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, 2020

☐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: **0-52567**

Lightwave Logic, Inc.

(Exact name of registrant as specified in its charter)

Nevada	82-0497368
(State or other jurisdiction of incorporation or organization)	(I.R.S. Employer Identification No.)
369 Inverness Parkway, Suite 350, Englewood, CO	**80112**
(Address of principal executive offices)	(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

Securities registered pursuant to section 12(g) of the Act:
Common Stock, Par Value $0.001
(Title of class)

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 ☐	Accelerated filer ☐
Non-accelerated filer ☒	Smaller reporting company ☒
	Emerging growth company ☐

If an emerging growth company, indicate by checkmark 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 $69,865,538 as of June 30, 2020.

As of March 31, 2021, there were 101,758,709 shares outstanding of the registrant's common stock, $.001 par value.

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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 P^2IC^{TM} technology platform which 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 2020, we made continued 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.

We are initially targeting applications in data communications and telecommunications markets and are exploring other applications 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.

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.

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 (P^2IC^{TM})

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 P^2IC™ 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.

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."

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 miniaturize 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 175^0C. 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 110^0C – exceeding typical commercial operating temperatures of approximately 85^0C, 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 waveguidemodulator*** 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 50Gbps, 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 Electro-Optic Material 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 2021. 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 consists of 56 granted patents that include 44 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, 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.

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 P^2IC™ 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 P^2IC™ 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.

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 85^0 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.

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.

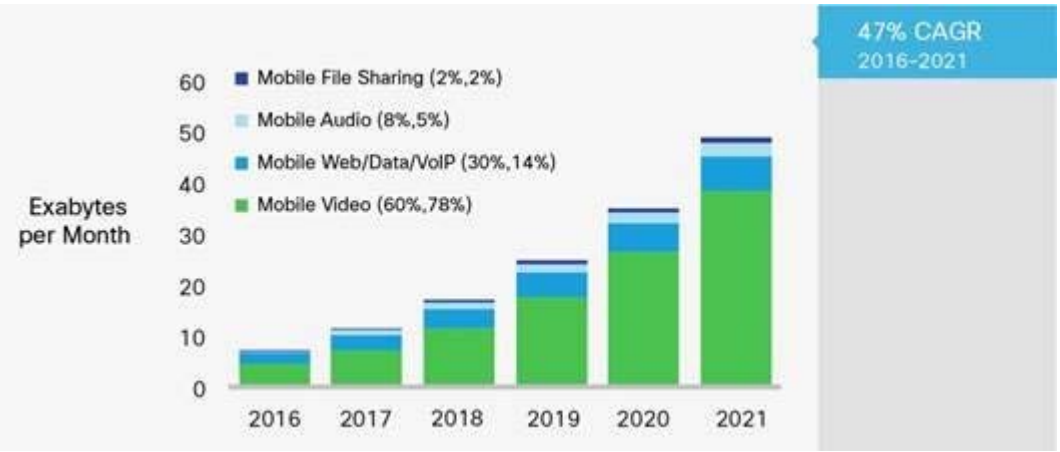
As we move forward to diligently meet our goals, we continue to work closely with our packaging partner for the 50Gbaud and 100 Gbaud prototypes, and we are advancing our reliability and characterization efforts to support our prototyping. We are actively engaged with test equipment manufacturers of 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. 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 of what these prospective customers are seeking from a prototype are delivered to our technical team.

The Global Photonic Device Market

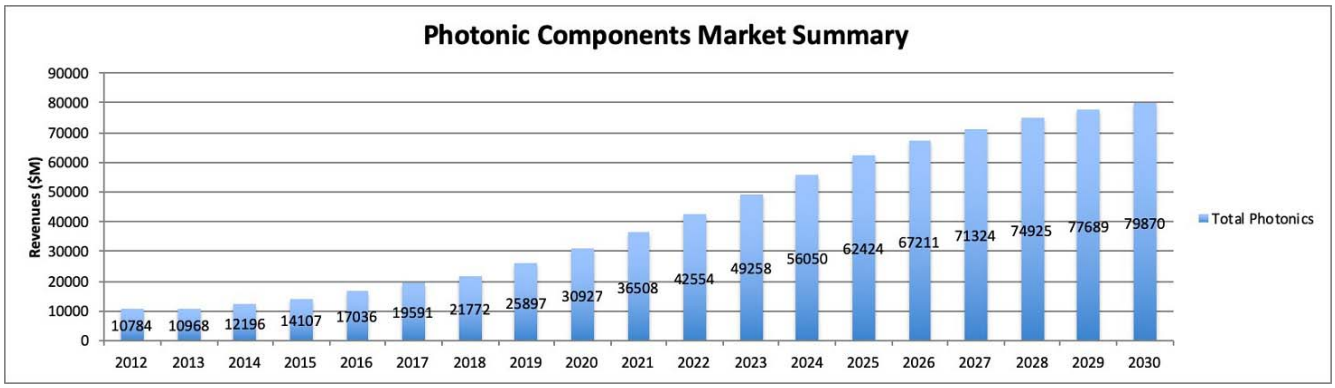
General Overview

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.

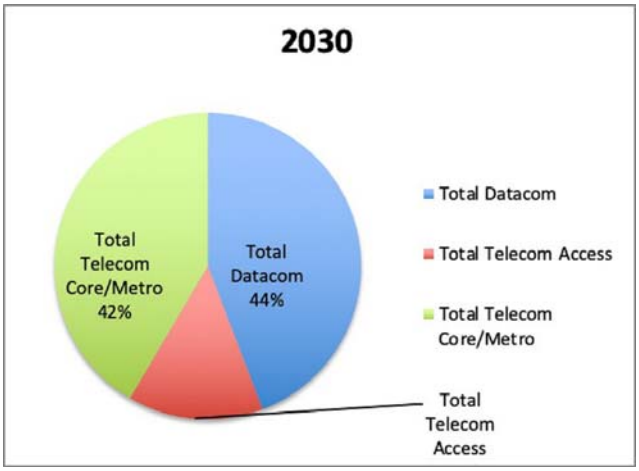
As we have already seen with products such as smart phones, lap top computers, and personal digital assistants (PDAs), Internet traffic, and especially mobile internet traffic is one of the important metrics that is being used to show activity in fiber communications, and particularly telecommunications 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.



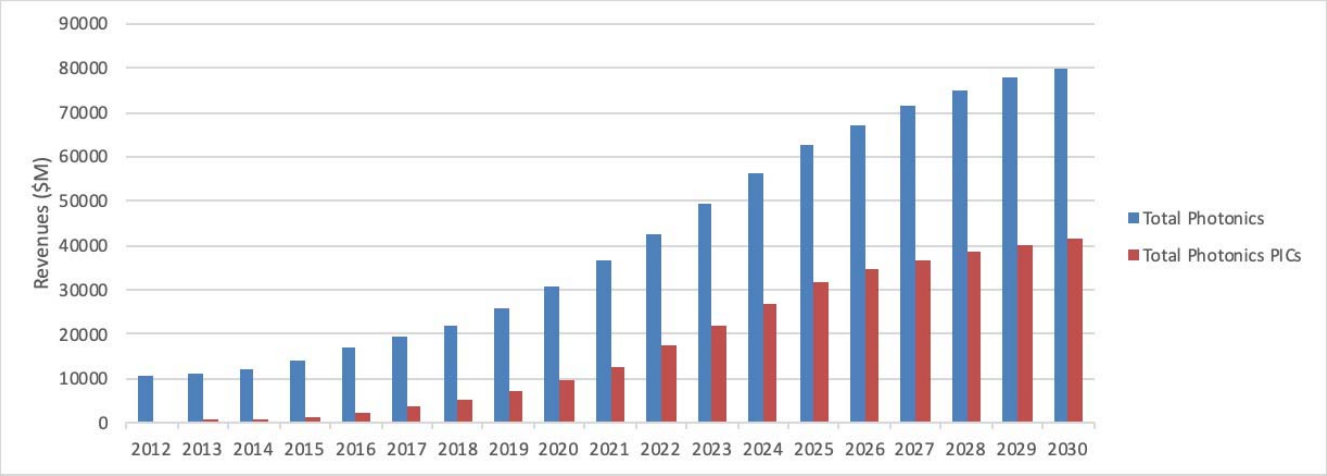
Within the overall market trends of IP traffic growth and in particular mobile video, the internet will need to be able to support high volumes of data traffic. In order to do this, the fiber-optic infrastructure that allows data to be communicated between network nodes such as datacenters, within datacenters, 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 $31B in 2020.



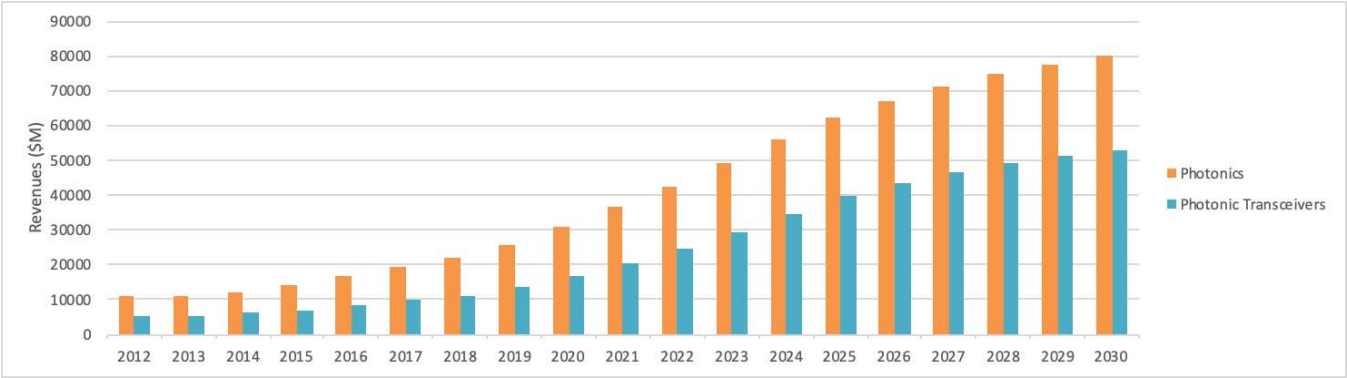
Within the summary photonics components market, three major segments exist: Telecom core/metro, Telecom access, and Datacom. The Telecom core/metro segment is forecast to grow to $33B by 2030 with a 13% CARG (20-30) or 42% of the market, and the Datacom segment is forecast to grow to $35B by 2030 with 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.



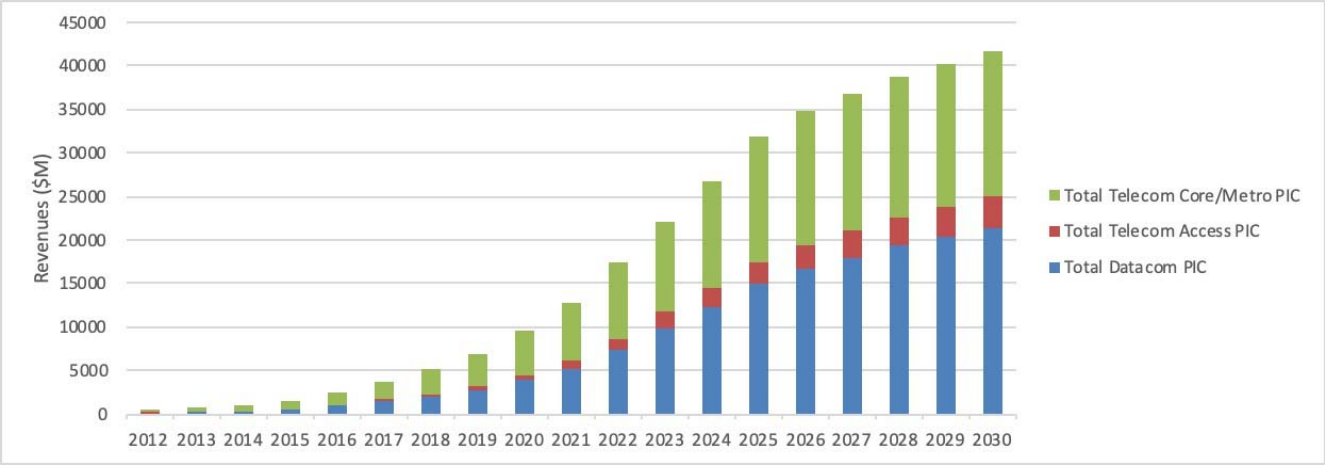
One of the key metrics that is needed for any overall market analysis is how photonics components will grow over the next decade from a PIC perspective. This is important as the trend to integrate photonics components is beginning to accelerate. The trend has been driven by customer applications that 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 ~$10B today, PIC based technologies are forecasted to grow 4X over the next decade.



