of commercializing our electro-optic polymer technology. We currently have no debt to service.

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On October 4, 2021, our Company entered into the Purchase Agreement with Lincoln Park, pursuant to which Lincoln Park agreed to purchase from us up to \$33,000,000 of our Common Stock (subject to certain limitations) from time to time over a 36-month period. Pursuant to the Purchase Agreement, Lincoln Park is obligated to make purchases as the Company directs in accordance with the Purchase Agreement, which may be terminated by the Company at any time, without cost or penalty. Sales of shares will be made in specified amounts and at prices that are based upon the market prices of our Common Stock immediately preceding the sales to Lincoln Park. We expect this financing to provide us with sufficient funds to maintain our operations for the foreseeable future. With the additional capital, we expect to achieve a level of revenues attractive enough to fulfill our development activities and adequate enough to support our business model for the foreseeable future. We cannot assure you that we will meet the conditions of the Purchase Agreement with Lincoln Park in order to obligate Lincoln Park to purchase our shares of common stock. In the event we fail to do so, and other adequate funds are not available to satisfy long-term capital requirements, or if planned revenues are not generated, we may be required to substantially limit our operations. This limitation of operations may include reductions in capital expenditures and reductions in staff and discretionary costs.

There are no trading volume requirements or restrictions under the Purchase Agreement, and we will control the timing and amount of any sales of our Common Stock to Lincoln Park. Lincoln Park has no right to require any sales by us, but is obligated to make purchases from us as we direct in accordance with the Purchase Agreement. We can also accelerate the amount of Common Stock to be purchased under certain circumstances. There are no limitations on the use of proceeds, financial or business covenants, restrictions on future financings (other than restrictions on the Company's ability to enter into a similar type of agreement or equity line of credit during the term, excluding an at-the-market transaction with a registered broker-dealer), rights of first refusal, participation rights, penalties or liquidated damages in the Purchase Agreement.

We expect that our cash used in operations will continue to increase during 2022 and beyond as a result of the following planned activities:

- The addition of management, sales, marketing, technical and other staff to our workforce;
- Increased spending for the expansion of our research and development efforts, including purchases of additional laboratory and production equipment;
- Increased spending in marketing as our products are introduced into the marketplace;
- Partnering with commercial foundries to implement our electro-optic polymers into accepted PDKs by the foundries;
- Developing and maintaining collaborative relationships with strategic partners;
- Developing and improving our manufacturing processes and quality controls; and
- Increases in our general and administrative activities related to our operations as a reporting public company and related corporate compliance requirements.

Analysis of Cash Flows

For the year ended December 31, 2021

Net cash used in operating activities was \$10,038,626 for the year ended December 31, 2021, primarily attributable to the net loss of \$18,631,381 adjusted by \$11,001 in warrants issued for services, \$1,022,985 in options issued for services, \$2,059,464 in common stock issued for services, \$878,520 in depreciation expenses and patent amortization expenses, (\$410,700) in Paycheck Protection Program loan forgiveness, \$334,877 in prepaid expenses, \$1,023,785 in accounts payable, accrued bonuses and accrued expenses and \$3,672,823 in cashless option exercise expense. Net cash used in operating activities consisted of payments for research and development, legal, professional and consulting expenses, rent and other expenditures necessary to develop our business infrastructure.

Net cash used by investing activities was \$1,116,179 for the year ended December 31, 2021, consisting of \$18,649 in cost for intangibles and \$1,097,530 in asset additions primarily for the Colorado headquarter facility and labs.

Net cash provided by financing activities was \$31,280,827 for the year ended December 31, 2021 and consisted of \$2,379,225 in proceeds from exercise of options and warrants, \$30,350,674 in proceeds from resale of common stock to an institutional investor offset by \$1,435,965 in cashless option exercise tax payments and \$13,107 repayment of equipment purchased.

On December 31, 2021, our cash and cash equivalents totaled \$23,432,612, our assets totaled \$27,228,575, our liabilities totaled \$2,024,303 and we had stockholders' equity of \$25,204,272.

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For the year ended December 31, 2020

Net cash used in operating activities was \$4,873,863 for the year ended December 31, 2020, primarily attributable to the net loss of \$6,715,564 adjusted by \$95,774 in warrants issued for services, \$539,414 in options issued for services, \$116,366 in common stock issued for services, \$784,419 in depreciation expenses and patent amortization expenses, (\$194,636) in prepaid expenses, \$89,664 in accounts payable and accrued expenses and \$410,700 in proceeds from Paycheck Protection Plan refundable advance. Net cash used in operating activities consisted of payments for research and development, legal, professional and consulting expenses, rent and other expenditures necessary to develop our business infrastructure.

Net cash used by investing activities was \$217,984 for the year ended December 31, 2020, consisting of \$59,923 in cost for intangibles and \$158,061 in asset additions primarily for the new Colorado headquarter facility and labs.

Net cash provided by financing activities was \$6,162,093 for the year ended December 31, 2020 and consisted of \$1,658,442 in proceeds from exercise of warrants, \$5,173,300 in proceeds from resale of common stock to an institutional investor offset by \$669,649 repayment of equipment purchased.

Item 7A. Quantitative and Qualitative Disclosures About Market Risk

At December 31, 2021, we had \$23,432,612 million in cash and cash equivalents. For the purposes of this Item 7A, we consider all highly liquid instruments with maturities of three months or less at the time of purchase to be cash equivalents. The fair value of all of our cash equivalents is determined based on "Level 1" inputs, which are based upon quoted prices for identical or similar instruments in markets that are active. We do not use any market risk sensitive instruments to hedge any risks, and we hold no market risk sensitive instruments for trading or speculative purposes. We place our cash investments in instruments that meet credit quality standards. At December 31, 2021, we had deposits with a financial institution that exceeded the Federal Depository Insurance coverage.

Market Interest Rate Risk

We are exposed to market risk related to changes in interest rates. Our primary exposure to market risk is interest rate sensitivity, which is affected by changes in the general level of U.S. interest rates. If a 10% change in interest rates had occurred on December 31, 2021, this change would not have had a material effect on the fair value of our investment portfolio as of that date.

Due to the short holding period of our investments and the nature of our investments, we have concluded that we do not have a material financial market risk exposure.

Item 8. Financial Statements and Supplementary Data

Our Financial Statements are attached as Appendix A (following Exhibits) and included as part of this Form 10-K Report. A list of our Financial Statements is provided in response to Item 15 of this Form 10-K Report.

Item 9. Changes In And Disagreements With Accountants On Accounting and Financial Disclosure

None.

Item 9A. Controls and Procedures.*Evaluation of Disclosure Controls and Procedures*

As of December 31, 2021, our Company evaluated the effectiveness and design and operation of its disclosure controls and procedures. Our Company's disclosure controls and procedures are the controls and other procedures that we designed to ensure that our Company records, processes, summarizes, and reports in a timely manner the information that it must disclose in reports that our Company files with or submits to the Securities and Exchange Commission. Our principal executive officer and principal financial officer reviewed and participated in this evaluation. Based on this evaluation, our Company made the determination that its disclosure controls and procedures were effective.

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Management's Annual Report on Internal Control Over Financial Reporting

Our management is responsible for establishing and maintaining adequate internal control over financial reporting, as such term is defined in Exchange Act Rules 13a-15(f) and 15d-15(f). Under the supervision and with the participation of management, including our principal executive officer and principal financial officer, we conducted an evaluation of the effectiveness of our internal controls over financial reporting based on the framework in Internal Control-Integrated Framework issued by the Committee of Sponsoring Organizations of the Treadway Commission ("COSO"). Based on this evaluation, management has concluded that our internal control over financial reporting was effective as of December 31, 2021.

The Company's internal control over financial reporting includes policies and procedures that (1) pertain to maintenance of records that, in reasonable detail, accurately and fairly reflect transactions and dispositions of the assets of the Company; (2) provide reasonable assurance that transactions are recorded as necessary to permit preparation of financial statements in accordance with generally accepted accounting principles, and that receipts and expenditures of the Company are being made only in accordance with authorizations of management and directors of the Company; and (3) provide reasonable assurance regarding prevention or timely detection of unauthorized acquisition, use, or disposition of the Company's assets that could have a material effect on the financial statements.

Our management, including our principal executive officer and principal financial officer, does not expect that our disclosure controls or our internal control over financial reporting will prevent or detect all errors and all fraud. A control system, no matter how well designed and operated, can provide only reasonable, not absolute, assurance that the control system's objectives will be met. Internal control over financial reporting is a process that involves human diligence and compliance and is subject to lapses in judgment and breakdowns resulting from human failures. In addition, the design of any system of controls is based in part on certain assumptions about the likelihood of future events, and controls may become inadequate if conditions change. There can be no assurance that any design will succeed in achieving its stated goals under all potential future conditions.

Audit Report on Internal Controls Over Financial Reporting of the Registered Public Accounting Firm

Morison Cogen LLP, the Company's independent registered public accounting firm has audited the financial statements included in this Annual Report on Form 10-K and, as part of their audit, has issued their report, included herein, on the effectiveness of the Company's internal control over financial reporting as of December 31, 2021.

Changes in Internal Control Over Financial Reporting

No change in our Company's internal control over financial reporting occurred during our fourth fiscal quarter that has materially affected, or is reasonably likely to materially affect, our internal control over financial reporting.

Item 9B. Other Information

None.

Item 9C. Disclosure Regarding Foreign Jurisdictions that Prevent Inspections.

None.

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PART III**Item 10. Directors, Executive Officers and Corporate Governance**

Information required under this Item will be contained in our definitive proxy statement, which will be filed within 120 days of December 31, 2021, our most recent fiscal year end, and is incorporated herein by reference.

Item 11. Executive Compensation.

