

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

FORM 10-K

(MARK ONE)

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

FOR THE FISCAL YEAR ENDED DECEMBER 31, 2019

OR

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 000-52008

LUNA INNOVATIONS INCORPORATED

(Exact name of Registrant as Specified in its Charter)

Delaware

(State or Other Jurisdiction of Incorporation or Organization)

54-1560050

(I.R.S. Employer Identification Number)

301 1st St SW, Suite 200

Roanoke, VA 24011

(Address of Principal Executive Offices)

(540) 769-8400

(Registrant's Telephone Number, Including Area Code)

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

<u>Title of each class</u>	<u>Trading Symbol</u>	<u>Name of each exchange on which registered</u>
Common Stock, \$0.001 par value per share	LUNA	The Nasdaq Stock Market LLC

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

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

Indicate by check mark if the registrant is not required to file reports pursuant to Section 13 or Section 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 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, a 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 check mark if the registrant has elected not to use the extended transition period for complying with any new or revised financial accounting standards provided pursuant to Section 13(a) of the Exchange Act.

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

The aggregate market value of the voting and non-voting common equity held by non-affiliates of the registrant on June 28, 2019 based upon the closing price of Common Stock on such date as reported by the Nasdaq Capital Market, was approximately \$100.4 million.

Indicate the number of shares outstanding of each of the issuer's classes of common stock, as of the latest practicable date: As of March 11, 2020 there were 30,391,879 shares of the registrant's common stock outstanding.

DOCUMENTS INCORPORATED BY REFERENCE

Specified portions of the registrant's Proxy Statement with respect to its 2020 Annual Meeting of stockholders, anticipated to be filed within 120 days after the end of its fiscal year ended December 31, 2019, are incorporated by reference into Part III of this annual report on Form 10-K.

LUNA INNOVATIONS INCORPORATED
ANNUAL REPORT ON FORM 10-K
FOR THE YEAR ENDED DECEMBER 31, 2019

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CAUTIONARY NOTE REGARDING FORWARD LOOKING STATEMENTS

This Annual Report on Form 10-K, including the “Management’s Discussion and Analysis of Financial Condition and Results of Operation” section in Item 7 of this report, and other materials accompanying this Annual Report on Form 10-K contain forward-looking statements within the meaning of Section 21E of the Securities Exchange Act of 1934, as amended, and Section 27A of the Securities Act of 1933, as amended. All statements other than statements of historical facts are “forward-looking statements” for purposes of these provisions, including those relating to future events or our future financial performance. In some cases, you can identify these forward-looking statements by words such as “intends,” “will,” “plans,” “anticipates,” “expects,” “may,” “might,” “estimates,” “believes,” “should,” “projects,” “predicts,” “potential” or “continue,” or the negative of those words and other comparable words, and other words or terms of similar meaning in connection with any discussion of future operating or financial performance. Similarly, statements that describe our business strategy, goals, prospects, opportunities, outlook, objectives, plans or intentions are also forward-looking statements. These statements are only predictions and may relate to, but are not limited to, expectations of future operating results or financial performance, capital expenditures, introduction of new products, regulatory compliance, plans for growth and future operations, as well as assumptions relating to the foregoing.

These statements are based on current expectations and assumptions regarding future events and business performance and involve known and unknown risks, uncertainties and other factors that may cause actual events or results to be materially different from any future events or results expressed or implied by these statements. These factors include those set forth in the following discussion and within Item 1A “Risk Factors” of this Annual Report on Form 10-K and elsewhere within this report.

You should not place undue reliance on these forward-looking statements, which apply only as of the filing date of this Annual Report on Form 10-K. You should carefully review the risk factors described in other documents that we file from time to time with the U.S. Securities and Exchange Commission (“SEC”). Except as required by applicable law, including the rules and regulations of the SEC, we do not plan to publicly update or revise any forward-looking statements, whether as a result of any new information, future events or otherwise, other than through the filing of periodic reports in accordance with the Securities Exchange Act of 1934, as amended.

We have proprietary rights to a number of trademarks used in this Annual Report which are important to our business. Solely for convenience, the trademarks and trade names in this prospectus are referred to without the ® and TM symbols, but such references should not be construed as any indicator that their respective owners will not assert, to the fullest extent under applicable law, their rights thereto. All other trademarks, trade names and service marks appearing in this Annual Report are the property of their respective owners.

PART I

ITEM 1. BUSINESS

Company Overview and Business Model

Luna Innovations Incorporated (“we” or the “Company”) is a leader in advanced optical technology, providing high performance fiber optic test, measurement and control products for the telecommunications and photonics industries and distributed fiber optic sensing products for industries utilizing composite and other advanced materials, such as the automotive, aerospace, energy and infrastructure industries. Our distributed fiber optic sensing products help designers and manufacturers more efficiently develop new and innovative products by providing valuable information such as highly detailed stress, strain, and temperature measurements of a new design or manufacturing process. In addition, our distributed fiber optic sensing products are used to monitor the structural integrity or operational health of critical assets, including large civil structures such as bridges. Our communications test and control products accelerate the development of advanced fiber optic components and networks by providing fast and highly accurate characterization of components and networks. We also provide applied research services, typically under research programs funded by the U.S. government, in areas of sensing and instrumentation, advanced materials, optical technologies and health sciences. Our business model is designed to accelerate the process of bringing new and innovative products to market. We use our in-house technical expertise across a range of technologies to perform applied research services for companies and for government funded projects. We continue to invest in product development and commercialization, which we anticipate will lead to increased product sales growth.

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We are organized into two main reporting segments, our Products and Licensing segment and our Technology Development segment. Our Products and Licensing segment develops, manufactures and markets distributed fiber optic sensing products and fiber optic communications test and control products. We continue to develop and commercialize our fiber optic technology for sensing applications for aerospace, automotive, energy and infrastructure as well as for test and measurement applications in the telecommunications and data communications industries. Our Products and Licensing segment revenues represented approximately 63% and 51% of our total revenues for the years ended December 31, 2019 and 2018, respectively.

Our Technology Development segment performs applied research principally in the areas of sensing and instrumentation, advanced materials, optical technologies and health sciences. Our Technology Development segment comprised approximately 37% and 49% of our total revenues for the years ended December 31, 2019 and 2018, respectively. Most of the government funding for our Technology Development segment is derived from the Small Business Innovation Research ("SBIR") program coordinated by the U.S. Small Business Administration ("SBA").

Our SBIR research is focused on technological areas with commercial potential and we strive to commercialize any resulting scientific advancements. For the year ended December 31, 2019, approximately 35% of our total revenues were generated under the SBIR program, compared to 44% for the year ended December 31, 2018.

For the years ended December 31, 2019 and 2018, 40% and 53%, respectively, of our total revenues were derived from the U.S. government.

Acquisition of General Photonics Corporation

On March 1, 2019, we acquired all of the outstanding stock of General Photonics Corporation ("GP"), a leading provider of innovative components, modules and test equipment focused on the generation, measurement and control of polarized light critical in fiber optic-based applications for aggregate consideration of \$19.0 million with an earn-out provision of up to \$1.0 million. Of the purchase price, \$17.1 million was paid at closing and \$1.9 million was placed into escrow for possible working capital adjustments to the purchase price and potential satisfaction of certain post-closing indemnification obligations. As of December 31, 2019 we expect to pay, and have accrued, \$1.0 million in additional cash consideration as a result of the successful completion of the earn-out provision.

Acquisition of Micron Optics, Inc.

On October 15, 2018, we acquired substantially all of the assets, other than cash, of the U. S. operations of Micron Optics, Inc. ("MOI"), a leading provider of innovative optical components and laser-based equipment that advance the quality of optical measurements, allowing the sensing, imaging and telecommunications industries, to make critical measurements. We paid total cash consideration of \$5.5 million for the acquisition of MOI. The acquisition of MOI expanded our technology and product portfolio to include optical sensors and sensing interrogators capable of a broader range of measurement capabilities, including higher speed measurements such as vibration, and the ability to instrument larger structures over longer distances. In addition, the MOI acquisition added a product suite of tunable optical filters, optical sensors and swept lasers.

Products and Licensing

Our Products and Licensing segment includes the sale of fiber optic test, measurement and control instruments and modules. We provide fiber optic test and measurement products which provide solutions primarily for the telecommunications industry marketed under the Luna Technologies brand. We also market our Optical Distributed Sensing Interrogator ("ODiSI") platform of products for distributed and very high-resolution sensing of strain and temperature utilizing optical fiber. Following the acquisition of MOI, we also market our Hyperion platform of products for distributed fiber optic sensing that offer dynamic measurement capabilities over longer distances. Following our acquisition of GP, we also market solutions for the measurement, management and control of polarization and delay in fiber optic networks. We refer to the groups within our company who develop, manufacture, support and sell these products as our Lightwave division.

Our key initiative for long term growth is to become a leading provider of fiber optic test, measurement and control equipment, including products for physical sensing systems and standard test methods based upon the ODiSI and Hyperion product platforms and products for the characterization of high-speed fiber optic components and networks, including the growing silicon photonics market. Our primary product lines in our Products and Licensing segment are described in more detail below.

Test and Measurement, Sensing and Instrumentation Products

Test and Measurement Equipment for Fiber Optic Components and Sub-Assemblies

Our product lines in the optical test and measurement domain include our Optical Vector Analyzer, our Optical Backscatter Reflectometer, and our Phoenix family of tunable lasers.

Our optical test and measurement products primarily serve the telecommunications industry, as well as provide valuable applications in other fields. Our test and measurement products test and monitor the integrity of fiber optic network components and sub-assemblies. These products are designed for manufacturers and suppliers of optical components and sub-assemblies allowing them to reduce development, test and production costs and improve the quality of their products. Our products are particularly useful for characterizing and testing photonic integrated circuits, such as silicon photonics components, which are a critical technology enabling the growing worldwide demand for internet connectivity. Most manufacturers and suppliers of optical components and modules currently use a combination of different types of optical test equipment to measure performance and identify failures in optical networks, such as bad splices, bends, crimps and other reflective and non-reflective events that can cause defects and negatively impact product performance. Our optical test equipment products eliminate the need to employ multiple test products by addressing all stages of the end user's product development lifecycle, including design verification, component qualification, assembly process verification and failure analysis.

ODiSI Sensing Solution

Our ODiSI products provide fully distributed strain and temperature measurements delivering an extraordinary amount of data by using an optical fiber as a continuous sensor for up to 50 meters in length. Compared to traditional sensing methods, such as electrical strain gages, this technology provides greater insight into the performance, tolerances and failure mechanisms of composite structures and vehicles and can be integrated into locations and environments not accessible with traditional sensors. We believe our ODiSI products provide exceptional value to the aerospace and automotive industries as they continue to adopt electrification and move to lighter weight systems made of composite structures.

We have significant expertise in distributed sensing systems, such as ODiSI, which are products that incorporate multiple channels of fiber optic sensors whose inputs are integrated through an advanced measurement system and software. These products use fiber optic sensing technology with our innovative monitoring system that allows several thousand sensors to be networked along a single optical fiber.

Hyperion Sensing Solution

Our Hyperion sensing products expand our capabilities in fiber optic sensing by providing distributed sensing using hundreds of Fiber-Bragg Grating ("FBG") or Extrinsic Fabry-Perot ("FP") sensors measured at sampling rates up to 5KHz. Hyperion enables rapid full-spectrum data acquisition and flexible peak detect algorithms of FBGs, Long Period FBGs and FP sensors with low-latency access to data for closed loop feedback applications. Our Hyperion products target fiber optic sensing applications that require more dynamic measurement capabilities or longer distances than provided by our ODiSI platform.

General Photonics

Our GP products include components, modules and instruments to measure, manage and control polarization and group delay in fiber optic networks. Our proprietary fiber optic squeezing technology ensures high performance polarization control. We also manufacture and sell fiber optic coils for use in gyroscopes.

Tunable Lasers

We manufacture a line of swept tunable lasers that are integrated into current and new products to help us provide our customers with faster, more flexible and cost-effective test and measurement products. Our laser has desirable properties in the quality of the laser light produced, the speed at which it can operate, the small size of the package, and the environmental conditions in which it can operate. We believe that these traits make it possible for us to move our fiber optic sensing capabilities out of the laboratory, and into more demanding environments such as aircraft structural health monitoring, automotive manufacturing, green energy and industrial applications.

TeraMetrix

Our TeraMetrix products are used to measure and verify physical properties on-line and in real-time to reduce raw materials and rework costs in manufacturing processes as well as conducting quality control monitoring utilizing terahertz ("THz") measurement technologies. THz is a region of the electromagnetic spectrum that lies between microwave and infrared waves and is in the early stages of adoption. While microwaves and infrared waves have been explored and commercialized

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for decades, THz waves are in the early stages of being explored and commercialized because they have historically been very difficult to generate and detect. Advances in femtosecond lasers and ultra-fast semiconductor and electro-optic devices combined with fiber-optic packaging technologies have enabled the development of practical THz instrumentation for the research market with increasing adoption in the industrial, military and aerospace markets. THz is used to "look" through and beneath materials with high two-dimensional and three-dimensional spatial resolution. It can also uniquely identify the chemical composition of many hidden or subsurface objects using non-ionizing radiation, which is not harmful to humans at the power levels commonly used today. We market our THz based products instruments and sensors primarily through value added resellers. Our TeraMetrix THz solutions are aimed at two primary market opportunities: Non-Destructive Test (NDE) and Industrial Process Control. For both of these markets, our TeraMetrix products are used to measure layer thicknesses with very high resolutions for otherwise opaque materials, allowing our customers to manage critical coating and manufacturing processes.

Sales and Marketing

We primarily market our fiber optic test, measurement and control products to telecommunications companies, defense agencies, government system integrators, researchers, original equipment manufacturers, distributors, testing labs and strategic partners worldwide. We have a regional sales force that markets and sells our products through manufacturer representative organizations to customers in North America and through partner and distribution channels for sales outside of North America. We have a dedicated sales force for direct marketing of our distributed sensing products, with an initial focus on customers in the automotive, aerospace, and energy industries.

We market our THz instruments primarily to original equipment manufacturers through a mix of technical sales engineers, value added resellers and independent sales representatives. We market these products and capabilities through industry specific channels, including the internet, industry trade shows and through trade journals.

We believe that we provide a high level of support in developing and maintaining our long-term relationships with our customers. Customer service and support are provided through our offices and those of our partners that are located throughout the world.

Technology Development

We provide applied research for customers in our primary areas of focus, including sensing and materials such as coatings, adhesives, composites and bio-engineered materials. We generally compete to win contracts in these areas on a fee-for-service basis. Our Technology Development segment has a successful track record of evaluating innovative technologies to address the needs of our customers.