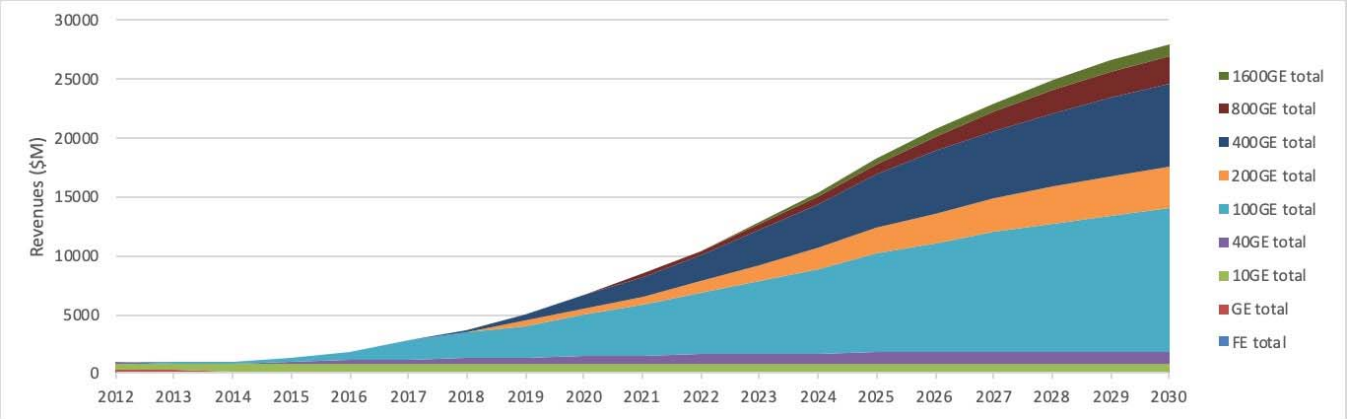
While the rise of PIC based technologies is exciting, what also is exciting in the photonics component market is the rise of fiber-optic transceivers. Transceivers are small boxes located at the end of each fiber-optic link that house photonics components and PIC components which send and receive data. 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.



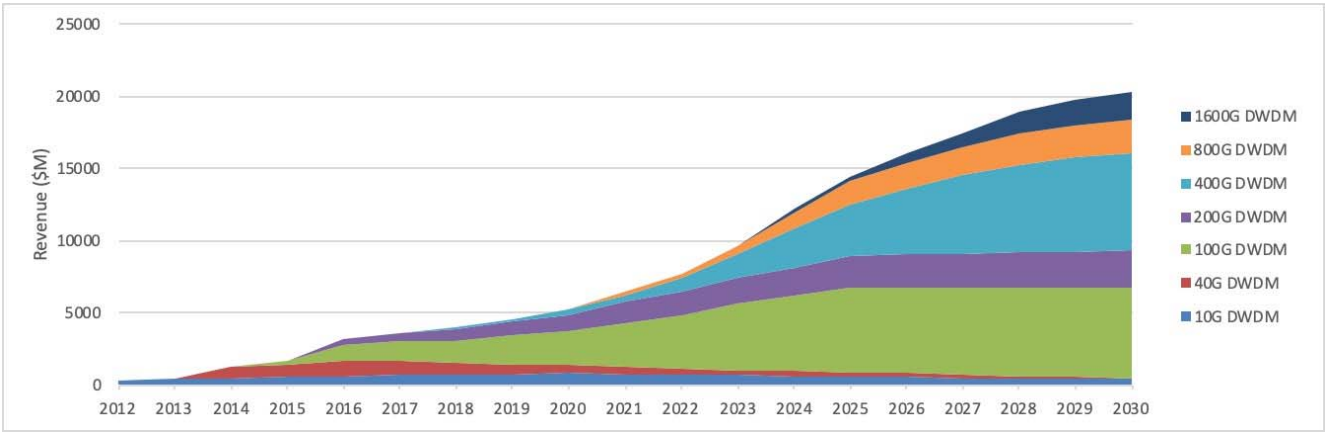
The market for PIC based technologies is expected to grow significantly in telcom core/metro over the next decade. Of the three application markets, the telecom core/metro and datacom markets are expected to be the driver for PIC based technologies. While PIC based technologies are expected to grow to $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 $3-5B range.

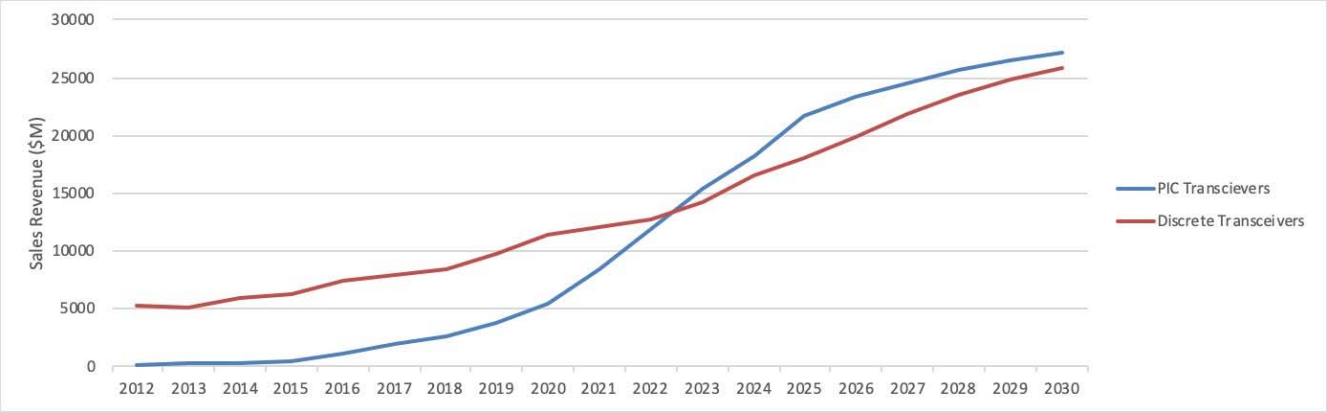


DWDM fiber optic transceivers are expected to reach $20B by 2030 with 27% CAGR (20-30). Like the Ethernet transceiver market, the DWDM transceiver market will also be driven in revenue by the 100G and 400G datarate platforms. The 100G and 400G DWDM markets are expected to reach $6B and $7B by 2030 respectively. DWDM will also benefit from increased datarates of 800G and 1600G by 2030, also in the $3-5B 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 datarates of 100G and beyond. While transceiver modules will trend to smaller footprints, lower power consumption and higher datarates, 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.

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.

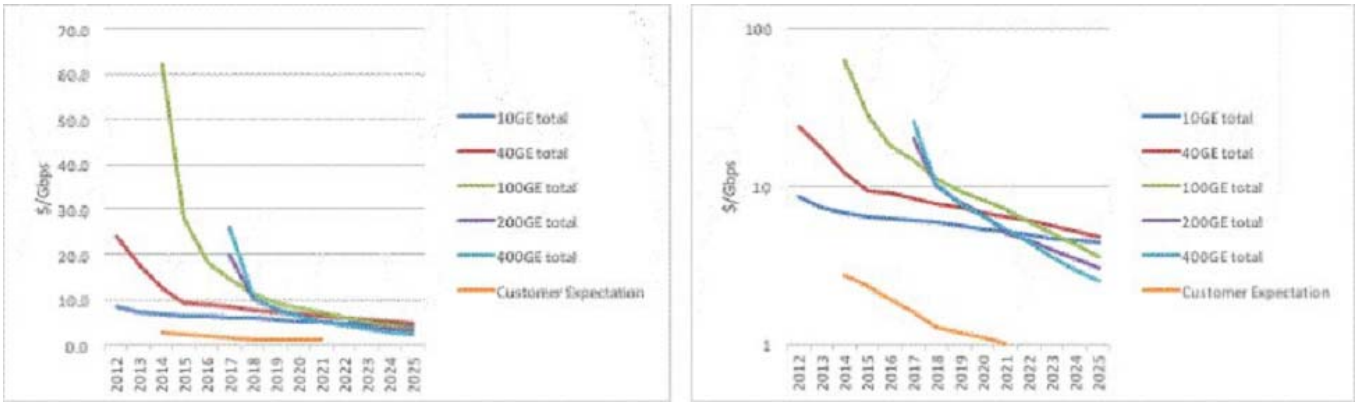
Telecommunications/Data Communications

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

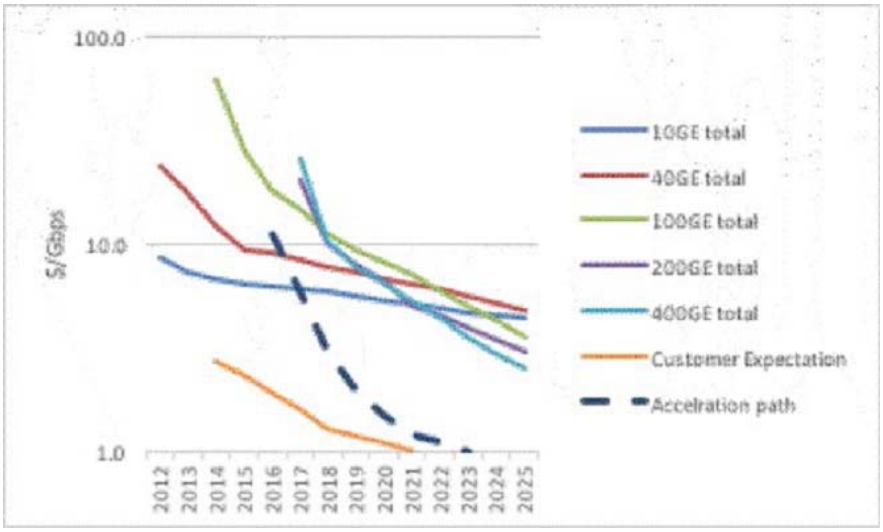
The key issues facing the fiber-optic communications industry are the economic progress and scalability of any PIC based technological platform. The polymer platform is unique in that it is truly scalable. Scalable means being able to scale up for high speed data rates, while simultaneously being able 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:



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 5years.



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

1. Increased r33 (which leads to very low Vpi 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 effective, 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. 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.

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; or (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 P^2IC^{TM} technology
- Continue to develop proprietary intellectual property
- Grow our commercial device development capabilities
- 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.

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 have and expect to continue to make significant operating and capital expenditures for research and development. Our research and development expenses were $4,529,498 and $4,319,295 for the years ended December 31, 2020 and 2019, 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 P^2IC™ 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 P^2IC™ 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 Stack ™

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 an associated third-party research. 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 (P^2IC™)

Our P^2IC™ platform is positioned to address markets with aggregated data rates of 100 Gbaud, 400 Gbaud, 800 Gbaud and beyond. Our P^2IC™ 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 P^2IC™ 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:

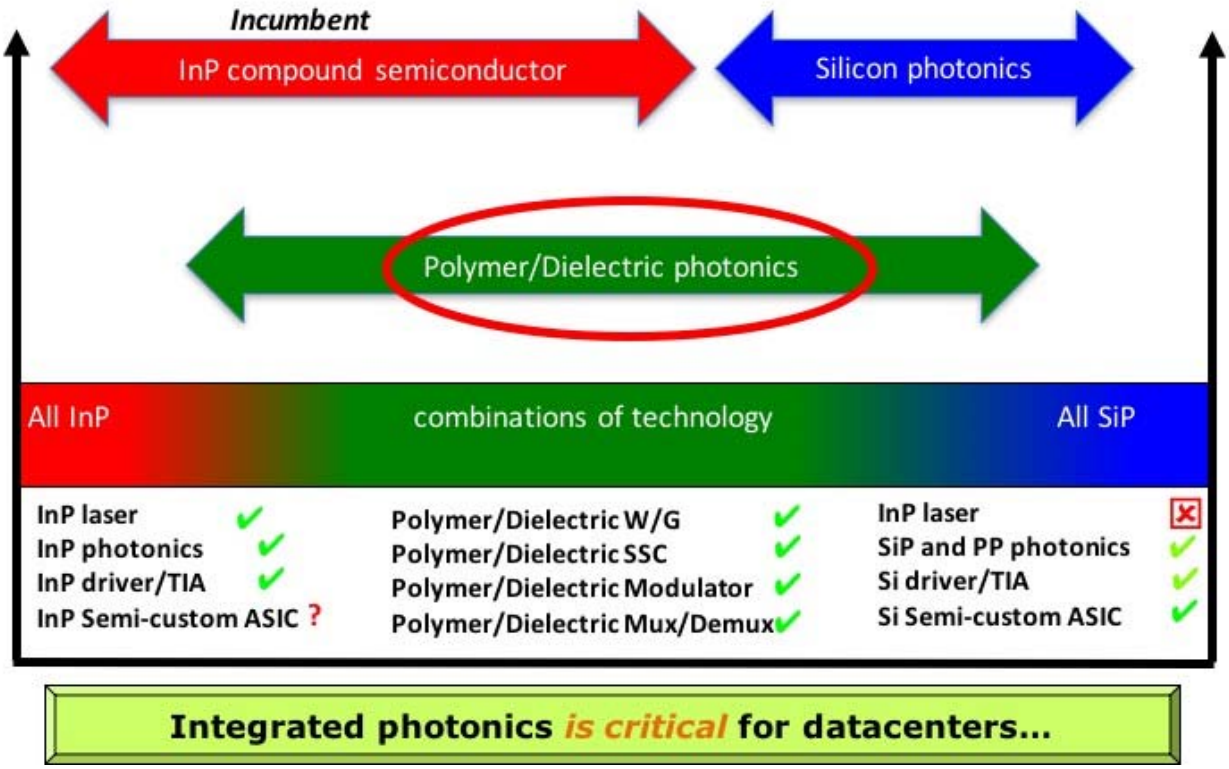
- National Reconnaissance Office (NRO)
- Properties Branch of the Army Research Laboratory on the Aberdeen Proving Grounds in Aberdeen, Maryland.
- Defense Advance Research Project Agency (DARPA)
- Naval Air Warfare Center Weapons Division in China Lake, California
- Air Force Research Laboratory at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