Information required under this Item will be contained in our definitive proxy statement, which will be filed within 120 days of December 31, 2021, our most recent fiscal year end, and is incorporated herein by reference.

Item 12. Security Ownership of Certain Beneficial Owners and Management and Related Stockholder Matters.

Information required under this Item will be contained in our definitive proxy statement, which will be filed within 120 days of December 31, 2021, our most recent fiscal year end, and is incorporated herein by reference.

Item 13. Certain Relationships and Related Transactions, and Director Independence.

Information required under this Item will be contained in our definitive proxy statement, which will be filed within 120 days of December 31, 2021, our most recent fiscal year end, and is incorporated herein by reference.

Item 14. Principal Accountant Fees and Services.

Information required under this Item will be contained in our definitive proxy statement, which will be filed within 120 days of December 31, 2021, our most recent fiscal year end, and is incorporated herein by reference.

PART IV

Item 15. Exhibits, Financial Statement Schedules

(a) The following Audited Financial Statements are filed as part of this Form 10-K Report:

Report of Independent Registered Public Accounting Firm
 Balance Sheets
 Statements of Comprehensive Loss
 Statement of Stockholders' Equity
 Statements of Cash Flows
 Notes to Financial Statements

(b) The following exhibits are filed as part of this report.

Exhibit No.	Description of Exhibit	Location
3.1	Articles of Incorporation	Incorporated by reference to Company's Form 10-SB as filed with the SEC on April 13, 2007
3.2	Certificate of Amendment to Articles of Incorporation	Incorporated by reference to Company's Definitive Schedule 14C Information Statement as filed with the SEC on February 19, 2008
3.3	Certificate of Amendment to Articles of Incorporation	Incorporated by reference to Company's Form S-1 Registration Statement as filed with the SEC on August 3, 2015
3.4	Restated Bylaws	Incorporated by reference to the Company's Form 10-K as filed with the SEC on March 16, 2018
4.1	Description of Registrant's Securities	Incorporated by reference to the Company's Form 10-K as filed with the SEC on March 16, 2020
10.1	Employee Agreement – Michael Lebby	Incorporated by reference to the Company's Current Report on Form 8-K as filed with the SEC on March 22, 2017
10.2	Employee Agreement Amendment - Michael Lebby	Incorporated by reference to the Company's Current Report on Form 8-K as filed with the SEC on April 20, 2021
10.3	Employee Agreement Amendment - Michael Lebby	Incorporated by reference to the Company's Current Report on Form 8-K as filed with the SEC on January 21, 2022
10.4	Employee Agreement - James Marcelli	Incorporated by reference to Company's Form 10-Q as filed with the SEC on August 12, 2015
10.5	Employee Agreement Amendment - James Marcelli	Incorporated by reference to the Company's Current Report on Form 8-K as filed with the SEC on January 21, 2022
10.6	Employee Agreement Amendment - James Marcelli	Incorporated by reference to the Company's Current Report on Form 8-K as filed with the SEC on January 21, 2022
10.7	Form of Executive Paid Time Off Waiver Agreement	Incorporated by reference to the Company's Form 10-K as filed with the SEC on March 16, 2018
10.8	Form of Director Agreement	Incorporated by reference to the Company's Form 10-K as filed with the SEC on March 16, 2018
10.9	Form of Director and Officer Indemnification Agreement	Incorporated by reference to the Company's Current Report on Form 8-K as filed with the SEC on January 21, 2022
10.10	Form of Director's Non-Disclosure Agreement	Incorporated by reference to the Company's Form 10-K as filed with the SEC on March 16, 2018
10.11	Operations Committee Charter	Incorporated by reference to the Company's Form 10-Q as filed with the SEC on August 15, 2016
10.12	Statement of Operations Committee Work - Frederick J. Leonberger	Incorporated by reference to the Company's Current Report on Form 8-K as filed with the SEC on April 3, 2017
10.13	Statement of Operations Committee Work - Siraj Nour El-Ahmadi	Incorporated by reference to the Company's Form 10-K as filed with the SEC on March 31, 2021

10.14	2007 Employee Stock Plan	Incorporated by reference to Company's Definitive Schedule 14C Information Statement as filed with the SEC on February 19, 2008
10.15	2007 Employee Stock Plan Amendment	Incorporated by reference to Company's Definitive Schedule 14A Proxy Statement as filed with the SEC on July 22, 2014
10.16	2016 Equity Incentive Plan	Incorporated by reference to Appendix A to the Company's Definitive Schedule 14A filed with the SEC on April 20, 2016
10.17	2016 Equity Incentive Plan Amendment	Incorporated by reference to Appendix A to the Company's Definitive Schedule 14A filed with the SEC on April 12, 2019
10.18	Form of Non-qualified Stock Option Award Agreement - Employees	Incorporated by reference to the Company's Annual Report on Form 10-K as filed with the SEC on March 17, 2017
10.19	Form of Non-qualified Stock Option Award Agreement - Executive Officers	Incorporated by reference to the Company's Annual Report on Form 10-K as filed with the SEC on March 17, 2017
10.20	Form of Non-qualified Stock Option Award Agreement - Non Employee Directors	Incorporated by reference to the Company's Annual Report on Form 10-K as filed with the SEC on March 17, 2017
10.21	Form of Restricted Stock Award Agreement -Non Employee Directors	Filed herewith
10.22	Lease Agreement – Englewood, CO. Facility	Incorporated by reference to the Company's Current Report on Form 8-K as filed with the SEC on November 2, 2017
10.23	Purchase Agreement, dated October 4, 2021, by and between the Company and Lincoln Park	Incorporated by reference to the Company's Current Report on Form 8-K as filed with the SEC on October 5, 2021
10.24	Registration Rights Agreement, dated October 4, 2021, by and between the Company and Lincoln Park	Incorporated by reference to the Company's Current Report on Form 8-K as filed with the SEC on October 5, 2021
14.1	Code of Ethics and Business Conduct	Incorporated by reference to the Company's Form 10-K as filed with the SEC on March 16, 2018
21.1	Subsidiaries of the Registrant	Filed herewith
23.1	Consent of Independent Registered Public Accounting Firm - Morison Cogen LLP	Filed herewith
31.1	Certification pursuant to Rule 13a-14(a) of the Securities Exchange Act of 1934, as amended, executed by the Principal Executive Officer of the Company.	Filed herewith
31.2	Certification pursuant to Rule 13a-14(a) of the Securities Exchange Act of 1934, as amended, executed by the Principal Financial Officer of the Company.	Filed herewith
32.1	Certification pursuant to 18 U.S.C. Section 1350, as adopted pursuant to Section 906 of the Sarbanes-Oxley Act of 2002, executed by the Principal Executive Officer of the Company.	Furnished herewith
32.2	Certification pursuant to 18 U.S.C. Section 1350, as adopted pursuant to Section 906 of the Sarbanes-Oxley Act of 2002, executed by the Principal Financial Officer of the Company.	Furnished herewith
101.INS	Inline XBRL Instance Document (the instance document does not appear in the Interactive Data File because its XBRL tags are embedded within the Inline XBRL document)	
101.SCH	Inline XBRL Taxonomy Extension Schema Document	
101.CAL	Inline XBRL Taxonomy Extension Calculation Linkbase Document	

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101.DEF	Inline XBRL Taxonomy Extension Definition Linkbase Document	
101.LAB	Inline XBRL Taxonomy Extension Label Linkbase Document	
101.PRE	Inline XBRL Taxonomy Extension Presentation Linkbase Document	
104	Cover Page Interactive Data File (formatted as Inline XBRL and contained in Exhibit 101)	

Item 16. Form 10-K Summary

None

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SIGNATURES

Pursuant to the requirements of Section 13 or 15(d) of the Securities Exchange Act of 1934, the registrant has duly caused this report to be signed on its behalf by the undersigned, thereunto duly authorized.

LIGHTWAVE LOGIC, INC.
Registrant

By: /s/ Michael Lebby
Michael Lebby,
Chief Executive Officer
(Principal Executive Officer)

Date: March 1, 2022

Pursuant to the requirements of the Securities Exchange Act of 1934, this report has been signed below by the following persons on behalf of the registrant and in the capacities and on the dates indicated.

<u>Signature</u>	<u>Title</u>	<u>Date</u>
<u>/s/ Michael Lebby</u> Michael Lebby	Chief Executive Officer, Principal Executive Officer, Director	March 1, 2022
<u>/s/ James S. Marcelli</u> James S. Marcelli	President, Chief Operating Officer, Principal Financial Officer, Secretary, Director	March 1, 2022
<u>/s/ Thomas E. Zelibor</u> Thomas E. Zelibor	Chair of the Board of Directors	March 1, 2022
<u>/s/ Ronald A. Bucchi</u> Ronald A. Bucchi	Director	March 1, 2022
<u>/s/ Siraj Nour El-Ahmadi</u> Siraj Nour El-Ahmadi	Director	March 1, 2022
<u>/s/ Frederick J. Leonberger</u> Frederick J. Leonberger	Director	March 1, 2022
<u>/s/ Craig Ciesla</u> Craig Ciesla	Director	March 1, 2022

LIGHTWAVE LOGIC, INC.
FINANCIAL STATEMENTS
DECEMBER 31, 2021 AND 2020

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REPORT OF INDEPENDENT REGISTERED PUBLIC ACCOUNTING FIRM

To the Board of Directors and
Stockholders of Lightwave Logic, Inc.

Opinions on the Financial Statements and Internal Control over Financial Reporting

We have audited the accompanying balance sheets of Lightwave Logic, Inc. (the Company) as of December 31, 2021 and 2020, and the related statements of comprehensive loss, stockholders' equity, and cash flows for each of the two years in the period ended December 31, 2021, and the related notes (collectively referred to as the financial statements).