We seek to maximize the benefits of our contract research business by generating revenue and identifying promising technologies to develop. We focus primarily on opportunities in which we develop intellectual property rights in areas that we believe we can commercialize. We take a disciplined approach to contract research to ensure the costs of contracts we undertake will be fully reimbursed. We believe this model is cost-efficient and significantly reduces our development risk by enabling us to defray the development costs of higher risk technology with third-party funding.

While we conduct our applied research on a fee-for-service basis for third parties, we seek to retain full or partial rights to the technologies and patents we develop under these contracts to continuously enlarge and strengthen our intellectual property portfolio. New technology that we develop may complement our existing technologies and enable us to develop applications and products that were previously not possible. In addition, the new technologies we develop may have commercial markets beyond the scope of the applications originally contemplated in the contract research stage, and we endeavor to capture the value of those opportunities. Funded research and development within this business segment was \$26.0 million and \$21.0 million for the years ended December 31, 2019 and 2018, respectively.

Each year, U.S. government federal agencies and departments are required to allocate a portion of their grant awards for SBIR-qualified organizations. SBIR contracts include Phase I feasibility contracts of up to \$225,000 and Phase II proof-of-concept contracts, which can be as high as \$1,500,000. We have won three National Tibbetts Awards from the SBA for outstanding SBIR performance. We have also won research contracts outside the SBIR program from corporations and government entities. These contracts typically have a longer duration and higher value than SBIR grants. In the future, we seek to derive a larger portion of our contract research revenues from contracts outside of the SBIR program.

Materials

We are actively developing a wide variety of materials. For example, we have developed a range of coatings, including both hydrophobic and superoleophobic coatings. These coatings are being evaluated for use in a number of applications. Other coatings under development include anti-corrosion and damage-indicating coatings.

We are also working on a variety of bioengineered materials for homeostatic agents and wound healing. These materials must be approved by the FDA or similar foreign regulatory agencies before they can be marketed, which we do not expect to occur for at least several years, if at all.

Sensing

Our Technology Development segment also performs a significant amount of applied research towards developing new sensors. This includes sensors for the purpose of corrosion, temperature, strain, pressure, structural health and chemical detection. Much of the work is directed to harsh environments and uses optics. Examples include measuring temperature and neutron flux in nuclear reactors, pressure and temperature in gas turbines and temperatures of cryogenic lines. The effort utilizes both discrete and distributed sensors. Our technology development work in this area is closely aligned with our Products and Licensing segment and is directed at advancing the technology and the development of new applications.

Intellectual Property

We seek patent protection on inventions that we consider important to the operations of our business. We rely on a combination of patent, trademark, copyright and trade secret laws in the United States and other jurisdictions, as well as confidentiality procedures and contractual provisions to protect our proprietary technology and our brand. We control access to our proprietary technology and enter into confidentiality and invention assignment agreements with our employees and consultants and confidentiality agreements with other third parties.

Our success depends in part on our ability to develop patentable products and obtain, maintain and enforce patent and trade secret protection for our products, including successfully defending our patents against third-party challenges both in the United States and in other countries. We will only be able to protect our technologies from unauthorized use by third parties to the extent that we own or have licensed valid and enforceable patents or trade secrets that cover them. Furthermore, the degree of future protection of our proprietary rights is uncertain because we may not be able to obtain patent protection on some or all of our technology and because legal means afford only limited protection and may not adequately protect our rights or permit us to gain or keep our competitive advantage.

Currently, we own or license approximately 400 U.S. and international patents and approximately 50 U.S. and international patent applications. Our issued patents generally have terms that are scheduled to expire between 2020 and 2037. The patents scheduled to expire in 2020 are not expected to have a significant impact on our revenues or results of operations. Patents may not be issued for any pending or future pending patent applications owned by or licensed to us. Claims allowed under any issued patent or future issued patent owned or licensed by us may not be valid or sufficiently broad to protect our technologies. Any issued patents owned by or licensed to us now or in the future may be challenged, invalidated or circumvented, and, in addition, the rights under such patents may not provide us with competitive advantages. In addition, competitors may design around our technology or develop competing technologies. To the extent we elect to pursue, intellectual property rights may also be unavailable or limited in some foreign countries, which could make it easier for competitors to capture or increase their market share with respect to related technologies.

A discussion of our material in-licensed patents is set forth below.

NASA Patents

We have licensed, on a non-exclusive basis, four U.S. patents and related patents in Japan, Canada, Germany, France, Great Britain and Belgium from the National Aeronautics and Space Administration, an agency of the U.S. government ("NASA"), which patents concern the measurement of strain in optical fiber using Bragg gratings and Rayleigh scatter and the measurement of the properties of fiber-optic communications devices. These patents expire between March 2020 and October 2020. Under the license agreements, we pay NASA certain royalties based on a percentage of net sales of products covered by the patents. We incur a royalty obligation to NASA based upon a specified percentage of the revenue earned on each product sold utilizing these patents subject to combined minimum royalties of \$220,000 per year under the license agreements. The term of the license agreements continues until the expiration of the last licensed patent. These license agreements may be terminated by us on 90 days' notice. Either party may terminate the license agreements for cause upon certain conditions.

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Shape Sensing Patents

As a part of our sale of assets associated with our fiber optic shape sensing technology in the medical field to Intuitive Surgical, Inc. ("Intuitive") in 2014, we transferred our related patents to Intuitive. Also, as a part of this transaction, we entered into a revocable license agreement with Intuitive pursuant to which we have the right to use all of our transferred technology outside the field of medicine and in respect of our existing non-shape sensing products in certain non-robotic medical fields. Two U.S. patents that we now license back from Intuitive cover the use of optical frequency domain reflectometry and multiple, closely spaced Bragg gratings for shape sensing, and the use of the inherent scatter as a strain sensor for shape sensing. These two patents expire in July 2025. We also license back from Intuitive patents and patent applications that cover certain refinements to the measurements covered in the foregoing two patents and related technologies, which are necessary in order to achieve the necessary accuracies for medical and other applications. These patent applications were filed in the United States, the European Patent Office, China, India, Russia, Brazil, Japan, Indonesia and elsewhere. These patents and patent applications can support other nonmedical applications of our fiber optic shape sensing technology.

Coherent

In December 2006, we entered into an asset transfer and license agreement with Coherent, Inc. Under the agreement, we acquired the rights to manufacture Coherent's "Iolon" brand of swept tunable lasers as well as certain manufacturing equipment and inventory previously used by Coherent to manufacture the lasers. We continue to enhance, produce and market these lasers under our "Phoenix" brand. Under this agreement, Coherent granted non-exclusive licenses to us for certain U.S. patents and other intellectual property rights owned or controlled by Coherent for making, having made, using, importing, selling and offering for sale the lasers. This agreement expired in 2016. However, the patent licenses became fully paid and perpetual, as we fulfilled our royalty obligations during the 10-year period and the license to the other intellectual property rights is perpetual. These U.S. patents expire between 2020 and 2022. As consideration, we paid Coherent a total of \$1.3 million in addition to paying royalties on net sales of products sold by us that incorporate the lasers or that are manufactured using the intellectual property covered by the licenses.

The Phoenix laser is a miniaturized, external-cavity laser offering high performance in a compact footprint and is applicable to a range of fiber optic test and measurement, instrumentation, and sensing applications. These products employ frequency-tuned lasers to measure various aspects of the transmission properties of telecommunications fiber optic components and systems. Lasers are also used in fiber optic sensing applications such as distributed strain and temperature mapping, and distributed measurement of shape. We currently use these lasers within our ODiSI platform of products, our fiber optic shape sensing products and certain of our backscatter reflectometer products, and we also sell variations of the Phoenix laser as standalone products. Under our agreements related to our sale of assets to Intuitive, we have certain obligations to supply Intuitive with these lasers.

Corporate History

We were incorporated in the Commonwealth of Virginia in 1990 and reincorporated in the State of Delaware in April 2003. We completed our initial public offering in June 2006. Our executive offices are located at 301 1st St SW, Suite 200, Roanoke, Virginia 24011 and our main telephone number is (540) 769-8400.

Material Agreements

Sale of High-Speed Optical Receiver ("HSOR") Business

On August 9, 2017, we completed the sale of our HSOR business, which was part of our Products and Licensing segment, to an unaffiliated third party for an initial purchase price of \$33.5 million, of which \$29.5 million in cash has been received, and \$4.0 million was placed into escrow until December 15, 2018 for possible working capital adjustments to the purchase price and potential satisfaction of certain post-closing indemnification obligations. In December 2018, we received \$1.5 million of the escrow amount. The remaining \$2.5 million remains in escrow and is pending the resolution of certain indemnification claims which the buyer has made and which are disputed by us. The HSOR business was a component of the operations of Advanced Photonix, Inc., which we acquired in May 2015.

Sale of Luna Optoelectronics

In July 2018 we sold substantially all of the assets associated with our custom optoelectronic components and sub-assemblies business for total cash consideration of \$17.5 million, paid at closing, in addition to contingent consideration of up to \$1.0 million. The contingent consideration is subject to the optoelectronic business achieving specified revenue targets for

the 18-month period following the closing date. As of December 31, 2019, we are unsure if any of the contingent consideration will be received. The optoelectronic business was a component of the operations of Advanced Photonix, Inc.

Competition

We compete with a variety of companies in several different product markets. The products that we have developed or are currently developing will compete with other technologically innovative products, as well as products incorporating conventional materials and technologies. We expect that we will compete with companies in a wide range of industries, including semiconductors, electronics, biotechnology, textiles, alternative energy, military, defense, healthcare, telecommunications, industrial measurement, security applications and consumer electronics. Although there can be no assurance that we will continue to do so, we believe that we compete favorably in these areas because our products leverage advanced technologies to offer superior performance. If we are unable to effectively compete in these areas in the future, we could lose business to our competitors, which could harm our operating results.

We also compete, or will compete, for government, university and corporate research contracts relating to a broad range of technologies. Competition for contract research is intense and the industry has few barriers to entry. We compete against a number of in-house research and development departments of major corporations, as well as a number of small, limited-service contract research providers and companies backed by large venture capital firms. The contract research industry continues to experience consolidation, which has resulted in greater competition for clients. Increased competition might lead to price and other forms of competition that could harm our operating results. We compete for contract research on the basis of a number of factors, including reliability, past performance, expertise and experience in specific areas, scope of service offerings, technological capabilities and price.

Government Regulation

Qualification for Small Business Innovation Research Grants

SBIR is a highly competitive program that encourages small businesses to explore their technological potential and provides them with incentives to commercialize their technologies by funding research that might otherwise be prohibitively expensive or risky for companies like us. As noted above, we presently derive a significant portion of our revenue from this program, but we must continue to qualify for the SBIR program in order to be eligible to receive future SBIR awards. The eligibility requirements are:

- Ownership. The company must be more than 50 percent owned and controlled by U.S. citizens or permanent resident aliens, or owned by an entity that is itself more than 50 percent owned and controlled by U.S. citizens or permanent resident aliens; and
- Size. The company, including its affiliates, cannot have more than 500 employees.

These requirements are set forth in the SBA's regulations and are interpreted by the SBA's Office of Hearings and Appeals. In determining whether we satisfy the more than 50% ownership requirement, agreements to merge, stock options, convertible debt and other similar instruments are given "present effect" by the SBA as though the underlying security were actually issued unless the exercisability or conversion of such securities is speculative, remote or beyond the control of the security holder. We therefore believe our outstanding options and warrants held by eligible individuals may be counted as outstanding equity for purposes of meeting the more than 50% equity ownership requirement. We believe that we are in compliance with the SBA ownership requirements.

In addition, to be eligible for SBIR contracts, the number of our employees, including those of any entities that are considered to be affiliated with us, cannot exceed 500. As of December 31, 2019, we, including all of our divisions, had 267 full- and part-time employees. In determining whether we have 500 or fewer employees, the SBA may count the number of employees of entities that are large stockholders who are "affiliated" or have the power to control us. In determining whether firms are affiliated, the SBA evaluates factors such as stock ownership and common management, but it ultimately may make its determination based on the totality of the circumstances. Eligibility protests can be raised to the SBA by a competitor or by the awarding contracting agency. If we grow larger, and if our ownership becomes more diversified, we may no longer qualify for the SBIR program, and we may be required to seek alternative sources and partnerships to fund some of our research and development costs. Additional information regarding these risks may be found below in "Risk Factors."

Environmental, Health and Safety Regulation

Our facilities and current and proposed activities involve the use of a broad range of materials that are considered hazardous under applicable laws and regulations. Accordingly, we are subject to a number of domestic and foreign laws and regulations and other requirements relating to employee health and safety, protection of the environment, product labeling and product take back. Regulated activities include the storage, use, transportation and disposal of, and exposure to, hazardous or potentially hazardous materials and wastes. Our current and proposed activities also include potential exposure to physical hazards associated with work environment and equipment. We could incur costs, fines, civil and criminal penalties, personal injury and third-party property damage claims, or we could be required to incur substantial investigation or remediation costs, if we were to violate or become liable under environmental, health and safety laws and regulations or requirements. Liability under environmental, health and safety laws can be joint and several and without regard to fault. There can be no assurance that violations of environmental, health and safety laws will not occur in the future as a result of the inability to obtain permits in a timely manner, human error, equipment failure or other causes. Environmental, health and safety laws could also become more stringent over time, imposing greater compliance costs and increasing risks and penalties associated with violations, which could harm our business. Further, violations of present and future environmental, health and safety laws could restrict our ability to expand facilities and pursue certain technologies, as well as require us to acquire costly equipment or to incur potentially significant costs to comply with environmental, health and safety regulations and other requirements.

We have made, and will continue to make, expenditures to comply with current and future environmental, health and safety laws. We anticipate that we could incur additional capital and operating costs in the future to comply with existing environmental, health and safety laws and new requirements arising from new or amended statutes and regulations. In addition, because the applicable regulatory agencies have not yet promulgated final standards for some existing environmental, health and safety programs, we cannot at this time reasonably estimate the cost for compliance with these additional requirements. The amount of any such compliance costs could be material. We cannot predict the impact that future regulations will impose upon our business.

Employees

As of December 31, 2019, we had approximately 267 total employees, including approximately 130 in research, development and engineering positions, approximately 72 in operations, approximately 25 in sales and marketing, and approximately 40 in administrative positions. None of our employees are covered by a collective bargaining agreement, and we consider our relationship with our employees to be good.

Backlog

Our backlog of purchase orders received for which the related goods have not been shipped or recognized as revenue within our Products and Licensing segment was \$16.1 million and \$5.8 million at December 31, 2019 and 2018, respectively.

We have historically had a backlog of contracts, primarily within our Technology Development segment, for which work has been scheduled, but for which a specified portion of work has not yet been completed. The approximate value of our backlog was \$31.3 million and \$26.0 million at December 31, 2019 and 2018, respectively.