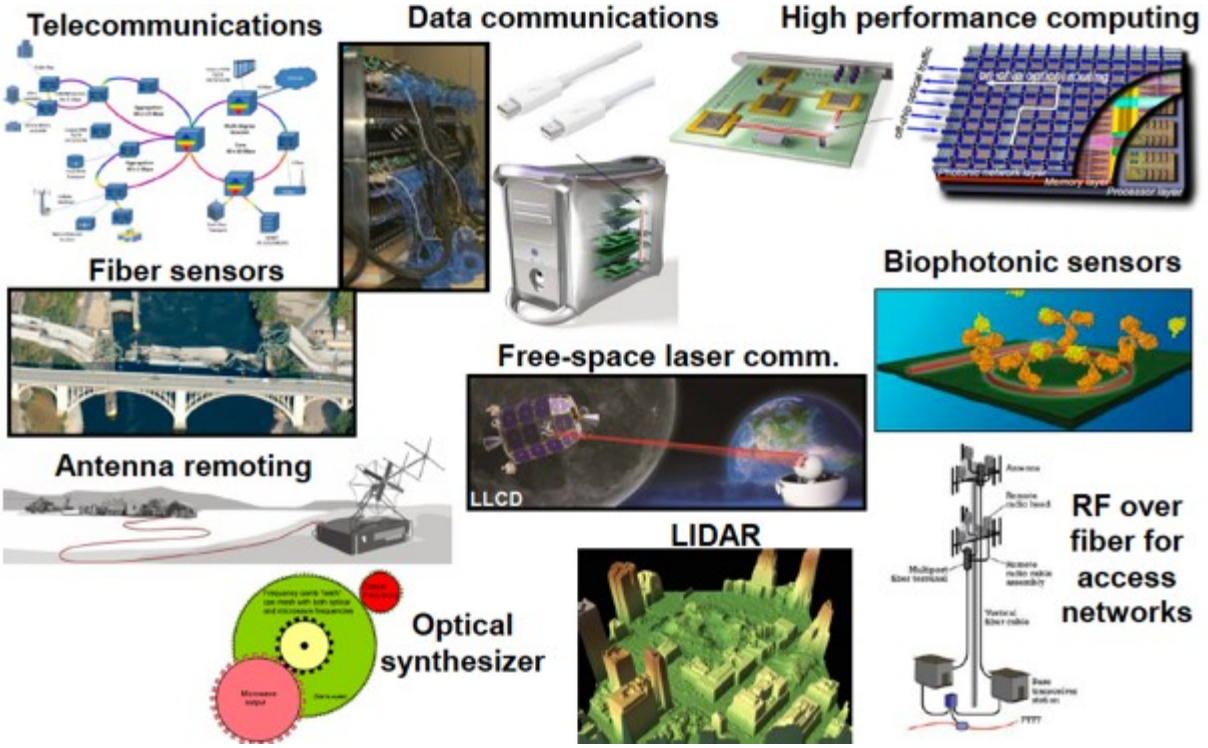
In the below figure, it can be seen in red that the incumbent technology for PICs is InP. InP is capable of providing a number of devices and opportunities in both electronics as well as photonics. InP main weakness from a function standpoint is that although it can provide HFETs, JFETs, bipolar electronic 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 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, 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, NeoPhotonics, Molex, Broadcom Avago. 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.
- 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

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 3 additional full-time employees in 2021. We believe that we have good relations with our employees.

Properties and Laboratory Facilities

Our principal executive offices and research and development facility is located at our new office, laboratory and research and development space located at 369 Inverness Parkway, Suite 350, Englewood, Colorado. The new 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, 220 square feet of class 100 cleanroom, chemistry laboratories, and analytic laboratories. The new Englewood facility streamlines all of our Company's research and development workflow for greater operational efficiencies.

Legal Proceedings

We are not currently a party to or engaged in any material legal proceedings and we are not aware of any litigation or threatened litigation of a material nature. However, we may be subject to various claims and legal actions arising in the ordinary course of business from time to time.

Corporate Information

Lightwave Logic, Inc. is a Nevada corporation. Our corporate headquarters is located at 369 Inverness Parkway, Suite 350, Englewood, CO 80112. Our telephone number is (720) 340-4949. Our corporate website is lightwavelogic.com. The information on our website is not incorporated herein by reference and is not part of this Form 10-K Annual Report. Also, this 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.

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 $6,715,564 for the year ended December 31, 2020 and $6,726,967 for the year ended December 31, 2019. We anticipate that we will continue to incur operating losses through at least 2021.

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 and 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; and
- Expand our facilities and increase capital investments.

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 2021; 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 $25 million (the "**Purchase Agreement**") we entered into with Lincoln Park Capital Fund, LLC ("**Lincoln Park**"), 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.

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 engineer next-generation organic nonlinear optical materials and devices for future applications to be utilized by electro-optic device manufacturers, such as telecommunications component and systems manufacturers, networking and switching suppliers, semiconductor companies, aerospace companies and government agencies as well as our proprietary photonic devices, such as our Polymer Photonic Integrated Circuits P^2IC^{TM}. 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.

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, and to a lesser extent, government agencies and academic institutions, to conduct research and development of 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 plan to sell many of our products directly to commercial customers or through potential industry partners. For example, we expect to sell our proprietary electro-optic polymer systems to electro-optic device manufacturers, such as telecommunications component and systems manufacturers, networking and switching suppliers, semiconductor companies, aerospace companies and government agencies. 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 are developing our proprietary electro-optic polymer systems to be utilized by electro-optic device manufacturers, such as telecommunications component and systems manufacturers, networking and switching suppliers, semiconductor companies, aerospace companies and government agencies, as well as our proprietary photonic devices, such as our Polymer Photonic Integrated Circuits P^2IC^{TM}. 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.

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.

As a result of the COVID-19 global pandemic, many countries, including the United States, have declared national emergencies and have implemented preventive measures by limiting large public gatherings (social distancing) and shelter-in-place mandates. Many employers are restricting non-essential work travel and are requiring that employees work from their homes to limit personal interaction. Many businesses are closed or are operating in a substantially reduced fashion and many employees have been laid off. While the extent of the impact of the COVID-19 pandemic on our business and financial results is 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.

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

As of December 31, 2020, we have outstanding options and warrants to purchase an aggregate of 10,022,500 shares of our common stock at exercise prices ranging from $0.51 - $1.69 per share with a weighted average exercise price of $0.84 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.

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.

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 quarter-to-quarter performance may vary substantially, and this variance, as well as general market conditions, may cause our stock price to fluctuate greatly and even potentially expose us to litigation.

We have generated no significant sales to date and we cannot accurately estimate future quarterly revenue and operating expenses based on historical performance. Our quarterly operating results may vary significantly based on many factors, including:

- Fluctuating demand for our potential products and technologies;
- Announcements or implementation by our competitors of technological innovations or new products;
- Amount and timing of our costs related to our marketing efforts or other initiatives;
- The status of particular development programs and the timing of performance under specific development agreements;
- Timing and amounts relating to the expansion of our operations;
- Product shortages requiring suppliers to allocate minimum quantities;
- Announcements or implementation by our competitors of technological innovations or new products;
- The status of particular development programs and the timing of performance under specific development agreements;
- Our ability to enter into, renegotiate or renew key agreements;
- Timing and amounts relating to the expansion of our operations;
- The extent of the impact of the novel strain of coronavirus known as COVID-19 on global commerce;
- Costs related to possible future acquisitions of technologies or businesses; or
- Economic conditions specific to our industry, as well as general economic conditions.

Our current and future expense estimates are based, in large part, on estimates of future revenue, which is difficult to predict. We expect to continue to make significant operating and capital expenditures in the area of research and development and to invest in and expand production, sales, marketing and administrative systems and processes. We may be unable to, or may elect not to, adjust spending quickly enough to offset any unexpected revenue shortfall. If our increased expenses were not accompanied by increased revenue in the same quarter, our quarterly operating results would be harmed.

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.

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

We conduct significantly all of our research and development activities at our Englewood, CO facility, and although we have an agreement with CU Boulder to use their facilities in case of any contingency, a disaster such as a fire, flood or severe storm at or near one of our facilities could prevent us from further developing our technologies or manufacturing our potential products, which would harm our business. 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 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 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 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 unsecure, 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.

As a smaller reporting company, we are subject to scaled disclosure requirements that may make it more challenging for investors to analyze our results of operations and financial prospects.

As a "smaller reporting company," we (i) are able to provide simplified executive compensation disclosures in our filings, (ii) are exempt from the provisions of Section 404(b) of the Sarbanes-Oxley Act requiring that independent registered public accounting firms provide an attestation report on the effectiveness of internal control over financial reporting and (iii) have certain other decreased disclosure obligations in our filings with the SEC, including being required to provide only two years of audited financial statements in annual reports. Consequently, it may be more challenging for investors to analyze our results of operations and financial prospects.

We will remain a smaller reporting company until the beginning of a fiscal year in which we had a public float of $250 million held by non-affiliates as of the last business day of the second quarter of the prior fiscal year, assuming our common stock is registered under Section 12 of the Exchange Act on the applicable evaluation date. Even if we remain a smaller reporting company, if our public float exceeds $250 million and our annual revenues are greater than $100 million, we will become subject to the provisions of Section 404(b) of the Sarbanes-Oxley Act.

If we are unable to maintain effective internal controls, our business, financial position and results of operations could be adversely affected.

If we are unable to maintain effective internal controls, our business, financial position and results of operations could be adversely affected. We are subject to the reporting and other obligations under the Securities Exchange Act of 1934 ("**Exchange Act**"), including the requirements of Section 404 of the Sarbanes-Oxley Act of 2002, which require annual management assessments of the effectiveness of our 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). Our 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 accounting principles generally accepted in the United States. Any failure to achieve and maintain effective internal controls could have an adverse effect on our business, financial position and results of operations. These reporting and other obligations place significant demands on our management and administrative and operational resources, including accounting resources. For as long as we are a non-accelerated filer, as defined in Rule 12b-2 under the Exchange Act, our auditors will not be required to attest as to our internal control over financial reporting. If we identify material weaknesses in our internal control over financial reporting, are unable to comply with the requirements of Section 404 in a timely manner, are unable to assert that our internal control over financial reporting is effective or, once required, our independent registered public accounting firm is unable to attest that our internal control over financial reporting is effective, investors may lose confidence in the accuracy and completeness of our financial reports and the market price of our common stock could decrease. We could also become subject to stockholder or other third-party litigation as well as investigations by the SEC or other regulatory authorities, which could require additional financial and management resources and could result in fines, trading suspensions or other remedies.

Any 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. Because of the inherent limitations in all control systems, no evaluation of controls can provide absolute assurance that misstatements due to error or fraud will not occur or that all control issues and instances of fraud will be detected.

Shares eligible for future sale may adversely affect the market.

From time to time, certain of the Company's shareholders may be eligible to sell all or some of their shares of common stock by means of ordinary brokerage transactions in the open market pursuant to Rule 144, promulgated under the Securities Act of 1933, as amended (the "Securities Act"), subject to certain limitations. In general, a non-affiliate stockholder who has satisfied a six-month holding period may, under certain circumstances, sell its shares, without limitation. Any substantial sale of the Company's common stock pursuant to Rule 144 or pursuant to any resale prospectus may have a material adverse effect on the market price of our common stock.

There is a limited market for our common stock, which may make it more difficult for you to sell your stock.

Our Company's common stock is quoted on the OTCMarkets (OTCQX) under the symbol "LWLG." The trading market for our common stock is limited, accordingly, there can be no assurance as to the liquidity of any markets that may develop for our common stock, your ability to sell our common stock, or the prices at which you may be able to sell our common stock.

Our Company's stock price may be volatile.

The market price of our Company's common stock is likely to be highly volatile and could fluctuate widely in price in response to various factors, many of which are beyond our control, including:

- Technological innovations or new products and services by our Company or our competitors;
- Additions or departures of key personnel;
- Sales of our Company's common stock;
- Our Company's ability to integrate operations, technology, products and services;
- Our Company's ability to execute our business plan;
- Operating results below expectations;
- Loss of any strategic relationship;
- Industry developments;
- The extent of the impact of the novel strain of coronavirus known as COVID-19 on global commerce;
- Economic and other external factors; and
- Period-to-period fluctuations in our Company's financial results.

You may consider any one of these factors to be material, and our stock price may fluctuate widely as a result of any of the above listed factors.

In addition, the securities markets have from time to time experienced significant price and volume fluctuations that are unrelated to the operating performance of particular companies. These market fluctuations may also materially and adversely affect the market price of our Company's common stock.

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 amende, 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.

Not Applicable.

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 2021 is expected to be approximately $201,501.

Item 3.Legal Proceedings.

We are not aware of any litigation or 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 is traded on the OTCQX under the symbol "LWLG". Any over-the-counter market quotations reflect inter-dealer prices, without retail mark-up, mark-down or commission and may not necessarily represent actual transactions.

Shareholders

As of March 31, 2021, there were approximately 106 holders of our common stock, including The Depository Trust Company, which holds shares of our common stock on behalf of an indeterminate number of beneficial owners.

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, 2020.

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)	8,207,500 (1)	$0.85	4,242,500
Equity compensation plans not approved by security holders (2)	1,815,000	$0.77	0
Total	10,022,500	$0.84	4,242,500

(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.

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
July 2020	Warrants — right to buy 100,000 shares of common stock at $.67 per share issued for services.
December 2020	Common Stock — 2,073,052 shares of Common Stock at $.80 per share pursuant to warrant exercises.

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.

Item 6.Selected Financial Data.

Not Applicable.

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

During this uncertain time, our critical priorities are the health and safety of our employees and contractors, all of whom began working from home and reduced travel to essential business needs starting in late March. We currently are 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. We began to incrementally bring certain employees back to work at our facilities on May 4, 2020 under the directives of the Governor's Executive Order, and under the guidelines of the local and state health departments. We will continue to actively monitor the situation and may take further actions that alter our business operations as may be required by federal, state, local authorities, or that we determine are in the best interests of our employees and stockholders.