We also have audited the Company's internal control over financial reporting as of December 31, 2021, based on criteria established in *Internal Control – Integrated Framework (2013)* issued by the Committee of Sponsoring Organizations of the Treadway Commission (COSO).

In our opinion, the financial statements referred to above present fairly, in all material respects, the financial position of the Company as of December 31, 2021 and 2020, and the results of its operations and its cash flows for each of the two years in the period ended December 31, 2021, in conformity with accounting principles generally accepted in the United States of America. Also, in our opinion, the Company maintained, in all material respects, effective internal control over financial reporting as of December 31, 2021, based on criteria established in *Internal Control – Integrated Framework (2013)* issued by COSO.

Basis for Opinion

The Company's management is responsible for these financial statements, for maintaining effective internal control over financial reporting, and for its assessment of the effectiveness of internal control over financial reporting included in the accompanying Management's Report on Internal Control over Financial Reporting. Our responsibility is to express an opinion on the Company's financial statements and an opinion on the Company's internal control over financial reporting based on our audits. We are a public accounting firm registered with the Public Company Accounting Oversight Board (United States) (PCAOB) and are required to be independent with respect to the Company in accordance with the U.S. federal securities laws and the applicable rules and regulations of the Securities and Exchange Commission and the PCAOB.

We conducted our audits in accordance with the standards of the PCAOB. Those standards require that we plan and perform the audits to obtain reasonable assurance about whether the financial statements are free of material misstatement, whether due to error or fraud, and whether effective internal control over financial reporting was maintained in all material respects.

Our audits of the financial statements included performing procedures to assess the risks of material misstatement of the financial statements, whether due to error or fraud, and performing procedures that respond to those risks. Such procedures included examining, on a test basis, evidence regarding the amounts and disclosures in the financial statements. Our audits also included evaluating the accounting principles used and significant estimates made by management, as well as evaluating the overall presentation of the financial statements. Our audit of internal control over financial reporting included obtaining an understanding of internal control over financial reporting, assessing the risk that a material weakness exists, and testing and evaluating the design and operating effectiveness of internal control based on the assessed risk. Our audits also included performing such other procedures as we considered necessary in the circumstances. We believe that our audits provide a reasonable basis for our opinions.

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To the Board of Directors and
Stockholders of Lightwave Logic, Inc.
(Continued)

Definition and Limitations of Internal Control over Financial Reporting

A company's internal control over financial reporting is a process designed to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles. A company's internal control over financial reporting includes those policies and procedures that (1) pertain to the maintenance of records that, in reasonable detail, accurately and fairly reflect the transactions and dispositions of the assets of the company; (2) provide reasonable assurance that transactions are recorded as necessary to permit preparation of financial statements in accordance with generally accepted accounting principles, and that receipts and expenditures of the company are being made only in accordance with authorizations of management and directors of the company; and (3) provide reasonable assurance regarding prevention or timely detection of unauthorized acquisition, use, or disposition of the company's assets that could have a material effect on the financial statements.

Because of its inherent limitations, internal control over financial reporting may not prevent or detect misstatements. Also, projections of any evaluation of effectiveness to future periods are subject to the risk that controls may become inadequate because of changes in conditions, or that the degree of compliance with the policies or procedures may deteriorate.

Critical Audit Matters

Critical audit matters are matters arising from the current period audit of the financial statements that were communicated or required to be communicated to the audit committee and that: (1) relate to accounts or disclosures that are material to the financial statements and (2) involved our especially challenging, subjective, or complex judgments. We determined that there are no critical audit matters.

/s/ Morison Cogen LLP

We have served as the Company's auditor since 2005.
PCAOB ID Number 00536

Blue Bell, Pennsylvania
March 1, 2022

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LIGHTWAVELOGIC, INC. BALANCE SHEETS

	<u>December 31, 2021</u>	<u>December 31, 2020</u>
ASSETS		
CURRENT ASSETS		
Cash and cash equivalents	\$ 23,432,612	\$ 3,306,590
Prepaid expenses and other current assets	232,308	567,185
	<u>23,664,920</u>	<u>3,873,775</u>
PROPERTY AND EQUIPMENT - NET	2,179,075	1,873,549
OTHER ASSETS		

Intangible assets - net	848,133	916,000
Operating Lease - Right of Use - Building	536,447	703,454
	1,384,580	1,619,454
TOTAL ASSETS	\$ 27,228,575	\$ 7,366,778
LIABILITIES AND STOCKHOLDERS' EQUITY		
CURRENT LIABILITIES		
Accounts payable	\$ 215,734	\$ 169,247
Accrued bonuses and accrued expenses	1,118,080	81,396
Current portion of equipment purchase	—	13,107
Accounts payable and accrued expenses - related parties	32,189	49,797
Deferred lease liability	41,778	41,778
Paycheck Protection Program advance	—	410,700
Operating lease liability	178,192	167,007
	1,585,973	933,032
LONG TERM LIABILITIES		
Deferred lease liability	80,075	121,853
Operating lease liability	358,255	536,447
	438,330	658,300
TOTAL LIABILITIES	2,024,303	1,591,332
STOCKHOLDERS' EQUITY		
Preferred stock, \$0.001 par value, 1,000,000 authorized, no shares issued or outstanding	—	—
Common stock \$0.001 par value, 250,000,000 authorized, 110,555,459 and 97,775,789 issued and outstanding at December 31, 2021 and December 31, 2020	110,556	97,776
Additional paid-in-capital	114,696,597	76,649,170
Accumulated deficit	(89,602,881)	(70,971,500)
TOTAL STOCKHOLDERS' EQUITY	25,204,272	5,775,446
TOTAL LIABILITIES AND STOCKHOLDERS' EQUITY	\$ 27,228,575	\$ 7,366,778

The accompanying notes are an integral part of these financial statements.

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LIGHTWAVELOGIC, INC.
STATEMENTS OF COMPREHENSIVE LOSS
FOR THE YEARS ENDING DECEMBER 31, 2021 AND 2020

	For the Year Ending December 31, 2021	For the Year Ending December 31, 2020
NET SALES	\$ —	\$ —
COST AND EXPENSE		
Research and development	12,476,040	4,590,545
General and administrative	4,520,403	2,009,429
	16,996,443	6,599,974
LOSS FROM OPERATIONS	(16,996,443)	(6,599,974)
OTHER INCOME (EXPENSE)		
Paycheck Protection Program loan forgiveness	410,700	—
Interest income	13,826	776
Commitment fee	(2,059,464)	(116,366)
NET LOSS	\$ (18,631,381)	\$ (6,715,564)
Basic and Diluted Loss per Share	\$ (0.18)	\$ (0.07)
Basic and Diluted Weighted Average Number of Shares	105,223,959	91,859,025

The accompanying notes are an integral part of these financial statements.

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**STATEMENT OF STOCKHOLDERS' EQUITY
FOR THE YEARS ENDING DECEMBER 31, 2021 AND 2020**

	Number of Shares	Common Stock	Additional Paid-in Capital	Accumulated Deficit	Total
BALANCE AT DECEMBER 31, 2019	87,409,600	\$ 87,410	\$ 69,076,240	\$ (64,255,936)	\$ 4,907,714
Common stock issued to institutional investor	8,125,000	8,125	5,165,175	—	5,173,300
Common stock issued for commitment shares	168,137	168	116,198	—	116,366
Exercise of warrants	2,073,052	2,073	1,656,369	—	1,658,442
Options issued for services	—	—	539,414	—	539,414
Warrants issued for services	—	—	95,774	—	95,774
Net loss for the year ending December 31, 2020	—	—	—	(6,715,564)	(6,715,564)
BALANCE AT DECEMBER 31, 2020	<u>97,775,789</u>	<u>\$ 97,776</u>	<u>\$ 76,649,170</u>	<u>\$ (70,971,500)</u>	<u>\$ 5,775,446</u>
	Number of Shares	Common Stock	Additional Paid-in Capital	Accumulated Deficit	Total
BALANCE AT DECEMBER 31, 2020	97,775,789	\$ 97,776	\$ 76,649,170	\$ (70,971,500)	\$ 5,775,446
Common stock issued to institutional investor	9,290,011	9,291	30,341,383	—	30,350,674
Common stock issued for commitment shares	514,536	514	2,058,950	—	2,059,464
Exercise of options	2,046,250	2,046	1,948,829	—	1,950,875
Cashless exercise of 445,252 options	251,873	252	2,236,606	—	2,236,858
Exercise of warrants	677,000	677	427,673	—	428,350
Options issued for services	—	—	1,022,985	—	1,022,985
Warrants issued for services	—	—	11,001	—	11,001
Net loss for the year ending December 31, 2021	—	—	—	(18,631,381)	(18,631,381)
BALANCE AT DECEMBER 31, 2021	<u>110,555,459</u>	<u>\$ 110,556</u>	<u>\$ 114,696,597</u>	<u>\$ (89,602,881)</u>	<u>\$ 25,204,272</u>

The accompanying notes are an integral part of these financial statements.