We define backlog as the dollar amount of obligations payable to us under negotiated contracts upon completion of a specified portion of work that has not yet been completed, exclusive of revenues previously recognized for work already performed under these contracts, if any. Total backlog includes funded backlog, which is the amount for which money has been directly authorized by the U.S. government or for which a purchase order has been received from a commercial customer, and unfunded backlog, which represents firm orders for which funding has not yet been appropriated. Unfunded backlog was \$2.2 million and \$4.5 million as of December 31, 2019 and 2018, respectively. Indefinite delivery and quantity contracts and unexercised options are not reported in total backlog. Our backlog is subject to delays or program cancellations that may be beyond our control.

Website Access to Reports

Our website address is www.lunainc.com. We make available, free of charge under “SEC Filings” on the Investor Relations portion of our website, access to our annual report on Form 10-K, our quarterly reports on Form 10-Q and our current reports on Form 8-K, as well as amendments to those reports filed or furnished pursuant to Section 13(a) or 15(d) of the Securities Exchange Act of 1934, as amended, as soon as reasonably practicable after such material is electronically filed with or furnished to the SEC. Information appearing on our website is not incorporated by reference in and is not a part of this annual report. The SEC maintains an internet site that contains reports, proxy and information statements, and other information regarding our filings at www.sec.gov.

ITEM 1A. RISK FACTORS

You should carefully consider the risks described below before deciding whether to invest in our common stock. The risks described below are not the only ones we face. Additional risks not presently known to us or that we currently believe are immaterial may also impair our business operations and financial results. If any of the following risks actually occurs, our business, financial condition or results of operations could be adversely affected. In such case, the trading price of our common stock could decline and you could lose all or part of your investment. Our filings with the Securities and Exchange Commission also contain forward-looking statements that involve risks or uncertainties. Our actual results could differ materially from those anticipated or contemplated by these forward-looking statements as a result of a number of factors, including the risks we face described below, as well as other variables that could affect our operating results. Past financial performance should not be considered to be a reliable indicator of future performance, and investors should not use historical trends to anticipate results or trends in future periods.

RISKS RELATING TO OUR BUSINESS GENERALLY

Our technology is subject to a license from Intuitive Surgical, Inc., which is revocable in certain circumstances. Without this license, we cannot continue to market, manufacture or sell our fiber-optic products.

As a part of the sale of certain assets to Intuitive Surgical, Inc. ("Intuitive") in 2014, we entered into a license agreement with Intuitive pursuant to which we received rights to use all of our transferred technology outside the field of medicine and in respect of our existing non-shape sensing products in certain non-robotic medical fields. This license back to us is revocable if after notice and certain time periods, we were to (i) challenge the validity or enforceability of the transferred patents and patent applications, (ii) commercialize our fiber optical shape sensing and localization technology in the field of medicine (except to perform on a development and supply project for Hansen Medical, Inc.), (iii) violate our obligations related to our ability to sub-license in the field of medicine or (iv) violate our confidentiality obligations in a manner that advantages a competitor in the field of medicine and not cure such violation. Maintaining this license is necessary for us to conduct our fiber-optic products business, both for our telecom products and our ODISI sensing products. If this license were to be revoked by Intuitive, we would no longer be able to market, manufacture or sell these products which could have a material adverse effect on our operations.

We depend on third-party vendors for specialized components in our manufacturing operations, making us vulnerable to supply shortages and price fluctuations that could harm our business.

We primarily rely on third-party vendors for the manufacture of the specialized components used in our products. The highly specialized nature of our supply requirements poses risks that we may not be able to locate additional sources of the specialized components required in our business. For example, there are few manufacturers who produce the special lasers used in our optical test equipment. Our reliance on these vendors subjects us to a number of risks that could negatively affect our ability to manufacture our products and harm our business, including interruption of supply. Although we are now manufacturing tunable lasers in low-rate initial production, we expect our overall reliance on third-party vendors to continue. Any significant delay or interruption in the supply of components, or our inability to obtain substitute components or materials from alternate sources at acceptable prices and in a timely manner could impair our ability to meet the demand of our customers and could harm our business.

We depend upon outside contract manufacturers for a portion of the manufacturing process for some of our products. Our operations and revenue related to these products could be adversely affected if we encounter problems with these contract manufacturers.

Many of our products are manufactured internally. However, we also rely upon contract manufacturers to produce the finished portion of certain lasers. Our reliance on contract manufacturers for these products makes us vulnerable to possible capacity constraints and reduced control over delivery schedules, manufacturing yields, manufacturing quality control and costs. If the contract manufacturer for our products were unable or unwilling to manufacture our products in required volumes and at high quality levels or to continue our existing supply arrangement, we would have to identify, qualify and select an acceptable alternative contract manufacturer or move these manufacturing operations to internal manufacturing facilities. An alternative contract manufacturer may not be available to us when needed or may not be in a position to satisfy our quality or production requirements on commercially reasonable terms, including price. Any significant interruption in manufacturing our products would require us to reduce the supply of products to our customers, which in turn would reduce our revenue, harm our relationships with the customers of these products and cause us to forego potential revenue opportunities.

As a provider of contract research to the U.S. government, we are subject to federal rules, regulations, audits and investigations, the violation or failure of which could adversely affect our business.

We must comply with and are affected by laws and regulations relating to the award, administration and performance of U.S. government contracts. Government contract laws and regulations affect how we do business with our government customers and, in some instances, impose added costs on our business. A violation of a specific law or regulation could result in the imposition of fines and penalties, termination of our contracts or debarment from bidding on contracts. In some instances, these laws and regulations impose terms or rights that are more favorable to the government than those typically available to commercial parties in negotiated transactions. For example, the U.S. government may terminate any of our government contracts and, in general, subcontracts, at their convenience, as well as for default based on performance.

In addition, U.S. government agencies, including the Defense Contract Audit Agency and the Department of Labor, routinely audit and investigate government contractors. These agencies review a contractor's performance under its contracts, cost structure and compliance with applicable laws, regulations and standards. The U.S. government also may review the adequacy of, and a contractor's compliance with, its internal control systems and policies, including the contractor's purchasing, property, estimating, compensation and management information systems. Any costs found to be improperly allocated to a specific contract will not be reimbursed, while such costs already reimbursed must be refunded. If an audit uncovers the inclusion of certain claimed costs deemed to be expressly unallowable, or improper or illegal activities, we may be subject to civil and criminal penalties and administrative sanctions, including termination of contracts, forfeiture of profits, suspension of payments, fines and suspension or prohibition from doing business with the U.S. government. In addition, our reputation could suffer serious harm if allegations of impropriety were made against us.

In addition to the risk of government audits and investigations, U.S. government contracts and grants impose requirements on contractors and grantees relating to ethics and business practices, which carry civil and criminal penalties including monetary fines, assessments, loss of the ability to do business with the U.S. government and certain other criminal penalties.

We may also be prohibited from commercially selling certain products that we develop under our Technology Development segment or related products based on the same core technologies if the U.S. government determines that the commercial availability of those products could pose a risk to national security. For example, certain of our wireless technologies have been classified as secret by the U.S. government and as a result we cannot sell them commercially. Any of these determinations would limit our ability to generate product sales and license revenues.

We rely and will continue to rely on contracts and grants awarded under the SBIR program for a significant portion of our revenues. A finding by the SBA that we no longer qualify to receive SBIR awards could adversely affect our business.

We compete as a small business for some of our government contracts. Our revenues derived from the SBIR program account for a significant portion of our consolidated total revenues, and contract research, including SBIR contracts, will remain a significant portion of our consolidated total revenues for the foreseeable future. For the year ended December 31, 2019, 35% of our total revenues were generated under the SBIR program, compared to 44% in for the year ended December 31, 2018.

We may not continue to qualify to participate in the SBIR program or to receive new SBIR awards from federal agencies. In order to qualify for SBIR contracts and grants, we must meet certain size and ownership eligibility criteria. These eligibility criteria are applied as of the time of the award of a contract or grant. A company can be declared ineligible for a contract award as a result of a size challenge filed with the SBA by a competitor or a federal agency.

In order to be eligible for SBIR contracts and grants, under current SBA rules we must be more than 50% owned and controlled by individuals who are U.S. citizens or permanent resident aliens, and/or other small business concerns (each of which is more than 50% owned and controlled by individuals who are U.S. citizens or permanent resident aliens) or certain qualified investment companies. In the event our institutional ownership significantly increases, either because of increased buying by institutions or selling by individuals, we could lose eligibility for new SBIR contracts and grants.

Also, in order to be eligible for SBIR contracts and grants, the number of our employees, including those of any entities that are considered to be affiliated with us, cannot exceed 500. As of December 31, 2019, we had approximately 267 full and part-time employees. In determining whether we are affiliated with any other entity, the SBA may analyze whether another entity controls or has the power to control us. Carilion Clinic is our largest institutional stockholder. Since early 2011, a formal size determination by the SBA that focused on whether or not Carilion is or was our affiliate has been outstanding. Although we do not believe that Carilion has or had the power to control our company, we cannot assure you that the SBA will interpret its regulations in our favor on this question. If the SBA were to make a determination that we are or were affiliated with Carilion, we would exceed the size limitations, as Carilion has over 500 employees. In that case, we would lose eligibility for new SBIR contracts and grants and other awards that are set aside for small businesses based on the criterion of number of employees, and the relevant government agency would have the discretion to suspend performance on existing SBIR grants. The loss of our eligibility to receive SBIR awards would have a material adverse impact on our revenues, cash flows and our ability to fund our growth.

Moreover, as our business grows, it is foreseeable that we will eventually exceed the SBIR size limitations, in which case we may be required to seek alternative sources of revenues or capital.

A decline in government research contract awards or government funding for existing or future government research contracts, including SBIR contracts, could adversely affect our revenues, cash flows and ability to fund our growth.

Technology Development segment revenues, which consist primarily of government-funded research, accounted for 37% and 49% of our total revenues for the years ended December 31, 2019 and 2018, respectively. As a result, we are vulnerable to adverse changes in our revenues and cash flows if a significant number of our research contracts and subcontracts were to be simultaneously delayed or canceled for budgetary, performance or other reasons. For example, the U.S. government may cancel these contracts at any time without cause or may change its requirements, programs or contract budget, any of which could reduce our revenues and cash flows from U.S. government research contracts. Our revenues and cash flows from U.S. government research contracts and subcontracts could also be reduced by declines or other changes in U.S. defense, homeland security and other federal agency budgets. In addition, we compete as a small business for some of these contracts, and in order to maintain our eligibility to compete as a small business, we, together with any affiliates, must continue to meet size and revenue limitations established by the U.S. government.

Our contract research customer base includes government agencies, corporations and academic institutions. Our customers are not obligated to extend their agreements with us and may elect not to do so. Also, our customers' priorities regarding funding for certain projects may change and funding resources may no longer be available at previous levels.

In addition to contract cancellations and changes in agency budgets, our future financial results may be adversely affected by curtailment of or restrictions on the U.S. government's use of contract research providers, including curtailment due to government budget reductions and related fiscal matters or any legislation or resolution limiting the number or amount of awards we may receive. These or other factors could cause U.S. defense and other federal agencies to conduct research internally rather than through commercial research organizations or direct awards to other organizations, to reduce their overall contract research requirements or to exercise their rights to terminate contracts. Alternatively, the U.S. government may discontinue the SBIR program or its funding altogether. Also, SBIR regulations permit increased competition for SBIR awards from companies that may not have previously been eligible, such as those backed by venture capital operating companies, hedge funds and private equity firms. Any of these developments could limit our ability to obtain new contract awards and adversely affect our revenues, cash flows and ability to fund our growth.

Our failure to attract, train and retain skilled employees or members of our senior management and to obtain necessary security clearances for such persons or maintain a facility security clearance would adversely affect our business and operating results.

The availability of highly trained and skilled technical and professional personnel is critical to our future growth and profitability. Competition for scientists, engineers, technicians and professional personnel is intense and our competitors aggressively recruit key employees. In the past, we have experienced difficulties in recruiting and hiring these personnel as a result of the tight labor market in certain fields. Any difficulty in hiring or retaining qualified employees, combined with our growth strategy and future needs for additional experienced personnel, particularly in highly specialized areas such as nanomaterial manufacturing and fiber optic sensing technologies, may make it more difficult to meet all of our needs for these employees in a timely manner. Although we intend to continue to devote significant resources to recruit, train and retain qualified employees, we may not be able to attract and retain these employees, especially in technical fields in which the supply of experienced qualified candidates is limited, or at the senior management level. Any failure to do so would have an adverse effect on our business. Any loss of key personnel could have a material adverse effect on our ability to meet key operational objectives, such as timely and effective project milestones and product introductions, which in turn could adversely affect our business, results of operations and financial condition.

We provide certain services to the U.S. government that require us to maintain a facility security clearance and for certain of our employees and our board chairman to hold security clearances. In general, the failure for necessary persons to obtain or retain sufficient security clearances, any loss by us of a facility security clearance or any public reprimand related to security matters could result in a U.S. government customer terminating an existing contract or choosing not to renew a contract or prevent us from bidding on or winning certain new government contracts.

In addition, our future success depends in a large part upon the continued service of key members of our senior management team. We do not maintain any key-person life insurance policies on our officers. The loss of any members of our management team or other key personnel could seriously harm our business.

Our business is subject to the cyclical nature of the markets in which we compete, and any future downturn may reduce demand for our products and revenue.

Many factors beyond our control affect our business, including consumer confidence in the economy, interest rates, fuel prices and the general availability of credit. The overall economic climate and changes in Gross National Product growth have a direct impact on some of our customers and the demand for our products. We cannot be sure that our business will not be adversely affected as a result of an industry or general economic downturn.

Our customers may reduce capital expenditures and have difficulty satisfying liquidity needs because of continued turbulence in the U.S. and global economies, resulting in reduced sales of our products and harm to our financial condition and results of operations.

In particular, our historical results of operations have been subject to substantial fluctuations, and we may experience substantial period-to-period fluctuations in future results of operations. Any future downturn in the markets in which we compete could significantly reduce the demand for our products and therefore may result in a significant reduction in revenue or increase the volatility of the price of our common stock. Our revenue and results of operations may be adversely affected in the future due to changes in demand from customers or cyclical changes in the markets utilizing our products.

In addition, the telecommunications industry has, from time to time, experienced, and may again experience, a pronounced downturn. To respond to a downturn, many service providers may slow their capital expenditures, cancel or delay new developments, reduce their workforces and inventories and take a cautious approach to acquiring new equipment and technologies from original equipment manufacturers, which would have a negative impact on our business. Weakness in the global economy or a future downturn in the telecommunications industry may cause our results of operations to fluctuate from quarter-to-quarter and year-to-year, harm our business, and may increase the volatility of the price of our common stock.