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 Safer-at-Home orders, 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 P^2IC^{TM} technology platform which 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 2019, we developed new materials that promise to further lower power consumption. 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.

We are initially targeting applications in data communications and telecommunications markets and are exploring other applications 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; or (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 P^2IC^{TM} technology
- Continue to develop proprietary intellectual property
- Grow our commercial device development capabilities
- 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

Comparison of year ended December 31, 2020 to year ended December 31, 2019

Revenues

As a development stage company, we had no revenues during the years ended December 31, 2020 and December 31, 2019. The Company is in various stages of photonic device and material development and evaluation. We expect the next revenue stream to be in product development agreements and prototype devices prior to moving into full commercialization.

Operating Expenses

Our operating expenses were $6,599,974 and $6,319,407 for the years ended December 31, 2020 and 2019, respectively, for an increase of $280,567. This increase is primarily due to increases in wages and salaries, investor relation expenses, depreciation, legal fees, director and officer insurance expense, research and development non-cash stock option and warrant amortization, other tax expenses, internet expenses and research and development rent offset by decreases in travel expenses, general and administrative non-cash stock option and warrant amortization, laboratory and wafer fabrication materials and supplies, office expenses, shareholders meeting expenses and general and administrative consulting expenses.

Included in our operating expenses for the year ended December 31, 2020 was $4,529,498 for research and development expenses compared to $4,319,295 for the year ended December 31, 2019, for an increase of $210,203. This is primarily due to increases in research and development salaries and wages, depreciation, research and development non-cash stock option and warrant amortization and research and development rent offset by decreases in laboratory and wafer fabrication materials and supplies and travel expenses.

Research and development expenses currently consist primarily of compensation for employees and consultants engaged in internal research, product development activities; material and device development operations, prototypes, electro-optic device designs, development and internal material and device testing; prototype device fabrication; costs; and related operating expenses.

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

Research and development wages and salaries increased $201,863 from $1,943,700 for the year ended December 31, 2019 to $2,145,563 for the year ended December 31, 2020. The reason for the variation was primarily due to an increase in full time technical personnel working on device and material development.

Depreciation expense increased $83,754 from $606,127 for the year ended December 31, 2019 to $689,881 for the year ended December 31, 2020. The primary reason for the increase was due to the addition of capital equipment for the fabrication of wafers in the Company’s facility.

Research and development non-cash stock option amortization increased $23,016 from $326,253 for the year ended December 31, 2019 to $349,269 for the year ended December 31, 2020. The reason for the variation was due to stock options and warrants vesting schedules.

Research and development rent increased $9,332 from $184,343 for the year ended December 31, 2019 to $193,675 for the year ended December 31, 2020. The primary reason for the increase was due to increase in facility operating expenses and rent.

Laboratory and wafer fabrication materials and supplies decreased $60,077 from $460,367 for the year ended December 31, 2019 to $400,290 for the year ended December 31, 2020. The primary reason for the decrease was the scale back of operations due to the COVID-19 pandemic.

Research and development travel expenses decreased $59,469 from $95,456 for the year ended December 31, 2019 to $35,987 for the year ended December 31, 2020. The primary reason for the decrease was the scale back of travel due to the COVID-19 pandemic.

General and administrative expense consists primarily of compensation and support costs for management staff, and for other general and administrative costs, including executive, sales and marketing, investor relations, accounting and finance, legal, consulting and other operating expenses.

General and administrative expenses increased $70,364 to $2,070,476 for the year ended December 31, 2020 compared to $2,000,112 for the year ended December 31, 2019. The increase is primarily due to increases in investor relation expenses, legal fees, director and officer insurance expense, other tax expenses, general and administrative wages and salaries and internet expenses offset by decreases in general and administrative non-cash stock option and warrant amortization, travel expenses, office expenses, shareholders meeting expenses and general and administrative consulting expenses.

Investor relation expenses increased $100,753 to $145,261 for the year ending December 31, 2020 from $44,508 for the year ended December 31, 2019. The primary reason for the increase was the engagement of an investor relations firm.

Legal fees increased $41,318 from $139,276 for the year ended December 31, 2019 to $180,594 for the year ended December 31, 2020. The primary reason for the variance was an overall increase in legal work.

Director and officer insurance expenses increased $30,245 to $184,239 for the year ended December 31, 2020 from $153,994 for the year ended December 31, 2019. The primary reason for the increase was an increase in insurance premiums due to the COVID-19 pandemic.

Other tax expenses increased $20,786 to $81,571 for the year ending December 31, 2020 from $60,785 for the year ending December 31, 2019. The primary reason for the increase was due to personal property tax on capital equipment.

General and administrative wages and salaries increased $20,761 from $575,471 for the year ended December 31, 2019 to $596,232 for the year ended December 31, 2020. The primary reason for the increase was due primarily to increase in salary and fringe benefit costs.

Internet expenses increased $13,014 from $5,747 for the year ending December 31, 2019 to $18,761 for the year ending December 31, 2020. The primary reason for the increase was due to the update of the Company website.

General and administrative non-cash stock option amortization decreased $68,695 from $354,614 for the year ended December 31, 2019 to $285,919 for the year ended December 31, 2020. The reason for the variation was due to stock options and warrants vesting schedules.

General and administrative travel expenses decreased $43,962 from $71,634 for the year ended December 31, 2019 to $27,672 for the year ended December 31, 2020. The primary reason for the decrease was the scale back of travel due to the COVID-19 pandemic.

Office expenses decreased $20,759 from $72,414 for the year ending December 31, 2019 to $51,655 for the year ending December 31, 2020. The primary reason for the decrease was the scale back of operations due to the COVID-19 pandemic.

Shareholders' meeting expenses decreased $12,612 from $54,992 for the year ending December 31, 2019 to $42,380 for the year ending December 31, 2020. The primary reason for the decrease was that the 2020 annual shareholders meeting was a virtual meeting due to the COVID-19 pandemic.

General and administrative consulting fees decreased $11,042 to $0 for the year ending December 31, 2020 from $11,042 for the year ended December 31, 2019. The primary reason for the decrease was due to a reduction in consulting fees.

We expect general and administrative expense to increase in future periods as we increase the level of corporate and administrative activity, including increases associated with our operation as a public company; and significantly increase expenditures related to the future production and sales of our products.

Other Income (Expense)

Other expenses decreased $291,970 to $115,590 for the year ending December 31, 2020 from $407,560 for the year ending December 31, 2019, relating to the commitment fee associated with the purchase of shares by an institutional investor for sale under a stock purchase agreement.

Net Loss

Net loss was $6,715,564 and $6,726,967 for the years ended December 31, 2020 and 2019, respectively, for a decrease of $11,403, due primarily to decreases in commitment fee associated with the purchase agreement, travel expenses, general and administrative non-cash stock option and warrant amortization, laboratory and wafer fabrication materials and supplies, office expenses, shareholders meeting expenses and general and administrative consulting expenses offset by increases in wages and salaries, investor relation expenses, depreciation, legal fees, director and officer insurance expense, research and development non-cash stock option and warrant amortization, other tax expenses, internet expenses and research and development rent.

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.

Recently Adopted Accounting Pronouncements. In February 2016, the FASB issued ASU No. 2016-02, Leases (Topic 842) and subsequent related updates. The core principle of Topic 842 is that a lessee should recognize the assets and liabilities that arise from operating leases. The Company adopted the standard effective January 1, 2019 under the optional transition method which allows the entity to apply the new lease standard at the adoption date and recognize a cumulative-effect adjustment, if any, to the opening balance of retained earnings in the period of adoption. The standard had a material impact on the balance sheet.

Liquidity and Capital Resources

For the year ended December 31, 2020

During the year ended December 31, 2020, net cash used in operating activities was $4,873,863 and net cash used in investing activities was $217,984, which was due primarily to the Company's research and development activities and general and administrative expenditures. Net cash provided by financing activities for the year ended December 31, 2020 was $6,162,093. At December 31, 2020, our cash and cash equivalents totaled $3,306,590, our assets totaled $7,366,778, our liabilities totaled $1,591,332, and we had stockholders' equity of $5,775,446.

For the year ended December 31, 2019

During the year ended December 31, 2019, net cash used in operating activities was $4,765,845 and net cash used in investing activities was $305,670, which was due primarily to the Company's research and development activities and general and administrative expenditures. Net cash provided by financing activities for the year ended December 31, 2019 was $5,133,234. At December 31, 2019, our cash and cash equivalents totaled $2,236,344, our assets totaled $6,824,856, our liabilities totaled $1,917,142, and we had stockholders' equity of $4,907,714.

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 $700,000 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 2021 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 the 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.

On January 21, 2019, our Company entered into the Purchase Agreement with Lincoln Park, pursuant to which Lincoln Park agreed to purchase from us up to $25,000,000 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 use of proceeds, financial or business covenants, restrictions on future funding, rights of first refusal, participation rights, penalties or liquidated damages in the Purchase Agreement. Lincoln Park may not assign or transfer its rights and obligations under the purchase agreement.

We expect that our cash used in operations will continue to increase during 2021 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;
- 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, 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.

For the year ended December 31, 2019

Net cash used in operating activities was $4,765,845 for the year ended December 31, 2019, primarily attributable to the net loss of $6,726,967 adjusted by $80,140 in warrants issued for services, $600,727 in options issued for services, $407,792 in common stock issued for services, $698,694 in depreciation expenses and patent amortization expenses, $165,410 in prepaid expenses and 8,359 in accounts payable and accrued expenses. 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 $305,670 for the year ended December 31, 2019, consisting of $82,195 in cost for intangibles and $223,475 in asset additions primarily for the new Colorado headquarter facility and labs.

Net cash provided by financing activities was $5,133,234 for the year ended December 31, 2019 and consisted of $5,638,960 in proceeds from resale of common stock to an institutional investor offset by $505,726 repayment of equipment purchased.

Item 7A.Quantitative and Qualitative Disclosures About Market Risk

Not Applicable.

Item 8.Financial Statements and Supplementary Data

Our Financial Statements of 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

Not Applicable.

Item 9A.Controls and Procedures.

Evaluation of Disclosure Controls and Procedures

As of December 31, 2020, 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.

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, 2020.

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.

This annual report does not include an attestation report of our Company's independent registered public accounting firm regarding internal control over financial reporting. Management's report was not subject to attestation by our Company's registered public accounting firm pursuant to rules of the Securities and Exchange Commission that permit our Company to provide only management's attestation in this annual report.

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

Not Applicable.

PART III

Item 10.Directors, Executive Officers and Corporate Governance

Identity of directors, executive officers and significant employees

Name	Age	Position	Director Class/ Term
Michael Lebby	60	Director; Chief Executive Officer	Class II Expires 2022
James S. Marcelli	73	Director; President; Chief Operating Officer, Secretary	Class III Expires 2023
Thomas E. Zelibor	66	Chair of the Board of Directors	Class III Expires 2023
Joseph A. Miller	79	Director	Class II Expires 2022
Ronald A Bucchi	66	Director	Class II Expires 2022
Siraj Nour El-Ahmadi	56	Director	Class I Expires 2021
Frederick J. Leonberger	73	Director	Class I Expires 2021

Business experience of directors, executive officers, and significant employees

Dr. Michael Lebby. Dr. Lebby has served as our Chief Executive Officer since May 1, 2017 and as a director of our Company since August 26, 2015. He also previously served a member of our Operations Committee until April 30, 2017. Dr. Lebby is in charge of the overall general management of the Company and supervision of Company policies, setting the Company's strategies, formulating and overseeing the Company's business plan, raising capital, expanding the Company's management team and the general promotion of the Company From June 2013 to 2015, Dr. Lebby has served as President and CEO of OneChip Photonics, Inc., a privately held company headquartered in Ottawa, Canada, that is a leading provider of low-cost, small-footprint, high-performance indium phosphide (InP)-based photonic integrated circuits (PICs) and PIC-based optical sub-assemblies (OSAs) for the Data Center markets. Also, from 2013 to 2015 Dr. Lebby served as part-time full professor, and chair of optoelectronics at Glyndwr University in Wales, UK, to bring forward advanced materials, device, and integrated photonics based technologies for the datacenter and high performance computing markets. During the period 2014 to 2016, Dr. Lebby focused on a foundry based model for InP-based photonic integrated circuits (PICs) and optoelectronic integrated circuits (OEICs) in the datacenter segment and was instrumental in assembling California's proposal (via USC) to the Federal Government for an integrated photonics manufacturing institute. Dr. Lebby holds a Doctor of Engineering, a Ph.D., a MBA and a bachelor's degree, all from the University of Bradford, United Kingdom. Dr. Lebby has well over 200 issued utility patents with the USPTO. This number expands to over 450 if international derivative patents are included.

Mr. James S. Marcelli. Mr. Marcelli has served as an officer and director of our Company since August 2008. Since May 2012, Mr. Marcelli has served as our Company's President and Chief Operating Officer, and he was named our Secretary in March 2018. Previously, from August 2008 to April 2012, Mr. Marcelli served as our President and Chief Executive Officer. Mr. Marcelli is in charge of the day-to-day operations of our Company and its movement to a fully functioning commercial corporation, and also serves as our Company's principal financial officer. Since 2000, Mr. Marcelli has served as the president and chief executive officer of Marcelli Associates, a consulting company that offers senior management consulting, mentoring, and business development services to start-up and growth companies. Business segments Mr. Marcelli has worked with included an Internet networking gaming center, high-speed custom gaming computers, high tech manufacturing businesses and business service companies.