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**LIGHTWAVE LOGIC, INC.
STATEMENTS OF CASH FLOWS
FOR THE YEARS ENDING DECEMBER 31, 2020 AND 2021**

	For the Year Ending December 31, 2021	For the Year Ending December 31, 2020
CASH FLOWS FROM OPERATING ACTIVITIES		
Net loss	\$ (18,631,381)	\$ (6,715,564)
Adjustments to reconcile net loss to net cash used in operating activities		
Warrants issued for services	11,001	95,774
Stock options issued for services	1,022,985	539,414
Cashless option exercise	3,672,823	—
Common stock issued for services and fees	2,059,464	116,366
Depreciation and amortization of patents	878,520	784,419
Paycheck Protection Program loan forgiveness	(410,700)	—
Decrease (increase) in assets		
Prepaid expenses and other current assets	334,877	(194,636)
Increase (decrease) in liabilities		
Accounts payable	46,487	80,824
Accrued bonuses and accrued expenses	1,036,684	15,627
Accounts payable and accrued expenses-related parties	(17,608)	34,992
Deferred lease liability	(41,778)	(41,779)
Paycheck Protection Program advance	—	410,700
Net cash used in operating activities	<u>(10,038,626)</u>	<u>(4,873,863)</u>
CASH FLOWS FROM INVESTING ACTIVITIES		
Cost of intangibles	(18,649)	(59,923)
Purchase of property and equipment	(1,097,530)	(158,061)
Net cash used in investing activities	<u>(1,116,179)</u>	<u>(217,984)</u>
CASH FLOWS FROM FINANCING ACTIVITIES		
Exercise of options and warrants	2,379,225	1,658,442
Cashless option exercise tax payments	(1,435,965)	—
Issuance of common stock, institutional investor	30,350,674	5,173,300
Repayment of equipment purchase payable	(13,107)	(669,649)

Net cash provided by financing activities	31,280,827	6,162,093
NET INCREASE IN CASH AND CASH EQUIVALENTS	20,126,022	1,070,246
CASH AND CASH EQUIVALENTS - BEGINNING OF YEAR	3,306,590	2,236,344
CASH AND CASH EQUIVALENTS - END OF YEAR	\$ 23,432,612	\$ 3,306,590

The accompanying notes are an integral part of these financial statements.

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LIGHTWAVE LOGIC, INC.
NOTES TO FINANCIAL STATEMENTS
DECEMBER 31, 2020 AND 2021

NOTE 1 – SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES

History and Nature of Business

Lightwave Logic, Inc. is a technology company focused on the development of next generation photonic devices and non-linear optical polymer materials systems for applications in high speed fiber-optic data communications and optical computing markets. Currently the Company is in various stages of photonic device and materials development and evaluation with potential customers and strategic partners. The Company expects to obtain a revenue stream from technology licensing agreements, technology transfer agreements and the production and direct sale of its own electro-optic device components.

The Company's current development activities are subject to significant risks and uncertainties, including failing to secure additional funding to operationalize the Company's technology now under development.

In March 2020, the World Health Organization declared the outbreak of a novel coronavirus (COVID-19) as a pandemic which continues to spread throughout the United States. In mid March 2020 the Governor of Colorado declared a health emergency and issued an order to close all nonessential businesses. The Company temporarily curtailed most of its business operations from mid March 2020 through May 1, 2020. The Company is currently operating under the guidelines of the State of Colorado Department of Public Health and Environment and the Governor of Colorado's Executive Order, Safer-at Home, as amended.

Lightwave Logic, Inc. (the "Company") was organized under the laws of the State of Nevada in 1997, and the Company commenced with its current business plan in 2004.

Basis of Presentation

The accompanying financial statements are presented in accordance with accounting principles generally accepted in the United States of America. For the statements of comprehensive loss, stockholders' equity and cash flows for the year ended December 31, 2019 refer to the Company's Annual Report on Form 10-K for the year ended December 31, 2020.

Estimates

The preparation of financial statements in conformity with accounting principles generally accepted in the United States requires management to make estimates and assumptions that affect the amounts reported in the financial statements and accompanying disclosures. Although these estimates are based on management's best knowledge of current events and actions the Company may undertake in the future, actual results could differ from the estimates.

Cash Equivalents

For the purposes of the statement of cash flows, the Company considers all highly liquid instruments with maturities of three months or less at the time of purchase to be cash equivalents.

Concentration of Credit Risk

Certain financial instruments potentially subject the Company to concentrations of credit risk. These financial instruments consist primarily of cash. At December 31, 2021, the Company did have deposits with a financial institution that exceed the Federal Depository Insurance coverage.

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LIGHTWAVE LOGIC, INC.
NOTES TO FINANCIAL STATEMENTS
DECEMBER 31, 2021 AND 2020

NOTE 1 – SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES (CONTINUED)

Property and Equipment

Equipment is stated at cost. Depreciation is principally provided by use of straight-line methods for financial and tax reporting purposes over the estimated useful lives of the assets, generally 5 years. When property is retired or otherwise disposed of, the cost and accumulated depreciation are removed from the accounts and any resulting gain or loss is included in operations.

Intangible Assets

Definite-lived intangible assets are stated at cost. Patents are amortized over their estimated useful lives, commencing from the date of grant for the remaining legal lives of the patents. The patents generally have a term of up to 20 years from the date of filing of the earliest related patent application. When certain patent applications are abandoned by the Company for claims that are covered by patents already granted to the Company, the cost of patent applications are removed from the accounts and the resulting expense is reflected in the statement of comprehensive loss.

Fair Value of Financial Instruments

The carrying value of the Company's short-term financial instruments such as cash, accounts payable and accrued expenses approximate their fair values because of their short maturities.

Revenue Recognition

In accordance with FASB ASC 606, *Revenue from Contracts with Customers*, the Company will recognize revenue upon transfer of promised goods or services in an amount that reflects the consideration expected to be received in exchange for those goods or services. To determine revenue recognition for arrangements within the scope of FASB ASC 606, the Company performs the following five steps:

1. Identify the contract with the customer.
2. Identify the performance obligations in the contract.
3. Determine the transaction price.
4. Allocate the transaction price to the performance obligations in the contract.
5. Recognize revenue as (or when) the performance obligations are satisfied.

For product sales, revenue will be recognized at a point in time when the product is shipped or is delivered to the customer's location.

For services performed, revenue will be recognized at a point in time when the service is performed. However, for certain contracts, revenue will be recognized over time as the customer simultaneously receives and consumes the benefits of performance as the Company performs the service.

Income Taxes

The Company follows Financial Accounting Standards Board ("FASB") Accounting Standards Codification ("ASC") 740, "Income Taxes," which requires an asset and liability approach to financial accounting and reporting for income taxes. Deferred income tax assets and liabilities are computed annually for temporary differences between the financial statement and tax bases of assets and liabilities that will result in taxable or deductible amounts in the future based on enacted tax laws and rates applicable to the periods in which the differences are expected to affect taxable income. Valuation allowances are established when necessary to reduce deferred tax assets to the amount expected to be realized. Income tax expense is the tax payable or refundable for the period plus or minus the change during the period in deferred tax assets and liabilities.

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LIGHTWAVE LOGIC, INC.
NOTES TO FINANCIAL STATEMENTS
DECEMBER 31, 2021 AND 2020

NOTE 1 – SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES (CONTINUED)

Stock-based Payments

The Company accounts for stock-based compensation under the provisions of Financial Accounting Standards Board (FASB) Accounting Standards Codification (ASC) 718, "Compensation - Stock Compensation", which requires the measurement and recognition of compensation expense for all stock-based awards made to employees and directors based on estimated fair values on the grant date. The Company estimates the fair value of stock-based awards on the date of grant using the Black-Scholes model. The value of the portion of the award that is ultimately expected to vest is recognized as expense over the requisite service periods using the straight-line method. In June 2018, the FASB issued ASU No. 2018-07, *Compensation – Stock Compensation (Topic 718), Improvements to Nonemployee Share-Based Payment Accounting* (the "2018 Update"). The amendments in the 2018 Update expand the scope of Topic 718 to include share-based payment transactions for acquiring goods and services from nonemployees. Prior to the 2018 Update, Topic 718 applied only to share-based transactions to employees. Consistent with the accounting requirement for employee share-based payment awards, nonemployee share-based payment awards within the scope of Topic 718 are measured at grant-date fair value of the equity instruments that an entity is obligated to issue when the good has been delivered or the service has been rendered and any other conditions necessary to earn the right to benefit from the instruments have been satisfied.

The Company has elected to account for forfeiture of stock-based awards as they occur.

Loss Per Share

The Company follows FASB ASC 260, "Earnings per Share", resulting in the presentation of basic and diluted earnings per share. Because the Company reported a net loss in 2021 and 2020, common stock equivalents, including stock options and warrants were anti-dilutive; therefore, the amounts reported for basic and dilutive loss per share were the same.

Recoverability of Long-Lived Assets

The Company follows FASB ASC 360, "Property, Plant, and Equipment". Long-lived assets to be held and used are reviewed for impairment whenever events or changes in circumstances indicate that the related carrying amount may not be recoverable. When required, impairment losses on assets to be held and used are recognized based on the excess of the asset's carrying amount.

Comprehensive Income (Loss)

The Company follows FASB ASC 220.10, "Reporting Comprehensive Income (Loss)." Comprehensive income (loss) is a more inclusive financial reporting methodology that includes disclosure of certain financial information that historically has not been recognized in the calculation of net income (loss). Since the Company has no items of other comprehensive income (loss), comprehensive income (loss) is equal to net income (loss).

Recently Adopted Accounting Pronouncements

As of December 31, 2021 and for the period then ended, there are no recently adopted accounting standards that have a material effect on the Company's financial statements.

Recently Issued Accounting Pronouncements Not Yet Adopted

As of December 31, 2021, there are no recently issued accounting standards not yet adopted which would have a material effect on the Company's financial statements.

Reclassifications

Certain reclassifications have been made to the 2020 financial statement in order to conform to the 2021 financial statement presentation.