Customer acceptance of our products is dependent on our ability to meet changing requirements, and any decrease in acceptance could adversely affect our revenue.

Customer acceptance of our products is significantly dependent on our ability to offer products that meet the changing requirements of our customers, including telecommunication, military, medical and industrial corporations, as well as government agencies. Any decrease in the level of customer acceptance of our products could harm our business.

Our products must meet exacting specifications, and defects and failures may occur, which may cause customers to return or stop buying our products.

Our customers generally establish demanding specifications for quality, performance and reliability that our products must meet. However, our products are highly complex and may contain defects and failures when they are first introduced or as new versions are released. Our products are also subject to harsh environments as they are integrated into our customer products for use by the end customers. If defects and failures occur in our products, we could experience lost revenue, increased costs, including warranty expense and costs associated with customer support, delays in or cancellations or rescheduling of orders or shipments, product returns or discounts, diversion of management resources or damage to our reputation and brand equity, and in some cases consequential damages, any of which would harm our operating results. In addition, delays in our ability to fill product orders as a result of quality control issues may negatively impact our relationship with our customers. We cannot assure you that we will have sufficient resources, including any available insurance, to satisfy any asserted claims.

The markets for many of our products are characterized by changing technology which could cause obsolescence of our products, and we may incur substantial costs in delivering new products.

The markets for many of our products are characterized by changing technology, new product introductions and product enhancements, and evolving industry standards. The introduction or enhancement of products embodying new technology or the emergence of new industry standards could render existing products obsolete and result in a write down to the value of our inventory, or result in shortened product life cycles. Accordingly, our ability to compete is in part dependent on our ability to continually offer enhanced and improved products.

The success of our new product offerings will depend upon several factors, including our ability to:

- accurately anticipate customer needs;
- innovate and develop new technologies and applications;
- successfully commercialize new technologies in a timely manner;
- price products competitively and manufacture and deliver products in sufficient volumes and on time; and
- differentiate our product offerings from those of our competitors.

Our inability to find new customers or retain existing customers could harm our business.

Our business is reliant on our ability to find new customers and retain existing customers. In particular, customers normally purchase certain of our products and incorporate them into products that they, in turn, sell in their own markets on an ongoing basis. As a result, the historical sales of these products have been dependent upon the success of our customers' products and our future performance is dependent upon our success in finding new customers and receiving new orders from existing customers.

In several markets, the quality and reliability of our products are a major concern for our customers, not only upon the initial manufacture of the product, but for the life of the product. Many of our products are used in remote locations for higher value assembly, making servicing of our products unfeasible. Any failure of the quality or reliability of our products could harm our business.

Customer demand for our products is difficult to accurately forecast and, as a result, we may be unable to optimally match production with customer demand, which could adversely affect our business and financial results.

We make planning and spending decisions, including determining the levels of business that we will seek and accept, production schedules, inventory levels, component procurement commitments, personnel needs and other resource requirements, based on our estimates of customer requirements. The short-term nature of commitments by many of our customers and the possibility of unexpected changes in demand for their products reduce our ability to accurately estimate future customer requirements. On occasion, customers may require rapid increases in production, which can strain our resources, cause our manufacturing to be negatively impacted by materials shortages, necessitate higher or more restrictive procurement commitments, increase our manufacturing yield loss and scrapping of excess materials, and reduce our gross margin. We may not have sufficient capacity at any given time to meet the volume demands of our customers, or one or more of our suppliers may not have sufficient capacity at any given time to meet our volume demands. Conversely, a downturn in the markets in which our customers compete can cause, and in the past have caused, our customers to significantly reduce or delay the amount of products ordered or to cancel existing orders, leading to lower utilization of our facilities. Because many of our costs and operating expenses are relatively fixed, reduction in customer demand due to market downturns or other reasons would have a negative effect on our gross margin, operating income and cash flow.

Rapidly changing standards and regulations could make our products obsolete, which would cause our revenue and results of operations to suffer.

We design products to conform to our customers' requirements and our customers' systems may be subject to regulations established by governments or industry standards bodies worldwide. Because some of our products are designed to conform to current specific industry standards, if competing or new standards emerge that are preferred by our customers, we would have to make significant expenditures to develop new products. If our customers adopt new or competing industry standards with which our products are not compatible, or the industry groups adopt standards or governments issue regulations with which our products are not compatible, our existing products would become less desirable to our customers and our revenue and results of operations would suffer.

The results of our operations could be adversely affected by economic and political conditions and the effects of these conditions on our customers' businesses and levels of business activity.

Global economic and political conditions affect our customers' businesses and the markets they serve. A severe or prolonged economic downturn or a negative or uncertain political climate could adversely affect our customers' financial conditions and the timing or levels of business activity of our customers and the industries we serve. This may reduce the demand for our products or depress pricing for our products and have a material adverse effect on our results of operations. Changes in global economic conditions could also shift demand to products or services for which we do not have competitive advantages, and this could negatively affect the amount of business we are able to obtain. In addition, if we are unable to successfully anticipate changing economic and political conditions, we may be unable to effectively plan for and respond to those changes, and our business could be negatively affected as a result.

We have experienced net losses in the past, and because our strategy for expansion may be costly to implement, we may experience losses and may not maintain profitability or positive cash flow.

We have experienced net losses in the past. We expect to continue to incur significant expenses as we pursue our strategic initiatives, including increased expenses for research and development, sales and marketing and manufacturing. We may also grow our business in part through acquisitions of additional companies and complementary technologies which could cause us to incur greater than anticipated transaction expenses, amortization or write-offs of intangible assets and other acquisition-related expenses. As a result, we may incur net losses in the future, and these losses could be substantial. At a certain level, continued net losses could impair our ability to comply with Nasdaq continued listing standards, as described further below.

Our ability to generate additional revenues and remain profitable will depend on our ability to execute our key growth initiative regarding the development, marketing and sale of sensing products, develop and commercialize innovative technologies, expand our contract research capabilities and sell the products that result from those development initiatives. We may not be able to sustain or increase our profitability on a quarterly or annual basis.

We may require additional capital to support and expand our business.

We intend to continue to make investments to support our business growth, including developing new products, enhancing our existing products, obtaining important regulatory approvals, enhancing our operating infrastructure, completing our development activities and building our commercial scale manufacturing facilities. To the extent that we are unable to become or remain profitable and to finance our activities from continuing operations, we may require additional funds to support these initiatives and to grow our business.

If we are successful in raising additional funds through issuances of equity or convertible debt securities, our existing stockholders could suffer significant dilution, including as the result of the issuance of warrants in connection with the financing, and any new equity securities we issue could have rights, preferences and privileges superior to those of our existing common stock. Furthermore, such financings may jeopardize our ability to apply for SBIR grants or qualify for SBIR contracts or grants, and our dependence on SBIR grants may restrict our ability to raise additional outside capital. If we raise additional funds through debt financings, these financings may involve significant cash payment obligations and covenants that restrict our ability to operate our business and make distributions to our stockholders.

If we are unable to obtain adequate financing or financing terms satisfactory to us when we require it, our ability to continue to support our business growth and to respond to business challenges could be significantly limited.

We face and will face substantial competition in several different markets that may adversely affect our results of operations.

We face and will face substantial competition from a variety of companies in several different markets. As we focus on developing marketing and selling fiber optic sensing products, we may also face substantial and entrenched competition in that market.

Many of our competitors have longer operating histories, greater name recognition, larger customer bases and significantly greater financial, sales and marketing, manufacturing, distribution, technical and other resources than we do. These competitors may be able to adapt more quickly to new or emerging technologies and changes in customer requirements. In addition, current and potential competitors have established or may establish financial or strategic relationships among themselves or with existing or potential customers or other third parties. Accordingly, new competitors or alliances among competitors could emerge and rapidly acquire significant market share. We cannot assure you that we will be able to compete successfully against current or new competitors, in which case our revenues may fail to increase or may decline.

Intense competition in our markets could result in aggressive business tactics by our competitors, including aggressively pricing their products or selling older inventory at a discount. If our current or future competitors utilize aggressive business tactics, including those described above, demand for our products could decline, we could experience delays or cancellations of customer orders, or we could be required to reduce our sales prices.

Shifts in product mix may result in declines in gross profit.

Our gross profit margins vary among our product platforms, and are generally highest on our test and measurement instruments. Our overall gross profit may fluctuate from period to period as a result of a variety of factors including shifts in product mix, the introduction of new products, and decreases in average selling prices for older products. If our customers decide to buy more of our products with low gross profit margins or fewer of our products with high gross profit margins, our total gross profits could be harmed.

Risks Relating to our Operations and Business Strategy

If we are unable to successfully integrate acquired businesses, it could have an adverse effect on our future results and the market price of our common stock.

In the past, we have acquired businesses to support our growth strategy, including the acquisition of General Photonics Corporation in March 2019 and Micron Optics, Inc. in October 2018. In the future, we may continue to seek acquisition targets supporting our growth strategy. The success of an acquisition will depend, in large part, on sales of the acquired company's products and the realization of operating synergies. To realize these anticipated benefits, we must successfully integrate the acquired company's business into our existing business. Such integrations may be complex and time-consuming. The failure to successfully integrate and manage the challenges presented by the integration process may result in our failure to achieve some or all of the anticipated benefits of the acquisition. Potential difficulties that may be encountered in the integration process include the following:

- lost sales and customers as a result of customers deciding not to do business with us;
- complexities associated with managing the larger combined company with distant business locations;
- integrating personnel while maintaining focus on providing consistent, high quality products;
- loss of key employees;
- potential unknown liabilities associated with the acquisition; and
- performance shortfalls as a result of the division of management's attention caused by completing the acquisition and integrating operations.

If any of these events were to occur, our ability to maintain relationships with the customers, suppliers and employees or our ability to achieve the anticipated benefits of the acquisition could be adversely affected, or could reduce our future earnings or otherwise adversely affect our business and financial results and, as a result, adversely affect the market price of our common stock.

If we cannot successfully transition our revenue mix from contract research revenues to product sales and license revenues, we may not be able to fully execute our business model or grow our business.

Our business model and future growth depend on our ability to transition to a revenue mix that contains significantly larger product sales and revenues from the provision of services or from licensing. Product sales and these revenues potentially offer greater scalability than contract research revenues. Our current plan is to increase our sales of commercial products, our licensing revenues and our provision of non-research services to customers so as to represent a larger percentage of our total revenues. If we are unable to develop and grow our product sales and revenues from the provision of services or from licensing to augment our contract research revenues, however, our ability to execute our business model or grow our business could suffer. There can be no assurance that we will be able to achieve increased revenues in this manner.

Failure to develop, introduce and sell new products or failure to develop and implement new technologies, could adversely impact our financial results.

Our success will depend on our ability to develop and introduce new products that customers choose to buy. The new products the market requires tend to be increasingly complex, incorporating more functions and operating at faster speeds than old products. If we fail to introduce new product designs or technologies in a timely manner or if customers do not successfully introduce new systems or products incorporating our products, our business, financial condition and results of operations could be materially harmed.

If we are unable to manage growth effectively, our revenues and net loss could be adversely affected.

We may need to expand our personnel resources to grow our business effectively. We believe that sustained growth at a higher rate will place a strain on our management as well as on our other human resources. To manage this growth, we must continue to attract and retain qualified management, professional, scientific and technical and operating personnel. If we are unable to recruit a sufficient number of qualified personnel, we may be unable to staff and manage projects adequately, which in turn may slow the rate of growth of our contract research revenues or our product development efforts.

We may not be successful in identifying market needs for new technologies or in developing new products.

Part of our business model depends on our ability to correctly identify market needs for new technologies. We intend to identify new market needs, but we may not always have success in doing so in part because our contract research largely

centers on identification and development of unproven technologies, often for new or emerging markets. Furthermore, we must identify the most promising technologies from a sizable pool of projects. If our commercialization strategy process fails to identify projects with commercial potential or if management does not ensure that such projects advance to the commercialization stage, we may not successfully commercialize new products and grow our revenues.

Our growth strategy requires that we also develop successful commercial products to address market needs. We face several challenges in developing successful new products. Many of our existing products and those currently under development are technologically innovative and require significant and lengthy product development efforts. These efforts include planning, designing, developing and testing at the technological, product and manufacturing-process levels. These activities require us to make significant investments. Although there are many potential applications for our technologies, our resource constraints require us to focus on specific products and to forgo other opportunities. We expect that one or more of the potential products we choose to develop will not be technologically feasible or will not achieve commercial acceptance, and we cannot predict which, if any, of our products we will successfully develop or commercialize. The technologies we research and develop are new and steadily changing and advancing. The products that are derived from these technologies may not be applicable or compatible with the state of technology or demands in existing markets. Our existing products and technologies may become uncompetitive or obsolete if our competitors adapt more quickly than we do to new technologies and changes in customers' requirements. Furthermore, we may not be able to identify if and when new markets will open for our products given that future applications of any given product may not be readily determinable, and we cannot reasonably estimate the size of any markets that may develop. If we are not able to successfully develop new products, we may be unable to increase our product revenues.

We face risks associated with our international business.

We currently conduct business internationally and we might considerably expand our international activities in the future. Our international business operations are subject to a variety of risks associated with conducting business internationally, including:

- having to comply with U.S. export control regulations and policies that restrict our ability to communicate with non-U.S. employees and supply foreign affiliates and customers;
- changes in or interpretations of foreign regulations that may adversely affect our ability to sell our products, perform services or repatriate profits to the United States;
- the imposition of tariffs;
- hyperinflation or economic or political instability in foreign countries;
- imposition of limitations on, or increase of withholding and other taxes on remittances and other payments by foreign subsidiaries or joint ventures;
- conducting business in places where business practices and customs are unfamiliar and unknown;
- the imposition of restrictive trade policies;
- the imposition of inconsistent laws or regulations;
- the imposition or increase of investment and other restrictions or requirements by foreign governments;
- uncertainties relating to foreign laws and legal proceedings;
- having to comply with a variety of U.S. laws, including the Foreign Corrupt Practices Act ("FCPA"); and
- having to comply with licensing requirements.

We do not know the impact that these regulatory, geopolitical and other factors may have on our international business in the future. Further, the developing situation regarding the public health epidemic originating in China, has prompted precautionary government-imposed closures of certain travel and business. It is unknown whether and how global supply chains, may be affected if such an epidemic persists for an extended period of time. We may incur expenses or delays relating to such events outside of our control, or experience potential disruption of our ability to travel to customer sites and industry conferences important to the marketing and support of our products, any of which could have an adverse impact on our business, operating results and financial condition.

Legal, political and economic uncertainty surrounding the exit of the U.K., from the European Union may be a source of instability in international markets, create significant currency fluctuations, adversely affect our operations in the U.K. and pose additional risks to our business, revenue, financial condition and results of operations.