Thomas E. Zelibor, Rear Admiral, USN (Ret). RADM Zelibor has served as our Chair of the Board of Directors (non-executive) since May 1, 2017. Previously, has served as our Chief Executive Officer and Chair of the Board of Directors (executive) from May 2012 to April 30, 2017. Mr. Zelibor also previously served as Chair of the Board of Directors (non-executive) of our Company since October 2011 and has served as a director of our Company since July 2008. He also previously served on our Operation Committee. Mr. Zelibor is currently the Chief Executive Officer of the Space Foundation. Mr. Zelibor previously served as a Director of Nuvectra Corp., the Chief Executive Officer and President of Zelibor & Associates, LLC, a management-consulting firm and as the Chief Executive Officer and President of Flatirons Solutions Corp. Prior to that time, RADM Zelibor served in the U.S. Navy in a number of positions, including as the Dean of the College of Operational and Strategic Leadership at the United States Naval War College where he was responsible for the adoption of a corporate approach to leadership development; Director of Global Operations, United States Strategic Command; Director, Space, Information Warfare, Command and Control on the Navy staff; Department of the Navy, Deputy Chief Information Officer (CIO), Navy; Commander, Carrier Group Three and Commander, Naval Space Command. Mr. Zelibor earned his bachelor's degree from the United States Naval Academy and has been a participant in the Senior Leader in Residence Program and a visiting scholar for the Zell Center for Risk Research at the Kellogg School of Management, Northwestern University.

Dr. Joseph A. Miller, Jr. Dr. Miller has served as a director of our Company since May 10, 2011. From 2002 to May 2012, Dr. Miller served as Executive Vice President and Chief Technology Officer of Corning Incorporated, having joined Corning Incorporated in 2001 as Senior Vice President and Chief Technology Officer. Prior to joining Corning Incorporated, Dr. Miller was with E.I. DuPont de Nemours, Inc., where he served as Chief Technology Officer and Senior Vice President for Research and Development since 1994. Dr. Miller began his career with DuPont in 1966. Dr. Miller previously served as a director and Non-executive Chairman of Nuvectra Corp., and as a director for Greatbatch, Inc. He holds a doctorate degree in Chemistry from Penn State University.

Mr. Ronald A. Bucchi. Mr. Bucchi has served as a director of our Company since June 11, 2012, and he currently serves as the Chair of our Audit Committee. Mr. Bucchi is currently a self-employed C.P.A., CGMA with a specialized practice that concentrates in CEO consulting, strategic planning, mergers, acquisitions, business sales and tax. He works with domestic and international companies. Mr. Bucchi is a former member of the board of directors of First Connecticut Bancorp, Inc., having served as Lead Director, Chair of the Audit Committee, Governance Chairman and a member of the Asset Liability Committee and Loan Committee. The Bank sold in September of 2018. He is currently a member of the Advisory Board of Baker Street Scientific, Inc., the Treasurer and a member of the Board of Directors of the Petit Family Foundation, Inc. and the Farmington Bank Foundation, Inc. He has served on numerous other community boards and is past Chairman of the Wheeler Clinic and the Wheeler YMCA. He is a member of the Connecticut Society of Certified Public Accountants, American Institute of Certified Public Accountants and Chartered Global Management Accountant. Mr. Bucchi is a graduate of the Harvard Business School Executive Education program with completed course studies in general board governance, audit and compensation and a graduate of Central Connecticut State University where he received his B.S. in Accounting.

Mr. Siraj Nour El-Ahmadi. Mr. El-Ahmadi has served as a director of our Company since October 2, 2013, and he currently serves a member of our Audit Committee. Since 2004, Mr. El-Ahmadi has served as Founder, President and Chief Executive Officer of Menara Networks, a developer of innovative products and solutions that simplify layered optical transport networks. Mr. El-Ahmadi has over 17 years of experience in optical transmission in particular and the telecom industry in general. Prior to founding Menara, Mr. El-Ahmadi served as Vice President-Marketing & Product Management at Nortel where he was responsible for the OPTera LH 4000 ULR product (acquired from Qtera) that achieved over $200M in revenues in its first two years. Prior to that, Mr. El-Ahmadi was the Product Architect & Vice President of Product Management at Qtera Corporation, a successful technology start-up acquired by Nortel in 2000 for $3.25 billion. Mr. El-Ahmadi also held a Senior Manager position at Bell Northern Research and worked as a Transmission Engineer at WilTel (WorldCom) where he evaluated and deployed the world's first bidirectional EDFA and bi-directional WDM transmission. Mr. El-Ahmadi holds a BS and MS in Electrical Engineering from the University of Oklahoma, is a member of Eta Kappa Nu and is the inventor of 11 patents, issued or pending, in the area of optical communications. He has authored a number of publications and is a frequent speaker at telecom and optical networking events and conferences.

Dr. Frederick J. Leonberger. Dr. Leonberger has served as a director of our Company since April 1, 2017. Since 2010, Dr. Leonberger has served as the Principal of EOvation Advisors LLC, a private technology and business advisory firm and presently serves as a board member for various private photonics companies and as a Professor at the Institute for Advanced Discovery & Innovation, University of South Florida. Dr. Leonberger is a widely known technologist and industry leader in the field of photonics and fiber optics. For nearly 40 years he has been a leading contributor to the development of a variety of important optical devices, company leadership, product and business strategy, and commercialization. The integrated optical modulator technology he and his colleagues pioneered has been used pervasively for over 20 years to encode data at multi-Gb/s rates in long-haul fiber optic networks (the Internet "superhighways"). He previously served as senior vice president and chief technology officer of JDS Uniphase Corporation (JDSU, now Lumentum), a leading optical components company, from 1995 until his retirement in 2003, where he played a lead role in technology strategy, mergers and acquisitions and intellectual property activities. Prior to JDSU, he was co-founder and general manager of United Technologies Photonics (UTP), a high-speed optical modulator company, and held research management positions at United Technologies Research Center **(**UTRC**)** and MIT Lincoln Laboratory. He is a member of the National Academy of Engineering and the recipient of several industry awards.

The Board of Directors believes that each of the Directors named above has the necessary qualifications to be a member of the Board of Directors. Each Director has exhibited during his prior service as a director the ability to operate cohesively with the other members of the Board of Directors. Moreover, the Board of Directors believes that each director brings a strong background and skill set to the Board of Directors, giving the Board of Directors as a whole competence and experience in diverse areas, including corporate governance and board service, finance, management and industry experience.

Our bylaws provide that the number of directors who constitute our Board of Directors is determined by resolution of the Board of Directors, but the total number of directors constituting the entire Board of Directors shall not be less than three or more than nine. Our Board of Directors currently consists of seven directors. Our Board of Directors is divided into three classes, as nearly equal in number as possible, designated: Class I, Class II and Class III, with staggered terms and with each director serving for a term ending on the date of the third annual meeting following the annual meeting at which such director was elected; provided that the term of each director shall continue until the election and qualification of a successor and be subject to such director's earlier death, resignation or removal.

Code of Ethics

Our Company has adopted a Code of Ethics and Business Conduct that applies to all of the Company's employees, including its principal executive officer and principal financial officer. A copy of our Code of Ethics and Business Conduct is available for review on the "Investors - Corporate Governance" page of our Company's website lightwavelogic.com. The Company intends to disclose any changes in or waivers from its Code of Ethics and Business Conduct by posting such information on its website.

Nominating Committee

Our Board of Directors does not have a nominating committee. This is due to our development stage and smaller sized Board of Directors. Instead of having such a committee, our entire Board of Directors historically has searched for and evaluated qualified individuals to become nominees for membership on our Board of Directors. No material changes to the procedures by which our stockholders may recommend nominees to our Board of Directors has occurred since we last provided disclosure regarding these procedures in our Definitive Schedule 14A filed on April 21, 2020.

Audit Committee

Our Company has in place a separately designated standing audit committee in accordance with Section 3(a)(58)(A) of the Securities Exchange Act of 1934, as amended. Our audit committee is governed by an audit committee charter. A copy of our Audit Committee Charter is available for review on the "Investors - Governance" page of our Company's website lightwavelogic.com.

Our audit committee is comprised of Ronald A. Bucchi and Siraj Nour El-Ahmadi. Mr. Bucchi serves as our audit committee financial expert as that term is defined by the rules promulgated by the Securities and Exchange Commission. Mr. Bucchi is an independent director, as defined below in Certain Relationships and Related Transactions, and Director Independence.

Item 11.Executive Compensation.

Compensation Discussion and Analysis

The Company's entire Board of Directors currently participates in the review and determination of the compensation packages of our executive officers because our Board of Directors currently has no standing compensation committee or committee performing similar functions. A discussion of the policies and decisions that shape our executive compensation program, including the specific objectives and elements, is set forth below.

Executive Compensation Objectives and Philosophy

The objective of our executive compensation program is to attract, retain and motivate talented executives who are critical for the continued growth and success of our Company and to align the interests of these executives with those of our shareholders. To this end, our compensation programs for executive officers are designed to achieve the following objectives:

- attract talented and experienced executives to join the Company;
- motivate, reward and retain executives whose knowledge, skills and performance are critical to our success;
- be "market-based" and reflect the competitive environment for personnel;
- focus executive behavior on achievement of our corporate mission and long-term corporate objectives and strategy;
- be affordable, within the context of our operating expense model;
- be fairly and equitably administered;
- reflect our values; and
- align the interests of management and shareholders by providing management with longer-term incentives through equity ownership.

The Board of Directors reviews the allocation of compensation components regularly to help ensure alignment with strategic and operating goals, competitive market practices and our changing business needs. The Board of Directors focuses on simplicity and flexibility wherever possible. The Board of Directors does not apply a specific formula to determine the allocation between cash and non-cash forms of compensation. Certain compensation components, such as base salaries, benefits and perquisites, are intended primarily to attract and retain qualified executives. Other compensation elements, such as long-term incentive opportunities, are designed to motivate and reward our long-term performance and to strongly align named executive officers' interests with those of shareholders.

Elements of Executive Officer Compensation

The primary elements of our executive officer compensation program are: (i) annual base salary; and (ii) long-term equity incentive compensation in the form of stock option grants, with the objective of aligning the executive officers' long-term interests with those of the shareholders.

In establishing overall executive compensation levels and making specific compensation decisions for the executives in 2020, the Board of Directors considered a number of criteria, including the executive's position, any applicable employment agreement, prior compensation levels, scope of responsibilities, prior and current period performance, attainment of individual and overall company performance objectives and retention concerns. In addition, the Board of Directors considered the results of the advisory vote by shareholders on the "say-on-pay" proposal presented to shareholders at the Company's 2018 Annual Meeting of Shareholders where approximately 96% of the votes cast on the "say-on-pay" proposal was voted for approval of the 2017 executive compensation. In determining our 2020 executive compensation program, the Board of Directors reviewed the results of the say-on-pay vote and concluded that changes to the program were not desired by our shareholders for 2020. Therefore, our 2020 executive compensation approach was overall generally in line with the executive officer compensation approach previously approved by our shareholders.

The Board of Directors performs a review of compensation for our executive officers annually. As part of this review, the Board of Directors takes into consideration its understanding of external market data, including companies competing in our industry. The Board of Directors does not engage independent consultants to perform an analysis of the current compensation program.

Generally, our Board of Directors reviews and approves compensation arrangements for executive officers annually and in connection with the hiring of new executives. We do not have any formal or informal policy regarding compensation arrangements for executive officers. Instead, the Board of Directors determines what it believes to be the appropriate level and mix of the various compensation components based on recommendations from our chief executive officer, Company performance against stated objectives and individual performance.

In considering compensation of executives, one of the factors the Board of Directors takes into account is the anticipated tax treatment of various components of compensation. Our Board's strategy is to be cost and tax efficient and the Board intends to preserve corporate tax deductions where possible, while maintaining the flexibility in the future to approve arrangements that it deems to be in our best interests and the best interests of our shareholders, even if such arrangements do not always qualify for full tax deductibility. We do not believe Section 162(m) of the Internal Revenue Code, which generally disallows a tax deduction for certain compensation in excess of $1 million to our named executive officers, will have a material effect on us due to the current compensation levels of named executive officers.

Base Salary

Base salaries are reviewed at least annually by our Board of Directors and may be adjusted from time to time based upon market conditions, individual responsibilities and Company and individual performance. We believe that a competitive base salary is a necessary element of any compensation program that is designed to attract and retain talented and experienced executives. We also believe that attractive base salaries can motivate and reward executives for their overall performance. Base salaries are established in part based on the individual experience, skills and expected contributions of our executives and our executives' performance during the prior year, in addition to affordability within the context of our operating expense model.

Annual Non-Equity Incentive Compensation

Annual non-equity incentive compensation is typically not included as part of our named executive compensation given that our Company is in the development stage.

Long-term Equity Incentive Compensation

Long-term incentive compensation allows the executive officers to share in any appreciation in the value of our common stock. The Board of Directors believes that stock option participation aligns executive officers' interests with those of the shareholders. The amounts of the awards are designed to reward past performance, create incentives to meet long-term objectives and ensure that we retain executive talent over a longer period of time. Awards are based upon various factors, including market conditions and incentives given by other companies in our industry.

Stock option awards provide our executive officers with the right to purchase shares of our common stock at a fixed exercise price, and stock option vest over time, subject to continued employment with our company over the vesting period. Stock options generally vest quarterly over a period of one year. All stock options have an exercise price equal to fair market value of our common stock on the date of grant, which is equal to our closing market price on such date.