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LIGHTWAVE LOGIC, INC.
NOTES TO FINANCIAL STATEMENTS
DECEMBER 31, 2021 AND 2020

NOTE 2 – MANAGEMENT'S PLANS

Our future expenditures and capital requirements will depend on numerous factors, including: the progress of our research and development efforts; the rate at which we can, directly or through arrangements with original equipment manufacturers, introduce and sell products incorporating our polymer materials technology; the costs of filing, prosecuting, defending and enforcing any patent claims and other intellectual property rights; market acceptance of our products and competing technological developments; our ability to establish cooperative development, joint venture and licensing arrangements; and the impact of the COVID-19 pandemic. We expect that we will incur approximately \$1,015,000 of expenditures per month over the next 12 months. Our current cash position enables us to finance our operations through December 2023. On July 2, 2021, the Company filed a \$100,000,000 universal shelf registration statement with the U.S. Securities and Exchange Commission which became effective on July 9, 2021. On October 4, 2021, the Company entered into a purchase agreement with the institutional investor to sell up to \$33,000,000 of common stock over a 36-month period (described in Note 10). Pursuant to the purchase agreement, the Company received \$3,173,743 in January and February and a remaining available amount of \$13,448,832 is available to the Company per the agreement. Our cash requirements are expected to increase at a rate consistent with the Company's path to revenue as we expand our activities and operations with the objective of commercializing our electro-optic polymer technology. We currently have no debt to service.

NOTE 3 – PREPAID EXPENSES AND OTHER CURRENT ASSETS

Prepaid expenses and other current assets consist of the following:

	<u>December 31, 2021</u>	<u>December 31, 2020</u>
Insurance	\$ 123,877	\$ 93,569
Other	33,041	40,134
Rent	36,525	36,525
License	38,865	36,728
Deposit for Equipment	—	140,394
Prototype Devices	—	118,206
Research & Development Credit	—	101,629
	<u>\$ 232,308</u>	<u>\$ 567,185</u>

NOTE 4 – PROPERTY AND EQUIPMENT

Property and equipment consist of the following:

	<u>December 31, 2021</u>	<u>December 31, 2020</u>
Office equipment	\$ 95,516	\$ 86,097
Lab equipment	4,952,933	3,884,807
Furniture	33,128	33,128
Leasehold improvements	254,350	234,366
	<u>5,335,927</u>	<u>4,238,398</u>
Less: Accumulated depreciation	<u>3,156,852</u>	<u>2,364,849</u>
	<u>\$ 2,179,075</u>	<u>\$ 1,873,549</u>

Depreciation expense for the years ending December 31, 2021 and 2020 was \$792,004 and \$701,015. During the years ended December 31, 2021 and 2020, the Company did not sell or retire property and equipment.

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LIGHTWAVELOGIC, INC.
NOTES TO FINANCIAL STATEMENTS
DECEMBER 31, 2021 AND 2020

NOTE 5 – INTANGIBLE ASSETS

This represents legal fees and patent fees associated with the prosecution of patent applications. The Company has recorded amortization expense on patents granted, which are amortized over the remaining legal life. Maintenance patent fees are paid to a government patent authority to maintain a granted patent in force. Some countries require the payment of maintenance fees for pending patent applications. Maintenance fees paid after a patent is granted are expensed, as these are considered ongoing costs to "maintain a patent". Maintenance fees paid prior to a patent grant date are capitalized to patent costs, as these are considered "patent application costs". No amortization expense has been recorded on the remaining patent applications since patents on these applications have yet to be granted.

Intangible assets consist of the following:

	<u>December 31, 2021</u>	<u>December 31, 2020</u>
Patents	\$ 1,345,649	\$ 1,327,000
Less: Accumulated amortization	<u>497,516</u>	<u>411,000</u>
	<u>\$ 848,133</u>	<u>\$ 916,000</u>

Amortization expense for the years ending December 31, 2021 and 2020 was \$86,516 and \$83,404. There were no patent costs written off for the years ended December 31, 2021 and 2020.

NOTE 6 – COMMITMENTS

On October 30, 2017, the Company entered into a lease agreement to lease approximately 13,420 square feet of office, laboratory and research and development space located in Colorado for the Company's principal executive offices and research and development facility. The term of the lease is sixty-one (61) months, beginning on November 1, 2017 and ending on November 30, 2022. During January 2022, the term was extended for an additional twenty-four (24) months. Base rent for the first year of the lease term is approximately \$168,824, with an increase in annual base rent of approximately 3% in each subsequent year of the lease term. As specified in the lease, the Company paid the landlord (i) all base rent for the period November 1, 2017 and ending on October 31, 2019, in the sum of \$347,045; and (ii) the estimated amount of tenant's proportionate share of operating expenses for the same period in the sum of \$186,293.

Commencing on November 1, 2019, monthly installments of base rent and one-twelfth of landlord's estimate of tenant's proportionate share of annual operating expenses shall be due on the first day of each calendar month. The lease also provides that (i) on November 1, 2019 landlord shall pay the Company for the cost of the cosmetic improvements in the amount of \$3.00 per rentable square foot of the premises, and (ii) on or prior to November 1, 2019, the Company shall deposit with Landlord the sum of \$36,524 as a security deposit which shall be held by landlord to secure the Company's obligations under the lease. The lease contains an option to extend the term to October 31, 2024. On October 30, 2017, the Company entered into an agreement with the tenant leasing the premise from the landlord ("Original Lessee") whereby the Original Lessee agreed to pay the Company the sum of \$260,000 in consideration of the Company entering into the lease and landlord agreeing to the early termination of the Original Lessee's lease agreement with landlord. The consideration of \$260,000 was received on November 1, 2017.

Due to the adoption of the new lease standard, the Company has capitalized the present value of the minimum lease payments commencing November 1, 2019, including the additional option period using an estimated incremental borrowing rate of 6.5%. The minimum lease payments do not include common area annual expenses which are considered

to be nonlease components.

As of January 1, 2019 the operating lease right-of-use asset and operating lease liability amounted to \$885,094 with no cumulative-effect adjustment to the opening balance of retained earnings/accumulated deficit. The Company has elected not to recognize right-of-use assets and lease liabilities arising from short-term leases.

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LIGHTWAVELOGIC, INC.
NOTES TO FINANCIAL STATEMENTS
DECEMBER 31, 2021 AND 2020

NOTE 6 – COMMITMENTS CONTINUED)

The Company is obligated under an operating lease for office and laboratory space. The aggregate minimum future lease payments under the operating lease, including the extended term are as follows:

YEARS ENDING DECEMBER 31,	AMOUNT
2022	\$ 207,563
2023	213,781
2024	182,624
	603,968
Less discounted interest	(67,521)
TOTAL	\$ 536,447

Rent expense totaling \$134,243 and \$44,747 is included in research and development and general and administrative expenses for the year ended December 31, 2021. Rent expense totaling \$129,806 and \$43,269 is included in research and development and general and administrative expenses for the year ended December 31, 2020.

NOTE 7 – PAYCHECK PROTECTION PROGRAM ADVANCE

On April 24, 2020, the Company received \$410,700 in loan funding from the Paycheck Protection Program, established pursuant to the Coronavirus Aid, Relief, and Economic Security Act enacted on March 27, 2020 and administered by the U.S. Small Business Administration. The unsecured loan is evidenced by a promissory note of the Company dated April 23, 2020 in the principal amount of \$410,700, to Community Banks of Colorado, a division of NBH Bank, the lender. The loan proceeds have been used to cover payroll costs, rent and utility costs. The loan was eligible for forgiveness as part of the CARES Act if certain requirements were met. The loan was forgiven by the Small Business Administration in its entirety on January 22, 2021.

NOTE 8 – INCOME TAXES

As discussed in Note 1, the Company utilizes the asset and liability method of accounting for income taxes in accordance with FASB ASC 740.

The income tax (benefit) provision consists of the following:

	2021	2020
Current	\$ —	\$ —
Deferred	(3,692,000)	(1,972,000)
Change in valuation allowance	3,692,000	1,972,000
	<u>\$ —</u>	<u>\$ —</u>

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LIGHTWAVELOGIC, INC.
NOTES TO FINANCIAL STATEMENTS
DECEMBER 31, 2021 AND 2020

NOTE 8 – INCOME TAXES (CONTINUED)

The reconciliation of the statutory federal rate to the Company's effective income tax rate is as follows:

	2021		2020	
	Amount	%	Amount	%
Income tax benefit at U.S. federal income tax rate	\$ (3,913,000)	(21)	\$ (1,544,000)	(21)
State tax benefit, net of federal tax effect	(838,000)	(4)	(441,000)	(6)
Federal deduction net of tax	38,000	—	—	—
Tax exempt income	(111,000)	(1)	—	—
Non-deductible share-based compensation	899,000	5	13,000	—
Change in valuation allowance	3,692,000	20	1,972,000	27
Other	233,000	1	—	—
	<u>\$ —</u>	<u>—</u>	<u>\$ —</u>	<u>—</u>

The components of deferred tax assets as of December 31, 2021 and 2020 are as follows:

2021

2020

Deferred tax asset for NOL carryforwards	\$ 19,966,000	\$ 15,338,000
Share-based compensation	1,242,000	2,178,000
Valuation allowance	(21,208,000)	(17,516,000)
	<u>\$ —</u>	<u>\$ —</u>

The valuation allowance for deferred tax assets as of December 31, 2021 and 2020 was \$21,208,000 and \$17,516,000, respectively. The change in the total valuation for the year ended December 31, 2021 was an increase of \$3,692,000 and for the year ended December 31, 2020 was an increase of \$1,972,000. In assessing the realization of deferred tax assets, management considers whether it is more likely than not that some portion or all of the deferred tax assets will not be realized. The ultimate realization of deferred tax assets is dependent upon the generation of future taxable income during the periods in which the net operating losses and temporary differences become deductible. Management considered projected future taxable income and tax planning strategies in making this assessment. The value of the deferred tax assets was offset by a valuation allowance, due to the current uncertainty of the future realization of the deferred tax assets.

As of December 31, 2021, the Company had net operating loss carry forwards of approximately \$73,950,000, expiring through the year ending December 31, 2038. Net operating losses recorded in tax years beginning January 1, 2018 and after of approximately \$35,670,000 are allowed for an indefinite carryforward period but limited to 80% of each subsequent year's net income. This amount can be used to offset future taxable income of the Company.