Following the result of a referendum in 2016, the U.K. left the EU on January 31, 2020, commonly referred to as Brexit. Pursuant to the formal withdrawal arrangements agreed between the U.K. and the EU, the U.K. will be subject to a transition period until December 31, 2020 (the "Transition Period"), during which the EU rules will continue to apply.

Negotiations between the U.K. and the EU are expected to continue in relation to the customs and trading relationship between the U.K. and the EU following the expiry of the Transition Period.

The uncertainty concerning the U.K.'s legal, political and economic relationship with the EU after the Transition Period may be a source of instability in the international markets, create significant currency fluctuations, and/or otherwise adversely affect trading agreements or similar cross-border cooperation arrangements (whether economic, tax, legal, regulatory or otherwise).

These developments, or the perception that any of them could occur, have had and may continue to have a significant adverse effect on global economic conditions and the stability of global financial markets, and could significantly reduce global market liquidity and limit the ability of key market participants to operate in certain financial markets. In particular, it could also lead to a period of considerable uncertainty in relation to the U.K. financial and banking markets, as well as on the regulatory process in Europe. Asset valuations, currency exchange rates and credit ratings may also be subject to increased market volatility.

If the U.K. and the EU are unable to negotiate acceptable trading and customs terms or if other EU Member States pursue withdrawal, barrier-free access between the U.K. and other EU Member States or among the European Economic Area overall could be diminished or eliminated. The long-term effects of Brexit will depend on any agreements (or lack thereof) between the U.K. and the EU and, in particular, any arrangements for the U.K. to retain access to EU markets after the Transition Period.

Such a withdrawal from the EU is unprecedented, and it is unclear how the U.K.'s access to the European single market for goods, capital, services and labor within the EU, or single market, and the wider commercial, legal and regulatory environment will impact our operations and customers. There may continue to be economic uncertainty surrounding the consequences of Brexit which could adversely impact customer confidence resulting in customers reducing their spending budgets, which could adversely affect our business, revenue, financial condition, and results of operations and could adversely affect the market price of our common stock.

We may dispose of or discontinue existing product lines and technology developments, which may adversely impact our future results.

On an ongoing basis, we evaluate our various product offerings and technology developments in order to determine whether any should be discontinued or, to the extent possible, divested. In addition, if we are unable to generate the amount of cash needed to fund the future operations of our business, we may be forced to sell one or more of our product lines or technology developments.

We cannot guarantee that we have correctly forecasted, or that we will correctly forecast in the future, the right product lines and technology developments to dispose or discontinue or that our decision to dispose of or discontinue various investments, product lines and technology developments is prudent if market conditions change. In addition, there are no assurances that the discontinuance of various product lines will reduce operating expenses or will not cause us to incur material charges associated with such decision. Furthermore, the discontinuance of existing product lines entails various risks, including the risk that we will not be able to find a purchaser for a product line or the purchase price obtained will not be equal to at least the book value of the net assets for the product line. Other risks include managing the expectations of, and maintaining good relations with, our historical customers who previously purchased products from a disposed or discontinued product line, which could prevent us from selling other products to them in the future. We may also incur other significant liabilities and costs associated with disposal or discontinuance of product lines, including employee severance costs and excess facilities costs.

We could be negatively affected by a security breach or other compromise, either through cyber-attack, cyber-intrusion or other significant disruption of our IT networks and related systems.

We face the risk, as does any company, of a security breach or other compromise, whether through cyber-attack or cyber-intrusion over the internet, malware, computer viruses, attachments to e-mails, persons inside our organization or persons with access to systems inside our organization, or other significant disruption of our IT networks and related systems. The risk of a security breach or disruption, particularly through cyber-attack or cyber-intrusion, including by computer hackers, foreign governments and cyber terrorists, has increased as the number, intensity and sophistication of attempted attacks and intrusions from around the world have increased. We may also experience security breaches or compromises from unintentional or accidental actions by our employees, contractors, consultants, business partners, and/or other third parties. To the extent that any security breach or disruption were to result in a loss, destruction, unavailability, alteration or dissemination of, or damage to, our data or applications, or for it to be believed or reported that any of these occurred, we could incur liability and reputational damage.

As a technology company, and particularly as a government contractor, we may face a heightened risk of a security breach, compromise or disruption from attempts to gain unauthorized access to our proprietary, confidential or classified information on our IT networks and related systems via cyber-attacks or cyber-intrusions. These types of information and IT networks and related systems are critical to the operation of our business and essential to our ability to perform day-to-day operations, and, in some cases, are critical to our operations or those of our customers. Such critical information includes our proprietary software code, which we protect as a trade secret and is critical to the competitive advantage of many of our products, which could be adversely affected if this code were stolen in a cyber-intrusion or otherwise compromised. In addition, as certain of our technological capabilities become widely known, it is possible that we may be subjected to cyber-attack or cyber-intrusion as third parties seek to gain improper access to information regarding these capabilities and cyber-attacks or cyber-intrusion could compromise our confidential information or our IT networks and systems generally, as it is not practical as a business matter to isolate all of our confidential information and trade secrets from email and internet access. A security breach, compromise or other significant disruption involving these types of information and IT networks and related systems could disrupt the proper functioning of these networks and systems and therefore our operations, compromise our confidential information and trade secrets, or damage our reputation among our customers and the public generally. We have not identified any significant security breaches or experienced other significant disruptions of these types to date. To date, we have not experienced a significant cyber-intrusion, cyber-attack or other similar disruption. There can be no assurance that our security efforts and measures will be effective or that attempted security breaches or disruptions would not be successful or damaging. Any of these developments in the future could have a negative impact on our results of operations, financial condition and cash flows.

We face risks related to health epidemics and other outbreaks, which could significantly disrupt our operations.

Our business could be adversely impacted by the effects of COVID-19 or other epidemics. Several of our customers and suppliers are located throughout Asia, and particularly in China and, consequently, we are susceptible to factors adversely affecting one or more of these locations. As a result, COVID-19, or any other epidemic, could impact our customers or suppliers in these regions, which could subject our business to disruptions, such as temporary closure of our offices or those of our customers or suppliers, or suspension of our services. Additionally, we are subject to risks that COVID-19 or other epidemic harms the Chinese economy in general. Any of such developments could materially and adversely affect our business, financial condition and results of operations.

Risks Relating to our Regulatory Environment

Our operations are subject to domestic and foreign laws, regulations and restrictions, and noncompliance with these laws, regulations and restrictions could expose us to fines, penalties, suspension or debarment, which could have a material adverse effect on our profitability and overall financial position.

Our operations, particularly our international sales, subject us to numerous U.S. and foreign laws and regulations, including, without limitation, regulations relating to imports, exports (including the Export Administration Regulations and the International Traffic in Arms Regulations), technology transfer restrictions, anti-boycott provisions, economic sanctions and the FCPA. The number of our various emerging technologies, the development of many of which has been funded by the Department of Defense, presents us with many regulatory challenges. Failure by us or our sales representatives or consultants to comply with these laws and regulations could result in administrative, civil, or criminal liabilities and could result in suspension of our export privileges, which could have a material adverse effect on our business. Changes in regulation or political environment may affect our ability to conduct business in foreign markets including investment, procurement and repatriation of earnings.

Environmental regulations could increase operating costs and additional capital expenditures and delay or interrupt operations.

The photonics industry, as well as the semiconductor industry, are subject to governmental regulations for the protection of the environment, including those relating to air and water quality, solid and hazardous waste handling, and the promotion of occupational safety. Various federal, state and local laws and regulations require that we maintain certain environmental permits. While we believe that we have obtained all necessary environmental permits required to conduct our manufacturing processes, if we are found to be in violation of these laws, we could be subject to governmental fines and liability for damages resulting from such violations.

Changes in the aforementioned laws and regulations or the enactment of new laws, regulations or policies could require increases in operating costs and additional capital expenditures and could possibly entail delays or interruptions of our operations.

If our manufacturing facilities do not meet Federal, state or foreign country manufacturing standards, we may be required to temporarily cease all or part of our manufacturing operations, which would result in product delivery delays and negatively impact revenues.

Our manufacturing facilities are subject to periodic inspection by regulatory authorities and our operations will continue to be regulated by the FDA for compliance with Good Manufacturing Practice requirements contained in the quality systems regulations. We are also required to comply with International Organization for Standardization ("ISO"), quality system standards in order to produce certain of our products for sale in Europe. If we fail to continue to comply with Good Manufacturing Practice requirements or ISO standards, we may be required to cease all or part of our operations until we comply with these regulations. Obtaining and maintaining such compliance is difficult and costly. We cannot be certain that our facilities will be found to comply with Good Manufacturing Practice requirements or ISO standards in future inspections and audits by regulatory authorities. In addition, if we cannot maintain or establish manufacturing facilities or operations that comply with such standards or do not meet the expectations of our customers, we may not be able to realize certain economic opportunities in our current or future supply arrangements.

We are subject to additional significant foreign and domestic government regulations, including environmental and health and safety regulations, and failure to comply with these regulations could harm our business.

Our facilities and current and proposed activities involve the use of a broad range of materials that are considered hazardous under applicable laws and regulations. Accordingly, we are subject to a number of foreign, federal, state and local laws and regulations relating to health and safety, protection of the environment and the storage, use, disposal of, and exposure to, hazardous materials and wastes. We could incur costs, fines and civil and criminal penalties, personal injury and third-party property damage claims or could be required to incur substantial investigation or remediation costs, if we were to violate or become liable under environmental, health and safety laws. Moreover, a failure to comply with environmental laws could result in fines and the revocation of environmental permits, which could prevent us from conducting our business. Liability under environmental laws can be joint and several and without regard to fault. There can be no assurance that violations of environmental and health and safety laws will not occur in the future as a result of the inability to obtain permits, human error, equipment failure or other causes. Environmental laws could become more stringent over time, imposing greater compliance costs and increasing risks and penalties associated with violations, which could harm our business. Accordingly, violations of present and future environmental laws could restrict our ability to expand facilities, pursue certain technologies, and could require us to acquire costly equipment or incur potentially significant costs to comply with environmental regulations.

Compliance with foreign, federal, state and local environmental laws and regulations represents a small part of our present budget. If we fail to comply with any such laws or regulations, however, a government entity may levy a fine on us or require us to take costly measures to ensure compliance. Any such fine or expenditure may adversely affect our development. We cannot predict the extent to which future legislation and regulation could cause us to incur additional operating expenses, capital expenditures or restrictions and delays in the development of our products and properties.

We are or may become subject to a variety of privacy and data security laws, and our failure to comply with them could harm our business.

We maintain sensitive information, including confidential business and personal information in connection with our business customers and our employees, and may be subject to laws and regulations governing the privacy and security of such information. In the United States, there are numerous federal and state privacy and data security laws and regulations governing the collection, use, disclosure and protection of personal information. Each of these constantly evolving laws can be subject to varying interpretations.

In addition, states are constantly adopting new laws or amending existing laws, requiring attention to frequently changing regulatory requirements. For example, California enacted the California Consumer Privacy Act, or the CCPA, on June 28, 2018, which took effect on January 1, 2020 and has been dubbed the first "GDPR-like" law in the United States. The CCPA gives California residents expanded rights to access and delete their personal information, opt out of certain personal information sharing and receive detailed information about how their personal information is used by requiring covered companies to provide new disclosures to California consumers (as that term is broadly defined and can include any of our current or future employees who may be California residents) and provide such residents new ways to opt-out of certain sales of personal information. The CCPA provides for civil penalties for violations, as well as a private right of action for data breaches that is expected to increase data breach litigation. The CCPA may increase our compliance costs and potential liability. Some observers have noted that the CCPA could mark the beginning of a trend toward more stringent privacy legislation in the United States. Other states are beginning to pass similar laws.

A similar situation exists in the EU. In May 2018, a new privacy regime, the General Data Protection Regulation, the GDPR, took effect in the European Economic Area, the EEA. The GDPR governs the collection, use, disclosure, transfer or other processing of personal data of European data subjects. Among other things, the GDPR imposes requirements regarding the security of personal data and notification of data processing obligations to the competent national data processing authorities, changes the lawful bases on which personal data can be processed, and expands the definition of personal data. In addition, the GDPR increases the scrutiny of transfers of personal data from the EEA to the United States and other jurisdictions that the European Commission does not recognize as having “adequate” data protection laws, and imposes substantial fines for breaches and violations (up to the greater of €20 million or 4% of our consolidated annual worldwide gross revenue). The GDPR also confers a private right of action on data subjects and consumer associations to lodge complaints with supervisory authorities, seek judicial remedies and obtain compensation for damages resulting from violations of the GDPR. Compliance with these and any other applicable privacy and data security laws and regulations is a rigorous and time-intensive process, and we may be required to put in place additional mechanisms ensuring compliance with the new data protection rules. If we fail to comply with any such laws or regulations, we may face significant fines and penalties that could adversely affect our business, financial condition and results of operations. Furthermore, the laws are not consistent, and compliance in the event of a widespread data breach could be costly.

Risks Relating to our Intellectual Property

Our proprietary rights may not adequately protect our technologies.

Our commercial success will depend in part on our obtaining and maintaining patent, trade secret, copyright and trademark protection of our technologies in the United States and other jurisdictions as well as successfully enforcing this intellectual property and defending it against third-party challenges. We will only be able to protect our technologies from unauthorized use by third parties to the extent that valid and enforceable intellectual property protections, such as patents or trade secrets, cover them. In particular, we place considerable emphasis on obtaining patent and trade secret protection for significant new technologies, products and processes. The degree of future protection of our proprietary rights is uncertain because legal means afford only limited protection and may not adequately protect our rights or permit us to gain or keep our competitive advantage. The degree of future protection of our proprietary rights is also uncertain for products that are currently in the early stages of development because we cannot predict which of these products will ultimately reach the commercial market or whether the commercial versions of these products will incorporate proprietary technologies.

Our patent position is highly uncertain and involves complex legal and factual questions. Accordingly, we cannot predict the breadth of claims that may be allowed or enforced in our patents or in third-party patents. For example:

- we or our licensors might not have been the first to make the inventions covered by each of our pending patent applications and issued patents;
- we or our licensors might not have been the first to file patent applications for these inventions;
- others may independently develop similar or alternative technologies or duplicate any of our technologies;
- it is possible that none of our pending patent applications or the pending patent applications of our licensors will result in issued patents;
- patents may issue to third parties that cover how we might practice our technology;
- our issued patents and issued patents of our licensors may not provide a basis for commercially viable technologies, may not provide us with any competitive advantages, or may be challenged and invalidated by third parties; and
- we may not develop additional proprietary technologies that are patentable.