Severance and Change in Control Benefits

Pursuant to employment agreements we have entered into with our executives and the terms of our 2016 Equity Incentive Plan, our executives are entitled to certain benefits in the event of a change in control of our Company or the termination of their employment under specified circumstances, including termination following a change in control. We believe these benefits help us compete for and retain executive talent and are generally in line with severance packages offered to executives by the companies in our peer group. We also believe that these benefits would serve to minimize the distraction caused by any change in control scenario and reduce the risk that key talent would leave the Company before any such transaction closes, which could reduce the value of the Company if such transaction failed to close.

Other Compensation

Generally, benefits available to executive officers are available to all employees on similar terms and include health and welfare benefits, disability benefits and a 401(k) plan.

We provide the benefits above to attract and retain our executive officers by offering compensation that is competitive with other companies similar in size and stage of development. These benefits represent a relatively small portion of their total compensation.

The table below summarizes all compensation awarded to, earned by, or paid to our named executive officers for the fiscal years ended December 31, 2020 and 2019.

Summary Compensation Table

Name and Principal Position (a)		Year (b)	Salary ($) (c)[1]	Bonus ($) (d)	Stock Awards ($) (e)[2]	Option Awards ($) (f)[2]	All Other Compensation ($) (g)[3]	Total ($) (h)
Dr. Michael S. Lebby		2020	278,250	—	—	42,178	3,024	323,452
CEO; Director		2019	273,833	—	—	38,805	2,963	315,601
James S. Marcelli		2020	262,500	—	—	42,178	2,189	306,867
President; COO; Sec., Director		2019	258,333	—	—	38,805	2,245	299,383

(1) The named executive officer's compensation includes the amount for services rendered to the Company in his capacity as both an officer and a director.
(2) The aggregate fair value of awards and options in columns (e) and (f) are computed in accordance with FASB ASC 718. All assumptions made in the valuation are more fully described in Note 10 - Stock Based Compensation of Notes to Financial Statements. The amounts shown in columns (f) do not reflect dollar amounts actually received by our named executive officers.
(3) The amount in column (g) reflects a salary gross up for long term disability premium payments.

At no time during the last fiscal year was any outstanding option otherwise modified or re-priced, and there was no tandem feature, reload feature, or tax-reimbursement feature associated with any of the stock options we granted to our executive officers or otherwise.

We grant stock awards and stock options to our executive officers based on their level of experience and contributions to our Company. The aggregate fair value of awards and options are computed in accordance with FASB ASC 718 and are reported in the Summary Compensation Table above in the columns (e) and (f).

No plan-based awards were granted to our named executive officers during the last completed fiscal year.

The table below summarizes all of the outstanding equity awards for our named executive officers as of December 31, 2020, our latest fiscal year end.

Outstanding Equity Awards At Fiscal Year-End

	Option Awards				
Name	Number of securities underlying unexercised options(#) exercisable	Number of securities underlying unexercised options(#) unexercisable	Equity incentive plan awards: number of securities underlying unexercised unearned options (#)	Option exercise price ($)	Option expiration date
(a)	(b)	(c)	(d)	(e)	(f)
Dr. Michael S. Lebby	200,000	—	—	0.69	08/25/25
CEO, Director[1][3]	50,000	—	—	0.68	01/28/26
	50,000	—	—	0.85	01/16/27
	350,000	—	—	0.70	03/19/27
	87,500	12,500	—	1.04	04/07/29
James S. Marcelli	50,000	—	—	0.67	08/09/25
President, COO, Sec.,	1,150,000	—	—	0.70	06/30/25
Director[2][3]	100,000	—	—	1.00	05/16/23
	87,500	12,500	—	1.04	04/07/29

(1) Dr. Lebby received an option to purchase up to: (i) 200,000 shares of Common Stock, of which 50,000 shares vested on August 26, 2015 and the remaining shares vest in equal annual installments of 50,000 options per year commencing on August 26, 2016; (ii) 50,000 shares of Common Stock, of which 20,000 shares vested on February 11, 2016 and the remaining shares vested quarterly in equal installments of 10,000 options per quarter commencing on April 1, 2016; (iii) 50,000 shares of Common Stock, of which 20,000 shares vested on January 17, 2017 and the remaining shares vested quarterly in equal installments of 10,000 options per quarter commencing on April 1, 2017; (iv) 350,000 shares of Common Stock, which vest quarterly over one year in equal installments of 87,500 shares per quarter beginning May 1, 2017; (v) 100,000 shares of Common Stock, of which 12,500 shares vested on May 1, 2019 and the remaining shares vested quarterly in equal installments of 12,500 options per quarter commencing on August 1, 2019.
(2) Mr. Marcelli received an option to purchase up to (i) 50,000 shares of Common Stock, of which 12,500 shares vested on August 10, 2015 and the remaining shares vested quarterly in equal installments of 12,500 shares; (ii) 1,150,000 shares of Common Stock at an exercise price of $.70 that vested immediately; and (iii) up to 100,000 shares of Common Stock, of which 25,000 shares vested on August 1, 2013 and the remaining shares vested quarterly in equal installments of 25,000 shares commencing on October 1, 2013; (iv) 100,000 shares of Common Stock, of which 12,500 shares vested on May 1, 2019 and the remaining shares vested quarterly in equal installments of 12,500 options per quarter commencing on August 1, 2019.
(3) In the event of a change in control of our Company, such person's options will become fully vested and/or exercisable, as the case may be, immediately prior to such change in control, and shall remain exercisable as set forth in their stock option agreement.

Option Exercises and Stock Vested

No stock options, SARs and similar instruments were exercised, and no stock, including restricted stock, restricted stock units and similar instruments vested, by or for any of our named executive officer during the last completed fiscal year.

Pension Benefits-Nonqualified Defined Contribution and Other Nonqualified Deferred Compensation

No pension benefits were paid to any of our named executive officers during the last completed fiscal year. We do not currently sponsor any non-qualified defined contribution plans or non-qualified deferred compensation plans.

Employee, Severance, Separation and Change in Control Agreements

Dr. Michael S. Lebby Employee Agreement- Chief Executive Officer

On March 20, 2017, we entered into an employment agreement with Dr. Michael S. Lebby (the "**Lebby Employment Agreement**"). The term of the Lebby Employment Agreement commenced on May 1, 2017 for a period of 24 months, following which time the Lebby Employment Agreement will be renewed for successive 12-month periods at the end of each term upon the written agreement of the parties that shall be delivered by each party to the other not less than 60 days prior to the expiration of the existing term. Upon entering into the Lebby Employment Agreement, Dr. Lebby was granted (i) 350,000 stock options, which have an exercise price of $0.70 per share and are fully vested at this time. In the event of a change in control of our Company, Dr. Lebby's options shall remain exercisable as set forth in Dr. Lebby's stock option agreement. On April 8, 2019, we entered into an amended employee agreement with Dr. Lebby to (i) increase his base salary to $278,250 per year effective May 1, 2019, (ii) provide him with eligibility to receive bonus compensation to be determined by the Board of Directors from time to time in its sole discretion, and (iii) extend his employee agreement's expiration date to April 30, 2021. Additionally, Dr. Lebby was granted an option to purchase up to 100,000 shares of Company common stock at an exercise price equal to $1.04 per share. The options vest quarterly over two years in equal installments of 12,500 shares per quarter beginning on May 1, 2019.

If Dr. Lebby's employment terminates upon the expiration of the term of the Lebby Employment Agreement, and the Company elects for any reason not to renew the Lebby Employment Agreement for an additional 12-month term, then our Company will continue to pay to Dr. Lebby the compensation described in the Lebby Employment Agreement for a period of 9 months the after the termination. If Dr. Lebby's employment is terminated by the Company without cause during the term of the Lebby Employment Agreement, the Company will pay to Dr. Lebby's the compensation described in the Lebby Employment Agreement for the remainder of the term of Lebby Employment Agreement or 12 months, whichever is longer.

Mr. James S. Marcelli Employee Agreement- President; Chief Operating Officer

On August 10, 2015, we entered into a new employment agreement with Mr. Marcelli, which was amended during 2015 and 2017 (collectively, the "**Marcelli Employment Agreement**"), which replaced his previous employment agreement, as amended. The term of the Marcelli Employment Agreement commenced on January 1, 2014 and expires December 31, 2019, following which time the Marcelli Employment Agreement will be renewed for successive 12-month periods at the end of each term upon the written agreement of the parties that shall be delivered by each party to the other not less than 60 days prior to the expiration of the existing term. Upon entering into the Marcelli Employment Agreement, Mr. Marcelli was granted (i) 50,000 stock options, which have an exercise price of $0.67 per share and are fully vested at this time. In the event of a change in control of our Company, Mr. Marcelli's options shall remain exercisable as set forth in Mr. Marcelli's stock option agreement. On April 8, 2019, we entered into an amended employee agreement with Mr. Marcelli, to (i) increase his base salary to $262,500 per year effective May 1, 2019, (ii) provide him with eligibility to receive bonus compensation to be determined by the Board of Directors from time to time in its sole discretion, and (iii) extend his employee agreement's expiration date to December 31, 2021. Additionally, Mr. Marcelli was granted an option to purchase up to 100,000 shares of Company common stock at an exercise price equal to $1.04 per share. The options vest quarterly over two years in equal installments of 12,500 shares per quarter beginning on May 1, 2019.

If Mr. Marcelli's employment terminates upon his death and key man life insurance is in place for Mr. Marcelli, our Company will continue to pay the compensation described in the Marcelli Employment Agreement to his estate through the remainder of the term of the Marcelli Employment Agreement, or 12 months, whichever is longer. If Mr. Marcelli's employment terminates upon the expiration of the term of the Marcelli Employment Agreement, and the Company elects for any reason not to renew the Marcelli Employment Agreement for an additional 12-month term, then our Company will continue to pay to Mr. Marcelli the compensation described in the Marcelli Employment Agreement for a period of 9 months the after the termination. If Mr. Marcelli's employment is terminated by the Company without cause during the term of the Marcelli Employment Agreement, the Company will pay to Mr. Marcelli the compensation described in the Marcelli Employment Agreement for the remainder of the term of Marcelli Employment Agreement or 12 months, whichever is longer.

Potential Payments Upon Termination or Change In Control

Pursuant to employment agreements we have entered into with our executives and the terms of our 2016 Equity Incentive Plan, our executives are entitled to certain benefits in the event of a change in control of our Company or the termination of their employment under specified circumstances, including termination following a change in control. We believe these benefits help us compete for and retain executive talent and are generally in line with severance packages offered to executives by the companies in our peer group. We also believe that these benefits would serve to minimize the distraction caused by any change in control scenario and reduce the risk that key talent would leave the Company before any such transaction closes, which could reduce the value of the Company if such transaction failed to close.

Compensation of Directors

Set forth below is a summary of the compensation of our directors during our December 31, 2020 fiscal year.

Name	Fees Earned or Paid in Cash ($)[1]	Stock Awards ($)	Option Awards ($)[2]	Non-Equity Incentive Plan Compensation ($)	Non-Qualified Deferred Compensation Earnings ($)	All Other Compensation ($)	Total ($)
Thomas E. Zelibor	7,400	—	66,932[3]	—	—	—	74,332
Joseph A. Miller	7,400	—	36,508[4]	—	—	—	43,008
Ronald A. Bucchi	7,400	—	48,678[5]	—	—	—	66,205
Siraj Nour El-Ahmadi	25,800	—	36,508[4]	—	—	—	62,308
Frederick Leonberger	145,400	—	42,258[4]	—	—	—	187,658

(1) The amount in this column reflects cash compensation received under the Director Compensation Program of $2,000 per attendance at an in-person meeting and $700 per participation in a teleconference meeting. With respect to Dr. Leonberger, it also reflects cash compensation received of $11,500 per month for serving on our Operations Committee. With respect to Siraj Nour El-Ahmadi, it also reflects cash compensation received of $4,600 per month commencing September 2020 for serving on our Operations Committee.
(2) The option awards in this column reflect options issued on January 14, 2020 to purchase shares of our Company's common stock at an exercise price of $.80 that vest pursuant to the following schedule: 25% of the options vest immediately, and the remaining options vest in three equal quarterly installments of 25% of the options granted commencing on April 1, 2020.
(3) Reflects an option to purchase up to 60,000 shares of common stock for board service and up to 50,000 shares of common stock for serving as Chair of the Board.
(4) Reflects an option to purchase up to 60,000 shares of common stock for board service. With respect to Dr. Leonberger only, it also reflects an additional $5,750 for the amortization of an option to purchase up to 200,000 shares of common stock for board service that was granted in March 2017.
(5) Reflects an option to purchase up to 60,000 shares of common stock for board service and up to 20,000 shares of common stock for serving as Audit Committee Chair.

In the event of a change in control of our Company, all of the above person's options become fully vested and/or exercisable, as the case may be, immediately prior to such change in control, and shall remain exercisable as set forth in their stock option agreement.

Compensation Policies and Practices as They Relate to Our Risk Management

No risks arise from our Company's compensation policies and practices for our employees that are reasonably likely to have a material adverse effect on our Company.

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

The following table sets forth, as of March 31, 2021, the names, addresses, amount and nature of beneficial ownership and percent of such ownership of our common stock of each of our officers and directors, our officers and directors as a group and each person or group known to our Company to be the beneficial owner of more than five percent (5%) of our common stock:

Name and Address (1)	Amount and Nature of Beneficial Ownership (2)	% Owned (3)(4)	Number of Options and Warrants Included in Amount and Nature of Beneficial Ownership (5)
Michael Lebby Chief Executive Officer, Principal Executive Officer and Director	812,643	*	750,000
James S. Marcelli President, Chief Operating Officer, Principal Financial Officer, Secretary and Director	1,646,700	1.6%	1,400,000
Thomas E. Zelibor Chair of the Board of Directors	1,560,124 (6)	1.5%	1,510,000
Joseph A. Miller, Jr. Director	583,400	*	570,000
Ronald A. Bucchi Director	934,000 (7)	*	760,000
Siraj Nour El-Ahmadi Director	570,000	*	570,000
Frederick Leonberger Director	1,095,000	1.0%	1,095,000
Directors and Officers as a Group (7 Persons):	7,201,867	7.0%	6,655,000

* Less than 1%.