The timing and manner in which the Company can utilize operating loss carryforwards in any year may be limited by provisions of the Internal Revenue Code regarding changes in ownership of corporations. Such limitation may have an impact on the ultimate realization of its carryforwards and future tax deductions.

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LIGHTWAVE LOGIC, INC.
NOTES TO FINANCIAL STATEMENTS
DECEMBER 31, 2021 AND 2020

NOTE 8 – INCOME TAXES (CONTINUED)

The Company follows FASB ASC 740.10, which provides guidance for the recognition and measurement of certain tax positions in an enterprise's financial statements. Recognition involves a determination of whether it is more likely than not that a tax position will be sustained upon examination with the presumption that the tax position will be examined by the appropriate taxing authority having full knowledge of all relevant information. The adoption of FASB ASC 740.10 did not require an adjustment to the Company's financial statements.

The Company's policy is to record interest and penalties associated with unrecognized tax benefits as additional income taxes in the statement of operations. As of January 1, 2021, the Company had no unrecognized tax benefits and no charge during 2021, and accordingly, the Company did not recognize any interest or penalties during 2021 related to unrecognized tax benefits. There is no accrual for uncertain tax positions as of December 31, 2021.

The Company files U.S. income tax returns and a state income tax return. With few exceptions, the U.S. and state income tax returns filed for the tax years ending on December 31, 2018 and thereafter are subject to examination by the relevant taxing authorities.

NOTE 9 – STOCKHOLDERS' EQUITY

Preferred Stock

Pursuant to the Company's Articles of Incorporation, the Company's board of directors is empowered, without stockholder approval, to issue series of preferred stock with any designations, rights and preferences as they may from time to time determine. The rights and preferences of this preferred stock may be superior to the rights and preferences of the Company's common stock; consequently, preferred stock, if issued could have dividend, liquidation, conversion, voting or other rights that could adversely affect the voting power or other rights of the common stock. Additionally, preferred stock, if issued, could be utilized, under special circumstances, as a method of discouraging, delaying or preventing a change in control of the Company's business or a takeover from a third party.

Common Stock Options and Warrants

In January 2019, the Company signed a purchase agreement with the institutional investor to sell up to \$25,000,000 of common stock. The Company registered 9,500,000 shares pursuant to a registration statement filed on January 30, 2019 which became effective February 13, 2019. The Company issued 350,000 shares of common stock to the institutional investor as an initial commitment fee valued at \$258,125, fair value, and 812,500 shares of common stock are reserved for additional commitment fees to the institutional investor in accordance with the terms of the purchase agreement. The Company registered an additional 6,000,000 shares pursuant to a registration statement filed on January 24, 2020 which became effective February 4, 2020. The Company registered an additional 8,000,000 shares pursuant to a registration statement filed on November 20, 2020 which became effective November 20, 2020. During the period January 2019 through December 30, 2021, the institutional investor purchased 22,337,500 shares of common stock for proceeds of \$23,773,924 and the Company issued 772,666 shares of common stock as additional commitment fee, valued at \$1,575,509, fair value, leaving 39,834 in reserve for additional commitment fees. During the year ending December 30, 2021, the institutional investor purchased 8,062,500 shares of common stock for proceeds of \$13,973,249 and the Company issued 454,138 shares of common stock as additional commitment fee, valued at \$1,333,628, fair value. All of the registered shares under the purchase agreement have been issued as of December 31, 2021.

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LIGHTWAVE LOGIC, INC.
NOTES TO FINANCIAL STATEMENTS
DECEMBER 31, 2021 AND 2020

NOTE 9 – STOCKHOLDERS' EQUITY (CONTINUED)

Common Stock Options and Warrants (Continued)

On July 2, 2021, the Company filed a \$100,000,000 universal shelf registration statement with the U.S. Securities and Exchange Commission which became effective on July 9, 2021. On October 4, 2021, the Company entered into a purchase agreement with the institutional investor to sell up to \$33,000,000 of common stock over a 36-month period. Concurrently with entering into the purchase agreement, the Company also entered into a registration rights agreement which provides the institutional investor with certain registration rights related to the shares issued under the purchase agreement. Pursuant to the purchase agreement, the Company issued 30,312 shares of common stock to the institutional investor as an initial commitment fee valued at \$279,174, fair value, and 60,623 shares of common stock are reserved for additional commitment fees to the institutional investor in accordance with the terms of the purchase agreement. During the year ending December 31, 2021, pursuant to the purchase agreement, the institutional investor purchased 1,227,511 shares of common stock for proceeds of \$16,377,425 and the Company issued 30,086 shares of common stock as additional commitment fee, valued at \$446,663, fair value, leaving 30,537 in reserve for additional commitment fees. During January and February 2022, pursuant to the purchase agreement, the institutional investor purchased 400,000 shares of common stock for proceeds of \$3,173,743 and the Company issued 5,831 shares of common stock as additional commitment fee, valued at \$53,123, fair value, leaving 24,706 in reserve for additional commitment fees.

NOTE 10 – STOCK BASED COMPENSATION

During 2007, the Board of Directors of the Company adopted the 2007 Employee Stock Plan ("2007 Plan") that was approved by the shareholders. Under the 2007 Plan, the Company is authorized to grant options to purchase up to 10,000,000 shares of common stock to directors, officers, employees and consultants who provide services to the Company. The 2007 Plan is intended to permit stock options granted to employees under the 2007 Plan to qualify as incentive stock options under Section 422 of the Internal Revenue Code of 1986, as amended ("Incentive Stock Options"). All options granted under the 2007 Plan, which are not intended to qualify as Incentive Stock Options are deemed to be non-qualified options ("Non-Statutory Stock Options"). Effective June 24, 2016, the 2007 Plan was terminated. As of December 31, 2021, options to purchase 3,085,000 shares of common stock have been issued and are outstanding.

During 2016, the Board of Directors of the Company adopted the 2016 Equity Incentive Plan ("2016 Plan") that was approved by the shareholders at the 2016 annual meeting of shareholders on May 20, 2016. Under the 2016 Plan, the Company is authorized to grant awards of incentive and non-qualified stock options and restricted stock to purchase up to 3,000,000 shares of common stock to employees, directors and consultants. Effective May 16, 2019, the number of shares of the Company's common stock available for issuance under the 2016 Plan was increased from 3,000,000 to 8,000,000 shares. As of December 31, 2021, options to purchase 3,663,248 shares of common stock have been issued and are outstanding and 3,210,250 shares of common stock remain available for grants under the 2016 Plan.

Both plans are administered by the Board of Directors or its compensation committee which determines the persons to whom awards will be granted, the number of awards to be granted, and the specific terms of each grant. Subject to the provisions regarding Ten Percent Shareholders, the exercise price per share of each option cannot be less than 100% of the fair market value of a share of common stock on the date of grant. Options granted under the 2016 Plan are generally exercisable for a period of 10 years from the date of grant and may vest on the grant date, another specified date or over a period of time.

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LIGHTWAVE LOGIC, INC.
NOTES TO FINANCIAL STATEMENTS
DECEMBER 31, 2021 AND 2020

NOTE 10 – STOCK BASED COMPENSATION (CONTINUED)

The Company uses the Black-Scholes option pricing model to calculate the grant-date fair value of an award, with the following assumptions for 2021: no dividend yield in all years, expected volatility, based on the Company's historical volatility, 70.4% to 77.1%, risk-free interest rate between 1.15% to 1.73% and expected option life of 10 years. Prior to May 2018, the expected life is based on the estimated average of the life of options using the "simplified" method, as prescribed in FASBASC 718, due to insufficient historical exercise activity during recent years. Starting in May 2018, the expected life is based on the legal contractual life of options. The Company uses the Black-Scholes option pricing model to calculate the grant-date fair value of an award, with the following assumptions for 2020: no dividend yield in all years, expected volatility, based on the Company's historical volatility, 64% to 78%, risk-free interest rate between 0.30% to 1.82% and expected option life of 4.6 to 10 years.

As of December 31, 2021, there was \$1,087,645 of unrecognized compensation expense related to non-vested market-based share awards that is expected to be recognized through September 30, 2023.

Share-based compensation was recognized as follows:

	2021	2020
2007 Employee Stock Option Plan	\$ —	\$ —
2016 Equity Incentive Plan	1,022,985	539,414
Warrants	11,001	95,774
Total share-based compensation	\$ 1,033,986	\$ 635,188

The following tables summarize all stock option and warrant activity of the Company during the years ended December 31, 2021 and 2020:

	Number of Shares	Exercise Price	Weighted Average Exercise Price
Outstanding, December 31, 2019	16,302,517	\$0.57 - \$1.69	\$ 0.85
Granted	647,500	\$0.51 - \$0.86	\$ 0.76
Expired	(4,845,715)	\$0.80 - \$1.02	\$ 0.86
Forfeited	(8,750)	\$1.10	\$ 1.10
Exercised	(2,073,052)	\$0.80	\$ 0.80
Outstanding, December 31, 2020	10,022,500	\$0.57 - \$1.69	\$ 0.85
Granted	1,061,000	\$1.27 - \$16.81	\$ 2.32
Forfeited	(28,750)	\$0.64 - \$0.86	\$ 0.82
Exercised	(3,168,502)	\$0.60 - \$1.50	\$ 0.88
Outstanding, December 31, 2021	7,886,248	\$0.51 - \$16.81	\$ 1.02
Exercisable, December 31, 2021	7,403,249	\$0.51 - \$16.81	\$ 0.89

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LIGHTWAVE LOGIC, INC.
NOTES TO FINANCIAL STATEMENTS
DECEMBER 31, 2021 AND 2020

NOTE 10 – STOCK BASED COMPENSATION (CONTINUED)

The aggregate intrinsic value of options and warrants outstanding and exercisable as of December 31, 2021 was \$103,604,322. The aggregate intrinsic value is calculated as the

difference between the exercise price of the underlying options and warrants and the closing stock price of \$14.88 for the Company's common stock on December 31, 2021. During the year ending December 31, 2021, 2,046,250 options were exercised for proceeds of \$1,950,875. During the year ending December 31, 2021, 677,000 warrants were exercised for proceeds of \$428,350 and 445,252 options were exercised via cashless method. No options were exercised during 2020. During the year ending December 31, 2020, 2,073,052 warrants were exercised for proceeds of \$1,658,442.