Patents may not be issued for any pending or future pending patent applications owned by or licensed to us, and claims allowed under any issued patent or future issued patent owned or licensed by us may not be valid or sufficiently broad to protect our technologies. Moreover, protection of certain of our intellectual property may be unavailable or limited in the United States or in foreign countries, and we have not sought to obtain foreign patent protection for certain of our products or technologies due to cost, concerns about enforceability or other reasons. Any issued patents owned by or licensed to us now or in the future may be challenged, invalidated, or circumvented, and the rights under such patents may not provide us with competitive advantages. In addition, competitors may design around our technology or develop competing technologies. Intellectual property rights may also be unavailable or limited in some foreign countries, and in the case of certain products no foreign patents were filed or can be filed. This could make it easier for competitors to capture or increase their market share with respect to related technologies. We could incur substantial costs to bring suits in which we may assert our patent rights against others or defend ourselves in suits brought against us. An unfavorable outcome of any litigation could have a material adverse effect on our business and results of operations.

We also rely on trade secrets to protect our technology, especially where we believe patent protection is not appropriate or obtainable. However, trade secrets are difficult to protect. We regularly attempt to obtain confidentiality agreements and contractual provisions with our collaborators, employees and consultants to protect our trade secrets and proprietary know-how. These agreements may be breached or may not have adequate remedies for such breach. While we use reasonable efforts to protect our trade secrets, our employees, consultants, contractors or scientific and other advisors, or those of our strategic partners, may unintentionally or willfully disclose our information to competitors. If we were to enforce a claim that a third party had illegally obtained and was using our trade secrets, our enforcement efforts would be expensive and time consuming, and the outcome would be unpredictable. In addition, courts outside the United States are sometimes unwilling to protect trade secrets. Moreover, if our competitors independently develop equivalent knowledge, methods and know-how, it will be more difficult for us to enforce our rights and our business could be harmed.

If we are not able to defend the patent or trade secret protection position of our technologies, then we will not be able to exclude competitors from developing or marketing competing technologies and we may not generate enough revenues from product sales to justify the cost of developing our technologies and to achieve or maintain profitability.

We also rely on trademarks to establish a market identity for our company and our products. To maintain the value of our trademarks, we might have to file lawsuits against third parties to prevent them from using trademarks confusingly similar to or dilutive of our registered or unregistered trademarks. Also, we might not obtain registrations for our pending trademark applications, and we might have to defend our registered trademark and pending trademark applications from challenge by third parties. Enforcing or defending our registered and unregistered trademarks might result in significant litigation costs and damages, including the inability to continue using certain trademarks.

Third parties may claim that we infringe their intellectual property, and we could suffer significant litigation or licensing expense as a result.

Various U.S. and foreign issued patents and pending patent applications, which are owned by third parties, exist in our technology areas. Such third parties may claim that we infringe their patents. Because patent applications can take several years to result in a patent issuance, there may be currently pending applications, unknown to us, which may later result in issued patents that our technologies may infringe. For example, we are aware of competitors with patents in technology areas applicable to our optical test equipment products. Such competitors may allege that we infringe these patents. There could also be existing patents of which we are not aware that our technologies may inadvertently infringe. We have from time to time been, and may in the future be, contacted by third parties, including patent assertion entities or intellectual property advisors, about licensing opportunities that also contain claims that we are infringing on third party patent rights. If third parties assert these claims against us, we could incur extremely substantial costs and diversion of management resources in defending these claims, and the defense of these claims could have a material adverse effect on our business, financial condition and results of operations. Even if we believe we have not infringed on a third party's patent rights, we may have to settle a claim on unfavorable terms because we cannot afford to litigate the claim. In addition, if third parties assert claims against us and we are unsuccessful in defending against these claims, these third parties may be awarded substantial damages as well as injunctive or other equitable relief against us, which could effectively block our ability to make, use, sell, distribute or market our products and services in the United States or abroad.

Commercial application of nanotechnologies in particular, or technologies involving nanomaterials, is new and the scope and breadth of patent protection is uncertain. Consequently, the patent positions of companies involved in nanotechnologies have not been tested, and there are complex legal and factual questions for which important legal principles will be developed or may remain unresolved. In addition, it is not clear whether such patents will be subject to interpretations or legal doctrines that differ from conventional patent law principles. Changes in either the patent laws or in interpretations of patent laws in the United States and other countries may diminish the value of our nanotechnology-related intellectual property. Accordingly, we cannot predict the breadth of claims that may be allowed or enforced in our nanotechnology-related patents or in third party patents. In the event that a claim relating to intellectual property is asserted against us, or third parties not affiliated with us hold pending or issued patents that relate to our products or technology, we may seek licenses to such intellectual property or challenge those patents. However, we may be unable to obtain these licenses on commercially reasonable terms, if at all, and our challenge of the patents may be unsuccessful. Our failure to obtain the necessary licenses or other rights could prevent the sale, manufacture or distribution of our products and, therefore, could have a material adverse effect on our business, financial condition and results of operations.

A substantial portion of our technology is subject to retained rights of our licensors, and we may not be able to prevent the loss of those rights or the grant of similar rights to third parties.

A substantial portion of our technology is licensed from academic institutions, corporations and government agencies. Under these licensing arrangements, a licensor may obtain rights over the technology, including the right to require us to grant a

license to one or more third parties selected by the licensor or that we provide licensed technology or material to third parties for non-commercial research. The grant of a license for any of our core technologies to a third party could have a material and adverse effect on our business. In addition, some of our licensors retain certain rights under the licenses, including the right to grant additional licenses to a substantial portion of our core technology to third parties for non-commercial academic and research use. It is difficult to monitor and enforce such non-commercial academic and research uses, and we cannot predict whether the third-party licensees would comply with the use restrictions of such licenses. We have incurred and could incur substantial expenses to enforce our rights against them. We also may not fully control the ability to assert or defend those patents or other intellectual property which we have licensed from other entities, or which we have licensed to other entities.

In addition, some of our licenses with academic institutions give us the right to use certain technology previously developed by researchers at these institutions. In certain cases, we also have the right to practice improvements on the licensed technology to the extent they are encompassed by the licensed patents and are within our field of use. Our licensors may currently own and may in the future obtain additional patents and patent applications that are necessary for the development, manufacture and commercial sale of our anticipated products. We may be unable to agree with one or more academic institutions from which we have obtained licenses whether certain intellectual property developed by researchers at these academic institutions is covered by our existing licenses. In the event that the new intellectual property is not covered by our existing licenses, we would be required to negotiate a new license agreement. We may not be able to reach agreement with current or future licensors on commercially reasonable terms, if at all, or the terms may not permit us to sell our products at a profit after payment of royalties, which could harm our business.

Some of our patents may cover inventions that were conceived or first reduced to practice under, or in connection with, U.S. government contracts or other federal funding agreements. With respect to inventions conceived or first reduced to practice under a federal funding agreement, the U.S. government may retain a non-exclusive, non-transferable, irrevocable, paid-up license to practice or have practiced for or on behalf of the United States the invention throughout the world. We may not succeed in our efforts to retain title in patents, maintain ownership of intellectual property or in limiting the U.S. government's rights in our proprietary technologies and intellectual property when an issue exists as to whether such intellectual property was developed in the performance of a federal funding agreement or developed at private expense.

If we fail to obtain the right to use the intellectual property rights of others which are necessary to operate our business, and to protect their intellectual property, our business and results of operations will be adversely affected.

In the past, we have licensed certain technologies for use in our products. In the future, we may choose, or be required, to license technology or intellectual property from third parties in connection with the development of our products. We cannot assure you that third-party licenses will be available on commercially reasonable terms, if at all. Our competitors may be able to obtain licenses, or cross-license their technology, on better terms than we can, which could put us at a competitive disadvantage. Also, we often enter into confidentiality agreements with such third parties in which we agree to protect and maintain their proprietary and confidential information, including at times requiring our employees to enter into agreements protecting such information. There can be no assurance that the confidentiality agreements will not be breached by any of our employees or that such third parties will not make claims that their proprietary information has been disclosed.

RISKS RELATING TO OUR COMMON STOCK

If there are substantial sales of our common stock, or the perception that such sales may occur, our stock price could decline.

If any of our stockholders were to sell substantial amounts of our common stock, the market price of our common stock may decline, which might make it more difficult for us to sell equity or equity-related securities in the future at a time and price that we deem appropriate. Substantial sales of our common stock, or the perception that such sales may occur, may have a material adverse effect on the prevailing market price of our common stock.

We may become involved in securities class action litigation that could divert management's attention and harm our business and our insurance coverage may not be sufficient to cover all costs and damages.

The stock market has from time to time experienced significant price and volume fluctuations that have affected the market prices for the common stock of technology companies. These broad market fluctuations may cause the market price of our common stock to decline. In the past, following periods of volatility in the market price of a particular company's securities, securities class action litigation has often been brought against that company. Securities class litigation also often follows certain significant business transactions, such as the sale of a business division or a change in control transaction. We

may become involved in this type of litigation in the future. Litigation often is expensive and diverts management's attention and resources, which could adversely affect our business.

Our common stock price has been volatile and we expect that the price of our common stock will fluctuate substantially in the future, which could cause you to lose all or a substantial part of your investment.

The public trading price for our common stock is volatile and may fluctuate significantly. Since January 1, 2009, our common stock has traded between a high of \$9.32 per share and a low of \$0.26 per share. Among the factors, many of which we cannot control, that could cause material fluctuations in the market price for our common stock are:

- sales of our common stock by our significant stockholders, or the perception that such sales may occur;
- changes in earnings estimates, investors' perceptions, recommendations by securities analysts or our failure to achieve analysts' earnings estimates;
- changes in our status as an entity eligible to receive SBIR contracts and grants;
- quarterly variations in our or our competitors' results of operations;
- challenges integrating our recent or future acquisitions, including the inability to realize any expected synergies;
- general market conditions and other factors unrelated to our operating performance or the operating performance of our competitors;
- announcements by us, or by our competitors, of acquisitions, new products, significant contracts, commercial relationships or capital commitments;
- pending or threatened litigation;
- any major change in our board of directors or management or any competing proxy solicitations for director nominees;
- changes in governmental regulations or in the status of our regulatory approvals;
- announcements related to patents issued to us or our competitors;
- a lack of, limited or negative industry or securities analyst coverage;
- discussions of our company or our stock price by the financial and scientific press and online investor communities; and
- general developments in our industry.

In addition, the stock prices of many technology companies have experienced wide fluctuations that have often been unrelated to the operating performance of those companies. These factors may materially and adversely affect the market price of our common stock.

We are obligated to develop and maintain proper and effective internal controls over financial reporting and any failure to maintain the adequacy of these internal controls may adversely affect investor confidence in our company and, as a result, the value of our common stock.

We are required, pursuant to Section 404 of the Sarbanes-Oxley Act, or Section 404, to furnish a report by management on, among other things, the effectiveness of our internal control over financial reporting on an annual basis. This assessment includes disclosure of any material weaknesses identified by our management in our internal control over financial reporting.

During the evaluation and testing process of our internal controls, if we identify one or more material weaknesses in our internal control over financial reporting, we will be unable to assert that our internal control over financial reporting is effective. While we have established certain procedures and controls over our financial reporting processes, we cannot assure you that these efforts will prevent restatements of our financial statements in the future. Our independent registered public accounting firm is also required, pursuant to Section 404, to attest to, and report on, management's assessment of our internal control over financial reporting, which report is included elsewhere in this Annual Report on Form 10-K. This assessment is required to include disclosure of any material weaknesses identified by our management in our internal control over financial reporting. For future reporting periods, our independent registered public accounting firm may issue a report that is adverse in the event it is not satisfied with the level at which our controls are documented, designed or operating. We may not be able to remediate any future material weaknesses, or to complete our evaluation, testing and any required remediation in a timely fashion.

Any failure to maintain internal control over financial reporting could severely inhibit our ability to accurately report our financial condition or results of operations. If we are unable to conclude that our internal control over financial reporting is effective, or if our independent registered public accounting firm determines we have a material weakness or significant deficiency in our internal control over financial reporting, we could lose investor confidence in the accuracy and completeness of our financial reports, the market price of our common stock could decline, and we could be subject to sanctions or investigations by the Nasdaq Stock Market, the SEC or other regulatory authorities. Failure to remedy any material weakness

in our internal control over financial reporting, or to implement or maintain other effective control systems required of public companies, could also restrict our future access to the capital markets.

If our estimates relating to our critical accounting policies are based on assumptions or judgments that change or prove to be incorrect, our operating results could fall below expectations of financial analysts and investors, resulting in a decline in our stock price.

The preparation of financial statements in conformity with U.S. GAAP requires our management to make estimates, assumptions and judgments that affect the amounts reported in the consolidated financial statements and accompanying notes. We base our estimates on historical experience and on various other assumptions that we believe to be reasonable under the circumstances, the results of which form the basis for making judgments about the carrying values of assets, liabilities, equity, revenue and expenses that are not readily apparent from other sources. Our operating results may be adversely affected if our assumptions change or if actual circumstances differ from those in our assumptions, which could cause our operating results to fall below the expectations of financial analysts and investors, resulting in a decline in our stock price. Significant assumptions and estimates used in preparing our consolidated financial statements include those related to revenue recognition, stock-based compensation and income taxes. Moreover, the revenue recognition guidance, ASC Topic 606, Revenue from Contracts with Customers, requires more judgment than did the prior guidance.

Our financial results may be adversely affected by changes in accounting principles applicable to us.

U.S. GAAP are subject to interpretation by the FASB, the SEC, and other bodies formed to promulgate and interpret appropriate accounting principles. For example, in May 2014, the FASB issued ASC Topic 606, Revenue from Contracts with Customers, which supersedes nearly all existing revenue recognition guidance under U.S. GAAP. We adopted this guidance as of January 1, 2018. The most significant impact relates to changing the revenue recognition for custom optoelectronics to an over time method. Before the adoption of this standard, we deferred the recognition of revenue until products were shipped to the customer. Any difficulties in implementing these pronouncements or adequately accounting after adoption could cause us to fail to meet our financial reporting obligations, which could result in regulatory discipline and harm investors' confidence in us.

Anti-takeover provisions in our amended and restated certificate of incorporation and bylaws and Delaware law could discourage or prevent a change in control, even if an acquisition would be beneficial to our stockholders, which could affect our stock price adversely and prevent attempts by our stockholders to replace or remove our current management.

Our amended and restated certificate of incorporation and bylaws and Delaware law contain provisions that might delay or prevent a change in control, discourage bids at a premium over the market price of our common stock and adversely affect the market price of our common stock and the voting and other rights of the holders of our common stock. These provisions include:

- a classified board of directors serving staggered terms;
- advance notice requirements to stockholders for matters to be brought at stockholder meetings;
- a supermajority stockholder vote requirement for amending certain provisions of our amended and restated certificate of incorporation and bylaws; and
- the right to issue preferred stock without stockholder approval, which could be used to dilute the stock ownership of a potential hostile acquirer.