(1) In care of our Company at 369 Inverness Parkway, Suite 350, Englewood, CO 80112.
(2) To our best knowledge, as of the date hereof, such holders had the sole voting and investment power with respect to the voting securities beneficially owned by them, unless otherwise indicated herein. Includes the person's right to obtain additional shares of common stock within 60 days from March 31, 2021.
(3) Based on 101,758,709 shares of common stock outstanding on March 31, 2021. Does not include shares underlying: (i) options to purchase shares of our common stock under our 2007 Employee Stock Plan and our 2016 Equity Incentive Plan; or (ii) outstanding warrants to purchase shares of our common stock.
(4) If a person listed on this table has the right to obtain additional shares of common stock within 60 days from March 31, 2021, the additional shares are deemed to be outstanding for the purpose of computing the percentage of class owned by such person but are not deemed to be outstanding for the purpose of computing the percentage of any other person.
(5) Represents options and warrants exercisable within 60 days from March 31, 2021.
(6) Mr. Zelibor disclaims beneficial ownership of 400 shares held by his spouse.
(7) Mr. Bucchi disclaims beneficial ownership of 53,000 shares held by his spouse.

We are not aware of any arrangements that could result in a change of control.

Securities Authorized for Issuance under Equity Compensation Plans

Information regarding our compensation plans under which our equity securities are authorized for issuance can be found in Part II –Item 5 of this report.

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

Transactions With Related Persons

None.

Policies and Procedures for Related-Party Transactions

Our Company does not have any formal written policies or procedures for related party transactions, however in practice, our Board of Directors reviews and approves all related party transactions and other matters pertaining to the integrity of management, including potential conflicts of interest, trading in our securities, or adherence to standards of business conduct.

Director Independence

Although we are currently traded on the OTCQX Market, our Board of Directors has reviewed each of the Directors' relationships with the Company in conjunction with NASDAQ Listing Rule 5605(a)(2) that provides that an "independent director" is 'one who is not an executive officer or an employee of the company and who does not have a relationship that, in the opinion of the board of directors, would interfere with exercising independent judgment in carrying out a director's responsibilities.' Our Board of Directors has affirmatively determined that the following directors, Joseph A. Miller, Jr., Ronald A. Bucchi, Siraj Nour El-Ahmadi, Thomas E. Zelibor and Frederick J. Leonberger are independent directors in that they are independent of management and free of any relationship that would interfere with their independent judgment as members of our Board of Directors. In making such determination, our Board of Directors considered the relationships that each such non-employee director has with our Company and all other facts and circumstances that our Board of Directors deemed relevant in determining their independence, including the beneficial ownership of our capital stock by each non-employee director. The following members of our Board of Directors, Dr. Michael Lebby and James S. Marcelli are not independent directors pursuant to the standards described above.

Our Company does not have a separately designated nominating or compensation committee or committee performing similar functions; therefore, our full Board of Directors currently serves in these capacities.

Item 14.Principal Accounting Fees and Services.

Audit Fees.

The aggregate fees billed for the years ended December 31, 2020 and December 31, 2019 for professional services rendered by Morison Cogen, LLP for the audit of the Company's annual financial statements and review of financial statements included in the Company's Form 10-Q or services that are normally provided by Morison Cogen, LLP in connection with statutory and regulatory filings or engagements were $84,460 for the year ended December 31, 2020 and were $56,000 for the year ended December 31, 2019.

Audit-Related Fees.

Fees billed for the years ended December 31, 2020 and December 31, 2019 for assurance and related services rendered by Morison Cogen, LLP that are reasonably related to the performance of the audit or review of the Company's financial statements and are not reported under the category Audit Fees described above were $0 for the year ended December 31, 2020 and $0 for the year ended December 31, 2019.

Tax Fees.

Fees billed for the years ended December 31, 2020 and December 31, 2019 for tax compliance services rendered by Morison Cogen, LLP were $6,000 for the year ended December 31, 2020 and $6,000 for the year ended December 31, 2019.

All Other Fees.

Fees billed for the years ended December 31, 2020 and December 31, 2019 for products and services provided by Morison Cogen, LLP, other than the services reported in the Audit Fees, Audit-Related Fees, and Tax Fees categories above were $0 for the year ended December 31, 2020 and $0 for the year ended December 31, 2019.

Audit Committee Pre-Approval Policies.

The Company's audit committee currently does not have any pre-approval policies or procedures concerning services performed by Morison Cogen, LLP. All the services performed by Morison Cogen, LLP that are described above were pre-approved by the Company's audit committee.

None of the hours expended on Morison Cogen, LLP 's engagement to audit the Company's financial statements for the years ended December 31, 2020 and December 31, 2019 were attributed to work performed by persons other than Morison Cogen, LLP's full-time, permanent employees.

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 10, 2019
10.3	Employee Agreement - James Marcelli	Incorporated by reference to Company's Form 10-Q as filed with the SEC on August 12, 2015
10.4	Employee Agreement Amendment - James Marcelli	Incorporated by reference to the Company's Current Report on Form 8-K as filed with the SEC on March 22, 2017
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 April 10, 2019
10.6	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
10.7	Form of Director 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 Indemnification 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's Non-Disclosure Agreement	Incorporated by reference to the Company's Form 10-K as filed with the SEC on March 16, 2018
10.10	Operations Committee Charter	Incorporated by reference to the Company's Form 10-Q as filed with the SEC on August 15, 2016
10.11	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
10.12	Statement of Operations Committee Work - Siraj Nour El-Ahmadi	Filed herewith
10.13	2007 Employee Stock Plan	Incorporated by reference to Company's Definitive Schedule 14C Information Statement as filed with the SEC on February 19, 2008

10.14	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
10.15	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
10.16	2016 Equity Incentive Plan Amendment Plan	Incorporated by reference to Appendix A to the Company's Definitive Schedule 14A filed with the SEC on April 12, 2019
10.17	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
10.18	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
10.19	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
10.20	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
10.21	Purchase Agreement dated as of January 21, 2019, by and between the Company and Lincoln Park Capital Fund, LLC	Incorporated by reference to the Company's Current Report on Form 8-K as filed with the SEC on January 22, 2019
10.22	Registration Rights Agreement, dated as of January 21, 2019, by and between the Company and Lincoln Park Capital Fund, LLC	Incorporated by reference to the Company's Current Report on Form 8-K as filed with the SEC on January 22, 2019
10.23	Promissory Note made to Community Banks of Colorado dated April 23, 2020	Incorporated by reference to the Company's Current Report on Form 8-K as filed with the SEC on April 28, 2020
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	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	XBRL data files of Financial Statements and Notes contained in this Annual Report on Form 10-K	

Item 16.Form 10-K Summary

None

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 31, 2021

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.

Signature	Title	Date
/s/ Michael Lebby Michael Lebby	Chief Executive Officer, Principal Executive Officer, Director	March 31, 2021
/s/ James S. Marcelli James S. Marcelli	President, Chief Operating Officer, Principal Financial Officer, Secretary, Director	March 31, 2021
/s/ Thomas E. Zelibor Thomas E. Zelibor	Chair of the Board of Directors	March 31, 2021
/s/ Joseph A. Miller Joseph A. Miller	Director	March 31, 2021
/s/ Ronald A. Bucchi Ronald A. Bucchi	Director	March 31, 2021
/s/ Siraj Nour El-Ahmadi Siraj Nour El-Ahmadi	Director	March 31, 2021
/s/ Frederick J. Leonberger Frederick J. Leonberger	Director	March 31, 2021

LIGHTWAVE LOGIC, INC.

FINANCIAL STATEMENTS

DECEMBER 31, 2020 AND 2019

CONTENTS

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, 2020 and 2019, and the related statements of comprehensive loss, stockholders' equity, and cash flows for each of the two years in the period ended December 31, 2020, and the related notes (collectively referred to as the financial statements). 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, 2020 and 2019, and the results of its operations and its cash flows for each of the two years in the period ended December 31, 2020, in conformity with accounting principles generally accepted in the United States of America.

Basis for Opinion

These financial statements are the responsibility of the Company's management. Our responsibility is to express an opinion on the Company's financial statements 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 audit to obtain reasonable assurance about whether the financial statements are free of material misstatement, whether due to error or fraud. The Company is not required to have, nor were we engaged to perform, an audit of its internal control over financial reporting. As part of our audits, we are required to obtain an understanding of internal control over financial reporting, but not for the purpose of expressing an opinion on the effectiveness of the Company's internal control over financial reporting. Accordingly, we express no such opinion.

Our audits 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. We believe that our audits provide a reasonable basis for our opinion.

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.

Blue Bell, Pennsylvania
March 31, 2021

LIGHTWAVE LOGIC, INC.
BALANCE SHEETS

	December 31, 2020	December 31, 2019
ASSETS		
CURRENT ASSETS		
Cash and cash equivalents	$ 3,306,590	$ 2,236,344
Prepaid expenses and other current assets	567,185	372,549
	3,873,775	2,608,893
PROPERTY AND EQUIPMENT - NET	1,873,549	2,416,503
OTHER ASSETS		
Intangible assets - net	916,000	939,481
Operating Lease - Right of Use - Building	703,454	859,979
	1,619,454	1,799,460
TOTAL ASSETS	$ 7,366,778	$ 6,824,856
LIABILITIES AND STOCKHOLDERS' EQUITY		
CURRENT LIABILITIES		
Accounts payable	$ 169,247	$ 88,423
Current portion of equipment purchase	13,107	630,329
Accounts payable and accrued expenses - related parties	49,797	14,805
Deferred lease liability	41,778	41,778
Paycheck Protection Program advance	410,700	—
Operating lease liability	167,007	156,524
Accrued expenses	81,396	65,769
	933,032	997,628
LONG TERM LIABILITIES		
Deferred lease liability	121,853	163,632
Operating lease liability	536,447	703,455
Long term portion of equipment purchase	—	52,427
	658,300	919,514
TOTAL LIABILITIES	1,591,332	1,917,142
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, 97,775,789 and 87,409,600 issued and outstanding at December 31, 2020 and December 31, 2019	97,776	87,410
Additional paid-in-capital	76,649,170	69,076,240
Accumulated deficit	(70,971,500)	(64,255,936)
TOTAL STOCKHOLDERS' EQUITY	5,775,446	4,907,714
TOTAL LIABILITIES AND STOCKHOLDERS' EQUITY	$ 7,366,778	$ 6,824,856

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

LIGHTWAVE LOGIC, INC.
STATEMENTS OF COMPREHENSIVE LOSS
FOR THE YEARS ENDING DECEMBER 31, 2020 AND 2019

	For the Year Ending December 31, 2020	For the Year Ending December 31, 2019
NET SALES	$ —	$ —
COST AND EXPENSE		
Research and development	4,529,498	4,319,295
General and administrative	2,070,476	2,000,112
	6,599,974	6,319,407
LOSS FROM OPERATIONS	(6,599,974)	(6,319,407)
OTHER INCOME (EXPENSE)		
Interest income	776	232
Commitment fee	(116,366)	(407,792)
NET LOSS	$ (6,715,564)	$ (6,726,967)
Basic and Diluted Loss per Share	$ (0.07)	$ (0.08)
Basic and Diluted Weighted Average Number of Shares	91,859,025	83,299,508

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

LIGHTWAVE LOGIC, INC.
STATEMENT OF STOCKHOLDERS' EQUITY
FOR THE YEARS ENDING DECEMBER 31, 2020 AND 2019

	Number of Shares	Common Stock	Additional Paid-in Capital	Accumulated Deficit	Total
BALANCE AT DECEMBER 31, 2018	79,176,330	$ 79,177	$ 62,356,854	$ (57,528,969)	$ 4,907,062
Common stock issued to institutional investor	7,700,000	7,700	5,631,260	—	5,638,960
Common stock issued for commitment shares	533,270	533	407,259	—	407,792
Options issued for services	—	—	600,727	—	600,727
Warrants issued for services	—	—	80,140	—	80,140
Net loss for the year ending December 31, 2019	—	—	—	(6,726,967)	(6,726,967)
BALANCE AT DECEMBER 31, 2019	87,409,600	$ 87,410	$ 69,076,240	$ (64,255,936)	$ 4,907,714

	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	97,775,789	$ 97,776	$ 76,649,170	$ (70,971,500)	$ 5,775,446

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

LIGHTWAVE LOGIC, INC.
STATEMENTS OF CASH FLOWS
FOR THE YEARS ENDING DECEMBER 31, 2020 AND 2019

	For the Year Ending December 31, 2020	For the Year Ending December 31, 2019
CASH FLOWS FROM OPERATING ACTIVITIES		
Net loss	$ (6,715,564)	$ (6,726,967)
Adjustments to reconcile net loss to net cash used in operating activities		
Warrants issued for services	95,774	80,140
Stock options issued for services	539,414	600,727
Common stock issued for services and fees	116,366	407,792
Depreciation and amortization of patents	784,419	698,694
Decrease (increase) in assets		
Prepaid expenses and other current assets	(194,636)	165,410
Increase (decrease) in liabilities		
Accounts payable	80,824	(62,318)
Accounts payable and accrued expenses-related parties	34,992	981
Deferred lease liability	(41,779)	5,082
Paycheck Protection Program advance	410,700	—
Accrued expenses	15,627	64,614
Net cash used in operating activities	(4,873,863)	(4,765,845)
CASH FLOWS FROM INVESTING ACTIVITIES		
Cost of intangibles	(59,923)	(82,195)
Purchase of property and equipment	(158,061)	(223,475)
Net cash used in investing activities	(217,984)	(305,670)
CASH FLOWS FROM FINANCING ACTIVITIES		
Exercise of warrants	1,658,442	—
Issuance of common stock, institutional investor	5,173,300	5,638,960
Repayment of equipment purchase payable	(669,649)	(505,726)
Net cash provided by financing activities	6,162,093	5,133,234
NET INCREASE IN CASH AND CASH EQUIVALENTS	1,070,246	61,719
CASH AND CASH EQUIVALENTS - BEGINNING OF YEAR	2,236,344	2,174,625
CASH AND CASH EQUIVALENTS - END OF YEAR	$ 3,306,590	$ 2,236,344
Supplemental Disclosure of Non-cash investing and financing activities:		
Operating Lease - Right of Use - Building and Operating lease liability	$ —	$ 885,094
Equipment acquisition funded by liability	—	1,010,000

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

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 datacom and telecom devices, sales of non-linear optical polymers, and product development agreements prior to moving into full-scale production.