Non-Qualified Stock Options and Warrants Outstanding			
Range of Exercise Prices	Number Outstanding Currently Exercisable at December 31, 2021	Weighted Average Remaining Contractual Life	Weighted Average Exercise Price of Options and Warrants Currently Exercisable
\$0.51 - \$16.81	7,403,249	5.0 Years	\$0.89

NOTE 11 – RELATED PARTY

At December 31, 2021 the Company had office expense accruals of officers in the amount of \$24,000, a legal accrual to related party of \$6,130 and accounting service fee accrual and expense reimbursements to related parties of \$2,059. At December 31, 2020 the Company had a legal accrual to related party of \$30,100, director fees accrued in the amount of \$10,000, travel and office expense accruals of officers in the amount of \$7,177 and accounting service fee accrual to a related party of \$2,520.

NOTE 12 – RETIREMENT PLAN

The Company established a 401(k) retirement plan covering all eligible employees beginning November 15, 2013. A contribution of \$53,035 was charged to expense and accrued for the year ending December 31, 2021 to all eligible non-executive participants. A contribution of \$53,832 was charged to expense and accrued for the year ending December 31, 2020 to all eligible non-executive participants.

Restricted Stock Award Agreement

This Restricted Stock Award Agreement (this "**Agreement**") is made and entered into as of [] (the "**Grant Date**") by and between Lightwave Logic, Inc., a Nevada corporation (the "**Company**") and [] (the "**Director**").

WHEREAS, the Company has adopted the 2016 Equity Incentive Plan (the "**Plan**") under which awards of Restricted Stock may be granted; and

WHEREAS, the Committee has determined that it is in the best interests of the Company and its shareholders to grant the award of Restricted Stock provided for herein.

NOW, THEREFORE, the parties hereto, intending to be legally bound, agree as follows:

1. **Grant of Restricted Stock.** Pursuant to Section 7 of the Plan, the Company hereby issues to the Director on the Grant Date a Restricted Stock Award consisting of, in the aggregate, [] shares of Common Stock of the Company (the "**Restricted Stock**"), on the terms and conditions and subject to the restrictions set forth in this Agreement and the Plan. Capitalized terms that are used but not defined herein have the meaning ascribed to them in the Plan.

2. **Consideration.** The grant of the Restricted Stock is made in consideration of the services to be rendered by the Director to the Company.

3. **Restricted Period; Vesting.**

3.1 Except as otherwise provided herein, provided that the Director remains in Continuous Service through the applicable vesting date, the Restricted Stock will vest in accordance with the following schedule:

Vesting Date	Shares of Common Stock
[]	[]
[]	[]
[]	[]

The period over which the Restricted Stock vests is referred to as the "**Restricted Period**".

3.2 If the Director's Continuous Service terminates for any reason at any time before all of the Director's Restricted Stock has vested, the Director's unvested Restricted Stock shall be automatically forfeited upon such termination of Continuous Service and neither the Company nor any Affiliate shall have any further obligations to the Director under this Agreement.

3.3 The foregoing vesting schedule notwithstanding, upon the occurrence of a Change in Control, 100% of the unvested Restricted Stock shall vest as of the date of the Change in Control.

4. **Restrictions.** Subject to any exceptions set forth in this Agreement or the Plan, during the Restricted Period, the Restricted Stock or the rights relating thereto may not be assigned, alienated, pledged, attached, sold or otherwise transferred or encumbered by the Director. Any attempt to assign, alienate, pledge, attach, sell or otherwise transfer or encumber the Restricted Stock or the rights relating thereto during the Restricted Period shall be wholly ineffective and, if any such attempt is made, the Restricted Stock will be forfeited by the Director and all of the Director's rights to such shares shall immediately terminate without any payment or consideration by the Company.

5. **Rights as Shareholder; Dividends.**

5.1 The Director shall be the record owner of the Restricted Stock until the shares of Common Stock are sold or otherwise disposed of, and shall be entitled to all of the rights of a shareholder of the Company including, without limitation, the right to vote such shares and receive all dividends or other distributions paid with respect to such shares. Notwithstanding the foregoing, any dividends or other distributions shall be subject to the same restrictions on transferability as the shares of Restricted Stock with respect to which they were paid.

5.2 The Company may issue stock certificates or evidence the Director's interest by using a restricted book entry account with the Company's transfer agent. Physical possession or custody of any stock certificates that are issued shall be retained by the Company until such time as the Restricted Stock vests.

5.3 If the Director forfeits any rights the Director has under this Agreement in accordance with Section 3 of this Agreement, the Director shall, on the date of such forfeiture, no longer have any rights as a shareholder with respect to the Restricted Stock and shall no longer be entitled to vote or receive dividends on such shares.

6. **No Right to Continued Service on the Board.** Neither the Plan nor this Agreement shall confer upon the Director any right to be retained as a Director of the Company or in any other capacity. Further, nothing in the Plan or this Agreement shall be construed to limit the discretion of the Company to terminate the Director's Continuous Service at any time.

7. **Adjustments.** If any change is made to the outstanding Common Stock or the capital structure of the Company, if required, the shares of Common Stock shall be adjusted or terminated in any manner as contemplated by 11 of the Plan.

8. **Tax Liability and Withholding.**

8.1 As a condition to the issuance of any Restricted Stock, the Company may withhold, or require the Director to pay or reimburse the Company for, any taxes which the Company determines are required to be withheld under federal, state or local law in connection with the grant or vesting of the Restricted Stock.

8.2 Notwithstanding any action the Company takes with respect to any or all income tax, social insurance, payroll tax, or other tax-related withholding ("**Tax-Related Items**"), the ultimate liability for all Tax-Related Items is and remains the Director's responsibility and the Company (a) makes no representation or undertakings regarding the treatment of any Tax-Related Items in connection with the grant or vesting of the Restricted Stock or the subsequent sale of any shares and (b) does not commit to structure the Restricted Stock to reduce or eliminate the Director's liability for Tax-Related Items.

9. **Section 83(b) Election.** The Director may make an election under Code Section 83(b) (a "**Section 83(b) Election**") with respect to the Restricted Stock. Any such election must be made within thirty (30) days after the Grant Date. If the Director elects to make a Section 83(b) Election, the Director shall provide the Company with a copy of an executed version and satisfactory evidence of the filing of the executed Section 83(b) Election with the US Internal Revenue Service. The Director agrees to assume full responsibility for ensuring that the Section 83(b) Election is actually and timely filed with the US Internal Revenue Service and for all tax consequences resulting from the Section 83(b) Election.

10. **Compliance with Law.** The issuance and transfer of shares of Common Stock shall be subject to compliance by the Company and the Director with all applicable

requirements of federal and state securities laws and with all applicable requirements of any stock exchange on which the Company's shares of Common Stock may be listed. No shares of Common Stock shall be issued or transferred unless and until any then applicable requirements of state and federal laws and regulatory agencies have been fully complied with to the satisfaction of the Company and its counsel. The Director understands that the Company is under no obligation to register the shares of Common Stock with the Securities and Exchange Commission, any state securities commission or any stock exchange to effect such compliance.

11. Legends. A legend may be placed on any certificate(s) or other document(s) delivered to the Director indicating restrictions on transferability of the shares of Restricted Stock pursuant to this Agreement or any other restrictions that the Committee may deem advisable under the rules, regulations and other requirements of the Securities and Exchange Commission, any applicable federal or state securities laws or any stock exchange on which the shares of Common Stock are then listed or quoted.

12. Notices. Any notice required to be delivered to the Company under this Agreement shall be in writing and addressed to the Chief Operating Officer of the Company at the Company's principal corporate offices. Any notice required to be delivered to the Director under this Agreement shall be in writing and addressed to the Director at the Director's address as shown in the records of the Company. Either party may designate another address in writing (or by such other method approved by the Company) from time to time.

13. Governing Law. This Agreement will be construed and interpreted in accordance with the laws of the State of Nevada without regard to conflict of law principles.

14. Interpretation. Any dispute regarding the interpretation of this Agreement shall be submitted by the Director or the Company to the Committee (excluding the Director if the Director serves on the Committee) for review. The resolution of such dispute by the Committee shall be final and binding on the Director and the Company.

15. Restricted Stock Subject to Plan. This Agreement is subject to the Plan as approved by the Company's shareholders. The terms and provisions of the Plan as it may be amended from time to time are hereby incorporated herein by reference. In the event of a conflict between any term or provision contained herein and a term or provision of the Plan, the applicable terms and provisions of the Plan will govern and prevail.

16. Successors and Assigns. The Company may assign any of its rights under this Agreement. This Agreement will be binding upon and inure to the benefit of the successors and assigns of the Company. Subject to the restrictions on transfer set forth herein, this Agreement will be binding upon the Director and the Director's beneficiaries, executors, administrators and the person(s) to whom the Restricted Stock may be transferred by will or the laws of descent or distribution.

17. Severability. The invalidity or unenforceability of any provision of the Plan or this Agreement shall not affect the validity or enforceability of any other provision of the Plan or this Agreement, and each provision of the Plan and this Agreement shall be severable and enforceable to the extent permitted by law.