We are also subject to provisions of the Delaware General Corporation law that, in general, prohibit any business combination with a beneficial owner of 15% or more of our common stock for three years unless the holder's acquisition of our stock was approved in advance by our board of directors or certain other conditions are satisfied.

The existence of these provisions could adversely affect the voting power of holders of common stock and limit the price that investors might be willing to pay in the future for shares of our common stock.

ITEM 1B. UNRESOLVED STAFF COMMENTS

Not applicable.

ITEM 2. PROPERTIES

We lease approximately 4,400 square feet of office space in Roanoke, Virginia, which serves as our corporate headquarters and is used for general and administrative functions. This lease expires March 31, 2021.

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We lease approximately 42,000 square feet of space in Blacksburg, Virginia, near Virginia Tech, which is used by both our Technology Development segment and our Products and Licensing segment. This lease expires December 31, 2024.

We lease approximately 11,000 square feet of space in Ann Arbor, Michigan, for research, development and manufacturing of our THz product platform. This lease expires November 30, 2021.

We lease approximately 19,600 square feet of space in Charlottesville, Virginia, near the University of Virginia, for use by certain groups in our Technology Development segment. This lease expires December 31, 2020.

We lease approximately 21,000 square feet of space in Atlanta, Georgia, for use by our Products and Licensing segment. This lease expires October 31, 2020.

We lease approximately 28,000 square feet of space in Chino, California, for use by our Products and Licensing segment. This lease expires October 31, 2020.

We own a 24,000 square foot facility in Danville, Virginia for use by certain groups in our Technology Development segment.

We believe that our existing facilities are adequate for our current needs and suitable additional or substitute space will be available as needed to accommodate expansion of our operations.

ITEM 3. LEGAL PROCEEDINGS

In December 2018, we received a notice of claim (the "Claim") from Macom Technology Solutions, Inc. ("Macom"), who acquired our HSOR business in August 2017 pursuant to an asset purchase agreement. Under the asset purchase agreement, we agreed to indemnify Macom for certain matters, including, among other things, the collection of accounts receivable from certain major customers, and placed \$4.0 million of the purchase price into an escrow account for the potential settlement of any valid indemnity claims. The Claim received from Macom totaled \$2.1 million under various indemnity provisions. We have disputed Macom's assertion of right to payment for the matters described in the Claim. It is uncertain what amount, if any, will be owed in settlement of the Claim. As of December 31, 2019, \$1.5 million of the escrow balance had been received with the remaining \$2.5 million in the escrow account pending resolution of the dispute.

Additionally, from time to time, we may become involved in litigation or claims arising out of our operations in the normal course of business. Management currently believes the amount of ultimate liability, if any, with respect to these actions will not materially affect our financial position, results of operations, or liquidity.

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

STOCKHOLDERS

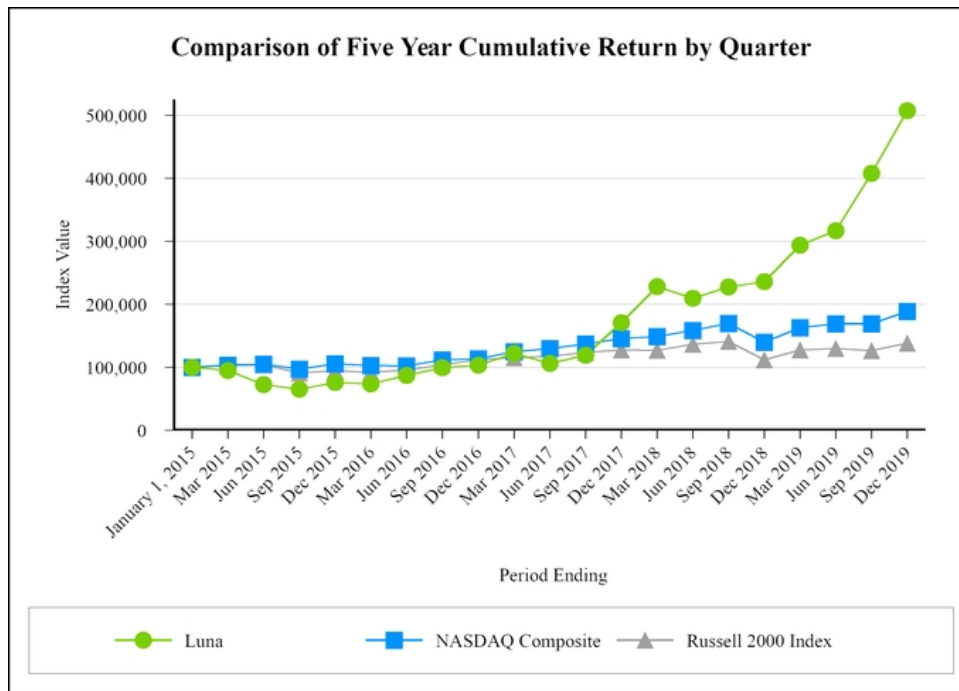
Our common stock is listed on the Nasdaq Capital Market under the symbol "LUNA." As of March 11, 2020, we had 30,391,879 shares of common stock outstanding held by 100 holders of record. The actual number of stockholders is greater than this number of record holders and includes stockholders who are beneficial owners but whose shares are held in street name by brokers and other nominees. This number of holders of record also does not include stockholders whose shares may be held in trust by other entities.

STOCK PERFORMANCE GRAPH

The graph set forth below compares the cumulative total stockholder return on our common stock for the previous five years, during which our common stock was traded on the Nasdaq Capital Market, as compared to the cumulative total return of the Nasdaq Composite Index and the Russell 2000 Index over the same period. This graph assumes the investment of \$100,000 in our common stock at the closing price on January 1, 2015, and an equivalent amount in the Nasdaq Composite Index and the Russell 2000 Index on that date, and assumes the reinvestment of dividends, if any. We have never paid dividends on our common stock and have no present plans to do so.

Since there is no published industry or line-of-business index for our business reflective of our performance, nor do we believe we can reasonably identify a peer group, we measure our performance against issuers with similar market capitalizations. We selected the Russell 2000 Index because it measures the performance of a broad range of companies with lower market capitalizations than those companies included in the S&P 500 Index.

The comparisons shown in the graph below are based upon historical data. We caution that the stock price performance shown in the graph below is not necessarily indicative of, nor is it intended to forecast, the potential future performance of our common stock.



The preceding Stock Performance Graph is not deemed filed with the Securities and Exchange Commission and shall not be incorporated by reference in any of our filings under the Securities Act of 1933, as amended, or the Securities Exchange Act of 1934, as amended, whether made before or after the date hereof and irrespective of any general incorporation language in any such filing.

DIVIDEND POLICY

Since our inception, we have never declared or paid any cash dividends on our common stock. We currently expect to retain any future earnings for use in the operation and expansion of our business, and therefore do not anticipate paying any cash dividends in the foreseeable future. In addition, our debt facility with Silicon Valley Bank restricts us from paying cash dividends on our capital stock without the bank’s prior written consent.

Unregistered Sales of Equity Securities

Not applicable.

Purchases of Equity Securities by the Issuer and Affiliated Parties-

Not applicable.

ITEM 6. SELECTED FINANCIAL DATA

The consolidated statement of operations data for each of the years ended December 31, 2019 and 2018 and the consolidated balance sheet data as of December 31, 2019 and 2018 have been derived from our audited consolidated financial statements appearing elsewhere in this report. The consolidated statement of operations data for the years ended December 31, 2017, 2016 and 2015 and the consolidated balance sheet data as of December 31, 2017, 2016 and 2015 have been derived from

our audited consolidated financial statements that do not appear in this report. The following selected consolidated financial data should be read in conjunction with our consolidated financial statements and the accompanying notes and “Management’s Discussion and Analysis of Financial Condition and Results of Operations” included at Part II, Item 7 in this Annual Report on Form 10-K. The selected data in this section is not intended to replace the consolidated financial statements, and the historical results are not necessarily indicative of the results to be expected in any future period.

In thousands, except share and per share data	Years ended December 31,				
	2019	2018	2017	2016	2015
Consolidated Statement of Operations Data:					
Revenues:					
Products and licensing	\$ 44,491	\$ 21,950	\$ 14,505	\$ 13,323	\$ 12,975
Technology development	26,025	20,968	18,576	16,281	13,599
Total revenues (1)	70,516	42,917	33,082	29,604	26,574
Cost of revenues:					
Products and licensing	16,684	8,079	5,724	5,417	5,651
Technology development	18,649	15,400	13,988	12,473	10,379
Total cost of revenues	35,333	23,479	19,713	17,890	16,030
Gross profit	35,182	19,438	13,369	11,714	10,544
Operating expense	31,867	18,560	15,577	15,840	17,359
Operating income/(loss)	3,315	878	(2,208)	(4,126)	(6,815)
Other (expense)/income, net	(5)	(17)	26	28	(53)
Interest income	394	550	—	—	—
Interest expense, net	(16)	(124)	(217)	(317)	(218)
Income/(loss) from continuing operations before income taxes	3,688	1,286	(2,399)	(4,415)	(7,086)
Income tax benefit/(expense)	1,654	(48)	1,149	136	602
Net income/(loss) from continuing operations	5,343	1,238	(1,251)	(4,279)	(6,484)
Income from discontinued operations, net of income taxes	—	9,766	15,866	1,909	8,801
Net income/(loss)	5,343	11,004	14,615	(2,370)	2,317
Less: Preferred stock dividend	285	257	147	105	85
Net income/(loss) attributable to common stockholders	\$ 5,057	\$ 10,747	\$ 14,468	\$ (2,475)	\$ 2,232
Net income/(loss) per share from continuing operations:					
Basic	\$ 0.19	\$ 0.04	\$ (0.05)	\$ (0.16)	\$ (0.28)
Diluted	\$ 0.17	\$ 0.04	\$ (0.05)	\$ (0.16)	\$ (0.28)
Net income per share from discontinued operations:					
Basic	\$ —	\$ 0.35	\$ 0.58	\$ 0.07	\$ 0.38
Diluted	\$ —	\$ 0.30	\$ 0.58	\$ 0.07	\$ 0.38
Net income/(loss) per share attributable to common stockholders:					
Basic	\$ 0.18	\$ 0.39	\$ 0.52	\$ (0.09)	\$ 0.10
Diluted	\$ 0.16	\$ 0.33	\$ 0.52	\$ (0.09)	\$ 0.10
Weighted-average shares:					
Basic	28,688,867	27,596,401	27,579,988	27,547,217	23,026,494
Diluted	31,840,584	32,452,228	27,579,988	27,547,217	23,026,494

(1) The consolidated statement of operations for years ended December 31, 2019 and 2018 were recognized in accordance with ASC 606.

Years ended December 31, 2017 and prior were recognized under ASC 605.

In thousands	As of December 31,				
	2019	2018	2017	2016	2015
Consolidated Balance Sheet Data:					
Cash and cash equivalents	\$ 25,006	\$ 42,460	\$ 36,982	\$ 17,464	\$ 14,117
Working capital (2)	41,072	56,089	43,975	23,417	15,413
Total assets (2)	86,524	75,599	66,223	58,132	27,584
Total current liabilities (2)	17,044	12,139	14,826	15,334	8,473
Total debt	—	619	2,436	6,125	625

(2) ROU assets and corresponding lease liabilities were recognized in the year ended December 31, 2019, in accordance with ASC 842. Years ended December 31, 2018 and prior were recognized under ASC 840.

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

The following discussion and analysis of our financial condition and results of operations should be read in conjunction with our consolidated financial statements and the related notes to those statements included elsewhere in this report. In addition to historical financial information, the following discussion and analysis contains forward-looking statements that involve risks, uncertainties and assumptions. Our actual results and timing of selected events may differ materially from those anticipated in these forward-looking statements as a result of many factors, including those discussed under "Risk Factors" and elsewhere in this report.

Business Overview

We are a leader in advanced optical technology, providing high performance fiber optic test, measurement and control products for the telecommunications and photonics industries and distributed fiber optic sensing products for industries utilizing composite and other advanced materials, such as the automotive, aerospace, energy and infrastructure industries. Our distributed fiber optic sensing products help designers and manufacturers more efficiently develop new and innovative products by providing valuable information such as highly detailed stress, strain, and temperature measurements of a new design or manufacturing process. In addition, our distributed fiber optic sensing products are used to monitor the structural integrity or operational health of critical assets, including large civil structures such as bridges. Our communications test and control products accelerate the development of advanced fiber optic components and networks by providing fast and highly accurate characterization of components and networks. We also provide applied research services, typically under research programs funded by the U.S. government, in areas of sensing and instrumentation, advanced materials, optical technologies and health sciences. Our business model is designed to accelerate the process of bringing new and innovative products to market. We use our in-house technical expertise across a range of technologies to perform applied research services for companies and for government funded projects. We continue to invest in product development and commercialization, which we anticipate will lead to increased product sales growth.

We are organized into two reporting segments, our Products and Licensing segment and our Technology Development segment. Our Products and Licensing segment develops, manufactures and markets distributed fiber optic sensing products and fiber optic communications test and control products. We continue to develop and commercialize our fiber optic technology for sensing applications for aerospace, automotive, energy and infrastructure as well as for test and measurement applications in the telecommunications and data communications industries. Our Products and Licensing segment revenues represented approximately 63% and 51% of our total revenues for the years ended December 31, 2019 and 2018, respectively.

Our Technology Development segment performs applied research principally in the areas of sensing and instrumentation, advanced materials and health sciences. Our Technology Development segment comprised approximately 37% and 49% of our total revenues for the years ended December 31, 2019 and 2018, respectively. Most of the government funding for our Technology Development segment is derived from the Small Business Innovation Research ("SBIR"), program coordinated by the U.S. Small Business Administration. Our Technology Development segment revenues have historically accounted for a large portion of our total revenues, and we expect that they will continue to represent a significant portion of our total revenues for the foreseeable future. Within the Technology Development segment, we have historically had a backlog of contracts for which work has been scheduled, but for which a specified portion of work has not yet been completed. We define backlog as the dollar amount of obligations payable to us under negotiated contracts upon completion of a specified portion of work that has not yet been completed, exclusive of revenues previously recognized for work already performed under these contracts, if any. Total backlog includes funded backlog, which is the amount for which money has been directly authorized by the U.S. government and for which a purchase order has been received by a commercial customer, and unfunded backlog, representing firm orders for which funding has not yet been appropriated. Indefinite delivery and quantity contracts and unexercised options are not reported in total backlog. The approximate value of our Products and Licensing segment backlog was \$16.1 million and

\$5.8 million at December 31, 2019 and 2018, respectively. The approximate value of our Technology Development segment backlog was \$31.3 million and \$26.0 million at December 31, 2019 and 2018, respectively.