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.

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.

NOTE 1 – SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES (CONTINUED)

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, 2020, the Company did have deposits with a financial institution that exceed the Federal Depository Insurance coverage.

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.

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 amendments in this Update expand the scope of Topic 718 to include share-based payment transactions for acquiring goods and services from nonemployees. Prior to this 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.

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 2020 and 2019, 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
In February 2016, the FASB issued ASU No. 2016-02, Leases (Topic 842) and subsequent related updates. The core principle of Topic 842 is that a lessee should recognize the assets and liabilities that arise from operating leases. The Company adopted the standard effective January 1, 2019 under the optional transition method which allows the entity to apply the new lease standard at the adoption date and recognize a cumulative-effect adjustment, if any, to the opening balance of retained earnings in the period of adoption. The standard had a material impact on the balance sheet (see Note 7).

Recently Issued Accounting Pronouncements Not Yet Adopted
As of December 31, 2020, there are no recently issued accounting standards not yet adopted which would have a material effect on the Company’s financial statements.

NOTE 2 – MANAGEMENT'S PLANS

Our future expenditures and capital requirements will depend on numerous factors, including: the impact of the COVID-19 pandemic; 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. From late March through May 1, 2020, the Company curtailed most operations due to the COVID-19 pandemic. On April 24, 2020, the Company received $410,700 in loan funding from the Coronavirus Aid, Relief, and Economic Security Act (CARES Act) Paycheck Protection Program, administered by the U.S. Small Business Administration. The loan was eligible for forgiveness as part of the CARES Act if certain requirements were met. The loan was forgiven in its entirely on January 22, 2021 (See Note 8). We expect that we will incur approximately $700,000 of expenditures per month over the next 12 months. Our current cash position enables us to finance our operations through December 2021 before we will be required to replenish our cash reserves pursuant to the Lincoln Park financing. Subject to any additional impact of the COVID-19 pandemic, we expect our Lincoln Park financing (described in Note 10) to provide us with sufficient funds to maintain our operations over that period of time and until May 2022. Our cash requirements are expected to increase at a rate consistent with the 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.

NOTE 3 – PREPAID EXPENSES AND OTHER CURRENT ASSETS

Prepaid expenses and other current assets consist of the following:

	December 31, 2020	December 31, 2019
Deposit for equipment	$ 140,394	$ —
Prototype Devices	118,206	27,810
Research & Development Credit	101,629	158,612
Insurance	93,569	89,828
Other	76,862	58,756
Rent	36,525	36,525
Prepaid Material	—	1,018
	$ 567,185	$ 372,549

NOTE 4 – PROPERTY AND EQUIPMENT

Property and equipment consists of the following:

	December 31, 2020	December 31, 2019
Office equipment	$ 86,097	$ 84,751
Lab equipment	3,884,807	3,733,057
Furniture	33,128	33,128
Leasehold improvements	234,366	229,401
	4,238,398	4,080,337
Less: Accumulated depreciation	2,364,849	1,663,834
	$ 1,873,549	$ 2,416,503

Depreciation expense for the years ending December 31, 2020 and 2019 was $701,015 and $617,741. During the years ended December 31, 2020 and 2019, the Company did not sell or retire property and equipment.

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 have yet to be granted.

Intangible assets consist of the following:

	December 31, 2020	December 31, 2019
Patents	$ 1,327,000	$ 1,267,077
Less: Accumulated amortization	411,000	327,596
	$ 916,000	$ 939,481

Amortization expense for the years ending December 31, 2020 and 2019 was $83,404 and $80,953. There were no patent costs written off for the years ended December 31, 2020 and December 31, 2019.

NOTE 6 – EQUIPMENT PURCHASE PAYABLE

Outstanding equipment purchase payable is comprised of the following:

Final Year of Maturity	Classification	Interest Rate	December 31, 2020	December 31, 2019
	Current	0.00%	$ 13,107	$ 630,329
2021	Long term	0.00%	—	52,427
			$ 13,107	$ 682,756

NOTE 7 – COMMITMENTS

On October 30, 2017, the Company entered into a new lease to lease approximately 13,420 square feet of office, laboratory and research and development space located in Colorado for the Company's new 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. The term shall be extended for an additional twenty-four (24) months, subject to certain conditions, waivable solely by Landlord in its sole and absolute discretion. 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.

NOTE 7 – COMMITMENTS (CONTINUED)

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

YEARS ENDING DECEMBER 31,	AMOUNT
2021	$ 201,501
2022	207,563
2023	213,781
2024	182,624
	805,469
Less discounted interest	(102,015)
TOTAL	$ 703,454

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. Rent expense totaling $114,559 and $38,220 is included in research and development and general and administrative expenses for the year ended December 31, 2019.

NOTE 8 – 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 recently enacted Coronavirus Aid, Relief, and Economic Security Act 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 in its entirety on January 22, 2021.

NOTE 9 – 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:

	2020	2019
Current	$ —	$ —
Deferred	(1,972,000)	(1,779,000)
Change in valuation allowance	1,972,000	1,779,000
	$ —	$ —

NOTE 9 – INCOME TAXES (CONTINUED)

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

	2020		2019	
	Amount	%	Amount	%
Income tax benefit at U.S. federal income tax rate	$ (1,544,000)	(21)	$ (1,413,000)	(21)
State tax benefit, net of federal tax effect	(441,000)	(6)	(404,000)	(6)
Non-deductible share-based compensation	13,000	—	38,000	1
Change in valuation allowance	1,972,000	27	1,779,000	26
	$ —	—	$ —	—

The components of deferred tax assets as of December 31, 2020 and 2019 are as follows:

	2020	2019
Deferred tax asset for NOL carryforwards	$ 15,338,000	$ 13,524,000
Share-based compensation	2,178,000	2,020,000
Valuation allowance	(17,516,000)	(15,544,000)
	$ —	$ —

The valuation allowance for deferred tax assets as of December 31, 2020 and 2019 was $17,516,000 and $15,544,000, respectively. The change in the total valuation for the year ended December 31, 2020 was an increase of $1,972,000 and for the year ended December 31, 2019 was an increase of $1,779,000. 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, 2020, the Company had net operating loss carry forwards of approximately $56,805,000, expiring through the year ending December 31, 2037 for net operating losses originating in tax years beginning before January 1, 2018. Net operating losses recorded in tax years beginning January 1, 2018 and after 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.

NOTE 9 – 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, 2020, the Company had no unrecognized tax benefits and no charge during 2020, and accordingly, the Company did not recognize any interest or penalties during 2020 related to unrecognized tax benefits. There is no accrual for uncertain tax positions as of December 31, 2020.

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, 2017 and thereafter are subject to examination by the relevant taxing authorities.

NOTE 10 – 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

2016 Purchase Agreement
In January 2016, the Company signed a Purchase Agreement with an institutional investor to sell up to $20,000,000 of common stock. The Company also entered into a registration rights agreement with the institutional investor whereby the Company agreed to file a registration statement related to the transaction with the U.S. Securities and Exchange Commission registering 5,000,000 shares of the Company's common stock. The registration statement was filed on March 25, 2016. The registration statement became effective April 7, 2016. The Company registered an additional 5,000,000 shares pursuant to a registration statement filed on April 19, 2017 which became effective June 15, 2017. The Company registered an additional 5,000,000 shares pursuant to a registration statement filed on May 2, 2018 which became effective May 11, 2018. Under the Purchase Agreement and at Company's sole discretion, the institutional investor has committed to invest up to $20,000,000 in common stock over a 36-month period. The Company issued 350,000 shares of restricted common stock to the institutional investor as an initial commitment fee valued at $237,965, fair value, and 650,000 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 period August 2016 through December 31, 2019, the institutional investor purchased 14,000,000 shares of common stock for proceeds of $13,150,370 and the Company issued 427,405 shares of common stock as additional commitment fee, valued at $456,367, fair value, leaving 222,595 in reserve for additional commitment fees. During the year ending December 31, 2019, the institutional investor purchased 1,550,000 shares of common stock for proceeds of $1,011,585 and the Company issued 32,879 shares of common stock as additional commitment fee, valued at $24,162, fair value. The 2016 Purchase Agreement expired April, 2019.

NOTE 10 – STOCKHOLDERS' EQUITY (CONTINUED)

Common Stock Options and Warrants (Continued)

2019 Purchase Agreement
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 31, 2020, the institutional investor purchased 14,275,000 shares of common stock for proceeds of $9,800,675 and the Company issued 318,528 shares of common stock as additional commitment fee, valued at $241,871, fair value, leaving 493,972 in reserve for additional commitment fees. During the year ending December 31, 2020, the institutional investor purchased 8,125,000 shares of common stock for proceeds of $5,173,300 and the Company issued 168,137 shares of common stock as additional commitment fee, valued at $116,366, fair value. During January through March 31, 2021, the institutional investor purchased 3,791,911 shares of common stock for proceeds of $4,953,972 and the Company issued 161,009 shares of common stock as additional commitment fee, valued at $250,280, fair value, leaving 332,963 in reserve for additional commitment fees.

NOTE 11 – 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 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 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, 2020, options to purchase 4,450,000 shares of common stock have been issued and are outstanding.

NOTE 11 – STOCK BASED COMPENSATION (CONTINUED)

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, 2020, options to purchase 3,757,500 shares of common stock have been issued and are outstanding and 4,242,500 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.

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. 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 FASB ASC 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 2019: no dividend yield in all years, expected volatility, based on the Company's historical volatility, 60% to 80.5%, risk-free interest rate between 1.47% to 2.71% and expected option life of 5.0 to 10 years.

As of December 31, 2020, there was $161,831 of unrecognized compensation expense related to non-vested market-based share awards that is expected to be recognized through September 30, 2022.

Share-based compensation was recognized as follows:

	2020	2019
2007 Employee Stock Option Plan	$ —	$ —
2016 Equity Incentive Plan	539,414	600,727
Warrants	95,774	80,140
Total share-based compensation	$ 635,188	$ 680,867

NOTE 11 – STOCK BASED COMPENSATION (CONTINUED)

The following tables summarize all stock option and warrant activity of the Company during the years ended December 31, 2020 and 2019:

	Non-Qualified Stock Options and Warrants Outstanding and Exercisable		
	Number of Shares	Exercise Price	Weighted Average Exercise Price
Outstanding, December 31, 2018	18,964,867	$ 0.57 - $1.69	$ 0.91
Granted	1,327,500	$ 0.64 - $1.05	$ 0.80
Expired	(3,838,600)	$ 0.95 - $1.25	$ 1.13
Forfeited	(151,250)	$ 0.77 - $1.50	$ 0.91
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	$ 0.51 - $1.69	$ 0.84
Exercisable, December 31, 2020	9,707,924	$ 0.51 - $1.69	$ 0.84

The aggregate intrinsic value of options and warrants outstanding and exercisable as of December 31, 2020 was $1,593,794. 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 $0.93 for the Company's common stock on December 31, 2020. During the year ending December 31, 2020, 2,073,052 warrants were exercised for proceeds of $1,658,442. No options were exercised during 2020. No options or warrants were exercised during 2019.

	Non-Qualified Stock Options and Warrants Outstanding		
Range of Exercise Prices	Number Outstanding Currently Exercisable at December 31, 2020	Weighted Average Remaining Contractual Life	Weighted Average Exercise Price of Options and Warrants Currently Exercisable
$0.51 - $1.69	9,707,924	5.0 Years	$0.84

NOTE 12 – RELATED PARTY

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. At December 31, 2019 the Company had a legal accrual to related party of $10,152 and travel and office expense accruals of officers in the amount of $4,653.

During July 2018, the Company issued a warrant to purchase 100,000 shares of common stock at a purchase price of $1.15 per share for professional services to be rendered over a twelve month period commencing July 1, 2018. The warrant was valued at $62,637, fair value upon issuance, using the Black-Scholes Option Pricing Formula. The expense is being recognized based on service terms of the agreement over a twelve month period. For the year ending December 31, 2019, the Company recognized $31,319 of expense.

NOTE 13 – RETIREMENT PLAN

The Company established a 401(k) retirement plan covering all eligible employees beginning November 15, 2013. A contribution of $53,832 was charged to expense and accrued for the year ending December 31, 2020 to all eligible non-executive participants. A contribution of $45,663 was charged to expense and accrued for the year ending December 31, 2019 to all eligible non-executive participants.