18. Discretionary Nature of Plan. The Plan is discretionary and may be amended, cancelled or terminated by the Company at any time, in its discretion. The grant of the Restricted Stock in this Agreement does not create any contractual right or other right to receive any Restricted Stock or other Awards in the future. Future Awards, if any, will be at the sole discretion of the Company. Any amendment, modification, or termination of the Plan shall not constitute a change or impairment of the terms and conditions of the Director's membership on the Board.

19. Amendment. The Committee has the right to amend, alter, suspend, discontinue or cancel the Restricted Stock, prospectively or retroactively; *provided, that*, no such amendment shall adversely affect the Director's material rights under this Agreement without the Director's consent.

20. Counterparts. This Agreement may be executed in counterparts, each of which shall be deemed an original but all of which together will constitute one and the same instrument. Counterpart signature pages to this Agreement transmitted by facsimile, by electronic mail in portable document format (.pdf), or by any other electronic means intended to preserve the original graphic and pictorial appearance of a document, will have the same effect as physical delivery of the paper document bearing an original signature.

21. Acceptance. The Director hereby acknowledges receipt of a copy of the Plan and this Agreement. The Director has read and understands the terms and provisions thereof, and accepts the Restricted Stock subject to all of the terms and conditions of the Plan and this Agreement. The Director acknowledges that there may be adverse tax consequences upon the grant or vesting of the Restricted Stock or disposition of the shares and that the Director has been advised to consult a tax advisor prior to such grant, vesting or disposition.

SIGNATURE PAGE FOLLOWS

IN WITNESS WHEREOF, the parties hereto have executed this Agreement as of the date first above written.

LIGHTWAVE LOGIC, INC.

By: _____

Name:

Title:

DIRECTOR

Name:

SUBSIDIARIES OF LIGHTWAVE LOGIC, INC.

None.

CONSENT OF INDEPENDENT REGISTERED PUBLIC ACCOUNTING FIRM

The Board of Directors of
Lightwave Logic, Inc.

We hereby consent to the incorporation by reference in the registration statements of Lightwave Logic, Inc. on:

- Form S-8 (No. 333-234737)
- Form S-8 (No. 333-213541)
- Form S-8 (No. 333-189943)
- Form S-8 (No. 333-198916)
- Form S-3 (No. 333-257670)

of our audit report dated March 1, 2022 relating to the financial statements of Lightwave Logic, Inc. as of December 31, 2021 and 2020 and for each of the two years in the period ended December 31, 2021, which report is included in this Annual Report on Form 10-K of the Company filed on March 1, 2022.

/s/ Morison Cogen LLP

Blue Bell, Pennsylvania
Date: March 1, 2022

CERTIFICATION

I, Michael Lebby, certify that:

1. I have reviewed this Annual Report on Form 10-K of Lightwave Logic, Inc.;

2. Based on my knowledge, this report does not contain any untrue statement of a material fact or omit to state a material fact necessary to make the statements made, in light of the circumstances under which such statements were made, not misleading with respect to the period covered by this report;

3. Based on my knowledge, the financial statements, and other financial information included in this report, fairly present in all material respects the financial condition, results of operations and cash flows of the registrant as of, and for, the periods presented in this report;

4. The registrant's other certifying officer(s) and I are responsible for establishing and maintaining disclosure controls and procedures (as defined in Exchange Act Rules 13a-15(e) and 15d-15(e)) and internal control over financial reporting (as defined in Exchange Act Rules 13a-15(f) and 15d-15(f)) for the registrant and have:

(a) Designed such disclosure controls and procedures, or caused such disclosure controls and procedures to be designed under our supervision, to ensure that material information relating to the registrant, including its consolidated subsidiaries, is made known to us by others within those entities, particularly during the period in which this report is being prepared;

(b) Designed such internal control over financial reporting, or caused such internal control over financial reporting to be designed under our supervision, to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles;

(c) Evaluated the effectiveness of the registrant's disclosure controls and procedures and presented in this report our conclusions about the effectiveness of the disclosure controls and procedures, as of the end of the period covered by this report based on such evaluation; and

(d) Disclosed in this report any change in the registrant's internal control over financial reporting that occurred during the registrant's most recent fiscal quarter (the registrant's fourth fiscal quarter in the case of an annual report) that has materially affected, or is reasonably likely to materially affect, the registrant's internal control over financial reporting; and

5. The registrant's other certifying officer(s) and I have disclosed, based on our most recent evaluation of internal control over financial reporting, to the registrant's auditors and the audit committee of the registrant's board of directors (or persons performing the equivalent functions):

(a) All significant deficiencies and material weaknesses in the design or operation of internal control over financial reporting which are reasonably likely to adversely affect the registrant's ability to record, process, summarize and report financial information; and

(b) Any fraud, whether or not material, that involves management or other employees who have a significant role in the registrant's internal control over financial reporting.

Date: March 1, 2022

/s/ Michael Lebby

Michael Lebby

Chief Executive Officer

(Principal Executive Officer)

CERTIFICATION

I, James S. Marcelli, certify that:

1. I have reviewed this Annual Report on Form 10-K of Lightwave Logic, Inc.;

2. Based on my knowledge, this report does not contain any untrue statement of a material fact or omit to state a material fact necessary to make the statements made, in light of the circumstances under which such statements were made, not misleading with respect to the period covered by this report;

3. Based on my knowledge, the financial statements, and other financial information included in this report, fairly present in all material respects the financial condition, results of operations and cash flows of the registrant as of, and for, the periods presented in this report;

4. The registrant's other certifying officer(s) and I are responsible for establishing and maintaining disclosure controls and procedures (as defined in Exchange Act Rules 13a-15(e) and 15d-15(e)) and internal control over financial reporting (as defined in Exchange Act Rules 13a-15(f) and 15d-15(f)) for the registrant and have:

(a) Designed such disclosure controls and procedures, or caused such disclosure controls and procedures to be designed under our supervision, to ensure that material information relating to the registrant, including its consolidated subsidiaries, is made known to us by others within those entities, particularly during the period in which this report is being prepared;

(b) Designed such internal control over financial reporting, or caused such internal control over financial reporting to be designed under our supervision, to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles;

(c) Evaluated the effectiveness of the registrant's disclosure controls and procedures and presented in this report our conclusions about the effectiveness of the disclosure controls and procedures, as of the end of the period covered by this report based on such evaluation; and

(d) Disclosed in this report any change in the registrant's internal control over financial reporting that occurred during the registrant's most recent fiscal quarter (the registrant's fourth fiscal quarter in the case of an annual report) that has materially affected, or is reasonably likely to materially affect, the registrant's internal control over financial reporting; and

5. The registrant's other certifying officer(s) and I have disclosed, based on our most recent evaluation of internal control over financial reporting, to the registrant's auditors and the audit committee of the registrant's board of directors (or persons performing the equivalent functions):

(a) All significant deficiencies and material weaknesses in the design or operation of internal control over financial reporting which are reasonably likely to adversely affect the registrant's ability to record, process, summarize and report financial information; and

(b) Any fraud, whether or not material, that involves management or other employees who have a significant role in the registrant's internal control over financial reporting.

Date: March 1, 2022

/s/ James S. Marcelli
James S. Marcelli
Chief Operating Officer
(Principal Financial Officer)

**CERTIFICATION PURSUANT TO
SECTION 1350, CHAPTER 63 OF TITLE 18, UNITED STATES CODE,
AS ADOPTED PURSUANT TO
SECTION 906 OF THE SARBANES-OXLEY ACT OF 2002**

In connection with the Annual Report on Form 10-K of Lightwave Logic, Inc. (the "Company") for the year ended December 31, 2021 as filed with the Securities and Exchange Commission on the date hereof (the "Report"), I, Michael Leby, Chief Executive Officer of our Company, certify, pursuant to Section 906 of the Sarbanes-Oxley Act of 2002 (subsections (a) and (b) of section 1350, Chapter 63 of Title 18, United States Code), that, to my knowledge:

1. The Report fully complies with the requirements of section 13(a) or 15(d) of the Securities Exchange Act of 1934; and
2. The information contained in the Report fairly presents, in all material respects, the financial condition and result of operations of our Company.

Date: March 1, 2022

/s/ Michael Leby

Michael Leby

Chief Executive Officer

(Principal Executive Officer)

The foregoing certification is being furnished solely pursuant to section 906 of the Sarbanes-Oxley Act of 2002 (subsections (a) and (b) of section 1350, Chapter 63 of Title 18, United States Code) and is not being filed as part of the Report or as a separate disclosure document.

**CERTIFICATION PURSUANT TO
SECTION 1350, CHAPTER 63 OF TITLE 18, UNITED STATES CODE,
AS ADOPTED PURSUANT TO
SECTION 906 OF THE SARBANES-OXLEY ACT OF 2002**

In connection with the Annual Report on Form 10-K of Lightwave Logic, Inc. (the "Company") for the year ended December 31, 2021 as filed with the Securities and Exchange Commission on the date hereof (the "Report"), I, James S. Marcelli, Chief Operating Officer of our Company, certify, pursuant to Section 906 of the Sarbanes-Oxley Act of 2002 (subsections (a) and (b) of section 1350, Chapter 63 of Title 18, United States Code), that, to my knowledge:

1. The Report fully complies with the requirements of section 13(a) or 15(d) of the Securities Exchange Act of 1934; and
2. The information contained in the Report fairly presents, in all material respects, the financial condition and result of operations of our Company.

Date: March 1, 2022

/s/ James S. Marcelli

James S. Marcelli

Chief Operating Officer

(Principal Financial Officer)

The foregoing certification is being furnished solely pursuant to section 906 of the Sarbanes-Oxley Act of 2002 (subsections (a) and (b) of section 1350, Chapter 63 of Title 18, United States Code) and is not being filed as part of the Report or as a separate disclosure document.