Revenues from product sales are mostly derived from the sales of our sensing and test, measurement and control products that make use of light-transmitting optical fibers, or fiber optics. We continue to invest in product development and commercialization, which we anticipate will lead to increased product sales growth. Although we have been successful in licensing certain technologies in past years, we do not expect license revenues to represent a significant portion of future revenues. Over time we intend to gradually increase such revenues. In the near term, we expect revenues from product sales to continue to be primarily in areas associated with our sensing and test, measurement and control fiber optic test platforms. In the long term, we expect that revenues from product sales will represent a larger portion of our total revenues. As we develop and commercialize new products, our revenues will reflect a broader and more diversified mix of products.

We realized net income attributable to common stockholders of approximately \$5.1 million for the year ended December 31, 2019 and net income attributable to common stockholders of approximately \$10.7 million for the year ended December 31, 2018. We realized net income from continuing operations of \$5.3 million for the year ended December 31, 2019 and a net income from continuing operations of \$1.2 million for the year ended December 31, 2018.

We may incur increasing expenses as we seek to expand our business, including expenses for research and development, sales and marketing and manufacturing capabilities. We may continue to grow our business in part through acquisitions of additional companies and complementary technologies, which could cause us to incur transaction expenses, amortization or write-offs of intangible assets and goodwill and other acquisition-related expenses. As a result, we may incur net losses in future periods, and these losses could be substantial.

Acquisition of General Photonics Corporation.

On March 1, 2019, we acquired all of the outstanding stock of General Photonics Corporation ("GP"), a leading provider of innovative components, modules and test equipment focused on the generation, measurement and control of polarized light critical in fiber optic-based applications for aggregate consideration of \$19.0 million with an earn-out provision of up to \$1.0 million. Of the purchase price, \$17.1 million was paid at closing and \$1.9 million was placed into escrow for possible working capital adjustments to the purchase price and potential satisfaction of certain post-closing indemnification obligations. As of December 31, 2019, we expect to pay, and have accrued, \$1.0 million in additional cash consideration as a result of the successful completion of the earn-out provision.

Acquisition of Micron Optics, Inc.

On October 15, 2018, we acquired substantially all of the assets, other than cash, of the U. S. operations of Micron Optics, Inc. ("MOI"), a leading provider of innovative optical components and laser-based equipment that advance the quality of optical measurements, allowing the sensing, imaging and telecommunications industries to make critical measurements. We paid total cash consideration of \$5.5 million for the acquisition of MOI. The acquisition of MOI expanded our technology and product portfolio to include optical sensors and sensing interrogators capable of a broader range of measurement capabilities, including higher speed measurements such as vibration, and the ability to instrument larger structures over longer distances. In addition, the MOI acquisition added a product suite of tunable optical filters, optical sensors and swept lasers.

Sale of Luna Optoelectronics Business

On July 31, 2018, we sold the assets associated with our optoelectronic components business to an unaffiliated third party. The asset purchase agreement provides for additional consideration of up to \$1.0 million contingent upon the achievement of a specified revenue level by the sold business during the 18 months following the sale. There have been no amounts recorded for the contingent consideration in the financial statements as of December 31, 2019, and it is uncertain what amount, if any, will be received or paid.

Description of Our Revenues, Costs and Expenses

Revenues

We generate revenues from product sales, commercial product development and licensing and technology development activities. Our Products and Licensing segment revenues reflect amounts that we receive from sales of our products or development of products for third parties and, to a lesser extent, fees paid to us in connection with licenses or sub-licenses of certain patents and other intellectual property.

We derive Technology Development segment revenues from providing research and development services to third parties, including government entities, academic institutions and corporations, and from achieving milestones established by

some of these contracts. In general, we complete contracted research over periods ranging from six months to three years and recognize these revenues over the life of the contract as costs are incurred.

Cost of Revenues

Cost of revenues associated with Products and Licensing segment revenues consists of license fees for use of certain technologies, product manufacturing costs including all direct material and direct labor costs, amounts paid to our contract manufacturers, manufacturing, shipping and handling, provisions for product warranties and inventory obsolescence, as well as overhead allocated to each of these activities.

Cost of revenues associated with Technology Development segment revenues consists of costs associated with performing the related research activities including direct labor, amounts paid to subcontractors and overhead allocated to Technology Development segment activities.

Operating Expense

Operating expense consists of selling, general and administrative expense, as well as expenses related to research, development and engineering, depreciation of fixed assets and amortization of intangible assets. These expenses also include compensation for employees in executive and operational functions including certain non-cash charges related to expenses from equity awards, facilities costs, professional fees, salaries, commissions, travel expense and related benefits of personnel engaged in sales, marketing, and administrative activities; costs of marketing programs and promotional materials; salaries, bonuses and related benefits of personnel engaged in our own research and development beyond the scope and activities of our Technology Development segment; product development activities not provided under contracts with third parties; and overhead costs related to these activities.

Investment Income

Investment income consists of amounts earned on our cash equivalents. We sweep on a daily basis a portion of our cash on hand into a fund invested in U.S. government obligations.

Interest Expense, Net

Interest expense is composed of interest paid under our term loans as well as interest accrued on our finance lease obligations.

Critical Accounting Policies and Estimates

Products and Licensing Revenues

To determine the proper revenue recognition method for Products and Licensing contracts, we evaluate whether two or more contracts should be combined and accounted for as one single contract and whether the combined or single contract should be accounted for as more than one performance obligation. We recognize revenue when the performance obligation has been satisfied by transferring the control of the product or service to the customer. For tangible products that contain software that is essential to the tangible product's functionality, we consider the product and software to be a single performance obligation and recognize revenue accordingly. For contracts with multiple performance obligations, we allocate the contract's transaction price to each performance obligation based on their relative stand-alone selling prices. In such circumstances, we use the observable price of goods or services which are sold separately in similar circumstances to similar customers. If these prices are not observable, then we will estimate the stand-alone selling price using information that is reasonably available. For the majority of our standard products and services, price list and discount structures related to customer type are available. For products and services that do not have price list and discount structures, we may use one or more of the following: (i) adjusted market assessment approach, (ii) expected cost plus a margin approach, and (iii) residual approach. The adjusted market approach requires us to evaluate the market in which we sell goods or services and estimate the price that a customer in that market would be willing to pay for those goods or services. The expected cost-plus margin approach requires us to forecast our expected costs of satisfying the performance obligation and then add a reasonable margin for that good or service. The residual approach decreases the total transaction price by the sum of the observable standalone selling prices if either the company sells the same good or services to different customers for a broad range of amounts or the company has not established a price for the good or service and that good or service has not been sold on a standalone basis. Shipping and handling activities primarily

occur after a customer obtains control and are considered fulfillment cost rather than separate performance obligations. Similarly, sales and similar taxes assessed by a governmental authority that are both imposed on and concurrent with a specific revenue-producing transaction and collected by the entity from a customer are excluded from the measurement of the transaction price.

For standard products, we recognize revenue at a point in time when control passes to the customer. Absent substantial product acceptance clauses, this is based on the shipping terms. For custom products that require engineering and development based on customer requirements, we will recognize revenue over time using the output method for any items shipped and any finished goods or work in process that is produced for balances of open sales orders. For any finished goods or work in process that has been produced for the balance of open sales orders we recognize revenue by applying the average selling price for such open order to the lesser of the on-hand balance in finished goods or open sales order quantity which we present as a contract asset on the balance sheet. Cost of sales is recognized based on the standard cost of the finished goods and work in process associated with this revenue and inventory balances are reduced accordingly. For extended warranties and product rentals, revenue is recognized over time using the output method based on the time elapsed for the warranty or service period. In the case of warranties, we record a contract liability for amounts billed but that are not recognized until subsequent periods. A separate contract liability is recorded for the cost associated with warranty repairs based on our estimate of future expense. For testing services where we are performing testing on an asset the customer controls, revenue is recognized over time by the output method using the performance to date. For training, where the customer is receiving the benefit of training as it is occurring, and for repairs to a customer-controlled asset, revenue is recognized over time by the output method using the performance to date. For royalty revenue, we apply the practical expedient "royalty exception" recognizing revenue based on the royalty agreement which specifies an amount based on sales or minimum amount, whichever is greater.

In some product rental contracts, a customer may be offered a discount on the purchase of an item that would provide for a material right. When a material right has been provided to a customer, a separate performance obligation is established, and a portion of the rental revenue will be deferred until the future product is purchased or the option expires. This deferred revenue is recognized as a contract liability on the balance sheet.

Technology Development Revenues

We perform research and development for U.S. Federal government agencies, educational institutions and commercial organizations. We account for a research contract when a contract has been executed, the rights of the parties are identified, payment terms are identified, the contract has commercial substance, and collectability of the contract price is considered probable. Revenue is earned under cost reimbursable, time and materials and fixed price contracts. Direct contract costs are expensed as incurred.

Our contracts with agencies of the U.S. government are subject to periodic funding by the respective contracting agency. Funding for a contract may be provided in full at inception of the contract or ratably throughout the contract as the services are provided. In evaluating the probability of funding for purposes of assessing collectability of the contract price, we consider our previous experience with our customers, communication with our customers regarding funding status and our knowledge of available funding for the contract or program. If funding is not assessed as probable, revenue recognition is deferred until realization is reasonably assured.

Under the typical payment terms of our U.S. government contracts, the customer pays us either performance-based payments ("PBPs") or progress payments. PBPs, which are typically used in the firm fixed price contracts, are interim payments based on quantifiable measures of performance or on the achievement of specified events or milestones. Progress payments, which are typically used in our cost type contracts, are interim payments based on costs incurred as the work progresses. For our U.S. government cost-type contracts, the customer generally pays us during the performance period for 80%-90% of our actual costs incurred. Because the customer retains a small portion of the contract price until completion of the contract and audit of allowable costs, cost type contracts generally result in revenue recognized in excess of billings which we present as contract assets on the balance sheet. Amounts billed and due from our customers are classified as receivables on the balance sheet. For non-U.S. government contracts, we typically receive interim payments as work progresses, although for some contracts, we may be entitled to receive advance payments. We recognize a liability for these advance payments and PBPs paid in advance which are in excess of the revenue recognized and present these amounts as contract liabilities on the balance sheet.

To determine the proper revenue recognition method for research and development contracts, we evaluate whether two or more contracts should be combined and accounted for as one single contract and whether the combined or single contract

should be accounted for as more than one performance obligation. For instances where a contract has options that were bid with the initial contract and awarded at a later date, we combine the options with the original contract when options are awarded. For most of our contracts, the customer contracts for research with multiple milestones that are interdependent. Consequently, the entire contract is accounted for as one performance obligation. The effect of the combined or modified contract on the transaction price and measure of progress for the performance obligation to which it relates, is recognized as an adjustment to revenue (either as an increase in or a reduction of revenue) on a cumulative catch-up basis.

Contract revenue recognition is measured over time as we perform because of continuous transfer of control to the customer. For U.S. government contracts which are typically subject to the Federal Acquisition Regulation, this continuous transfer of control to the customer is supported by clauses in the contract that allow the customer to unilaterally terminate the contract for convenience, pay us for cost incurred plus a reasonable profit and take control of any work in process. From time to time, as part of normal management processes, facts may change, causing revisions to estimated total costs or revenues expected. The cumulative impact of any revisions to estimates and the full impact of anticipated losses on any type of contract are recognized in the period in which they become known.

Because of control transfers over time, revenue is recognized over time based on the extent of progress towards completion of the performance obligation. The selection of the method to measure progress towards completion requires judgment and is based on the nature of the services to be provided. We generally use the input method, more specifically the cost-to-cost measure of progress for our contracts because it best depicts the transfer of control to the customer which occurs as we incur costs on our contracts. Under the cost-to-cost measure of progress, the extent of progress towards completion is measured based on the ratio of costs incurred to date to the total estimated costs at completion of the performance obligation. The underlying bases for estimating our contract research revenues are measurable expenses, such as labor, subcontractor costs and materials, and data that are updated on a regular basis for purposes of preparing our cost estimates. Our research contracts generally have a period of performance of six months to three years, and our estimates of contract costs have historically been consistent with actual results. Revisions in these estimates between accounting periods to reflect changing facts and circumstances have not had a material impact on our operating results, and we do not expect future changes in these estimates to be material. The cumulative impact of any revisions to estimates and the full impact of anticipated losses on any type of contract are recognized in the period in which they become known.

Under cost reimbursable contracts, we are reimbursed for costs that are determined to be reasonable, allowable and allocable to the contract and paid a fixed fee representing the profit negotiated between us and the contracting agency. Revenue from cost reimbursable contracts is recognized as costs are incurred plus an estimate of applicable fees earned. We consider fixed fees under cost reimbursable contracts to be earned in proportion to the allowable costs incurred in performance of the contract.

Revenue from time and materials contracts is recognized based on direct labor hours expended at contract billing rates plus other billable direct costs.

Fixed price contracts may include either a product delivery or specific service performance throughout a period. For fixed price contracts that are based on the proportional performance method and involve a specified number of deliverables, we recognize revenue based on the proportion of the cost of the deliverables compared to the cost of all deliverables included in the contract as this method more accurately measures performance under these arrangements. For fixed price contracts that provide for the development and delivery of a specific prototype or product, revenue is recognized based upon the percentage of completion method.

Whether certain costs under government contracts are allowable is subject to audit by the government. Certain indirect costs are charged to contracts using provisional or estimated indirect rates, which are subject to later revision based on government audits of those costs. Management is of the opinion that costs subsequently disallowed, if any, would not likely have a significant impact on revenues recognized for those contracts.

Income Taxes

We estimate our tax liability through calculating our current tax liability, together with assessing temporary differences resulting from the different treatment of items for tax and accounting purposes. These differences result in deferred tax assets and liabilities, which we record on our balance sheet. Management then assesses the likelihood that deferred tax assets will be recovered in future periods. In assessing the need for a valuation allowance against the net deferred tax asset, management considers factors such as future reversals of existing taxable temporary differences, taxable income in prior carry back years, whether carry back is permitted under the tax law, tax planning strategies and estimated future taxable income exclusive of

reversing temporary differences and carryforwards. To the extent that we cannot conclude that it is more likely than not that the benefit of such assets will be realized, we establish a valuation allowance to reduce their net carrying value.

As we assess our projections of future taxable income or other factors that may impact our ability to generate taxable income in future periods, our estimate of the required valuation allowance may change, which could have a material impact on future earnings or losses.

We recognize tax benefits from an uncertain tax position only if it is more likely than not that the tax position will be sustained on examination by taxing authorities. While it is often difficult to predict the final outcome of timing of the resolution of any particular tax matter, we establish a liability at the time we determine it is probable we will be required to pay additional taxes related to certain matters. These liabilities are recorded in accrued liabilities in our consolidated balance sheets. We adjust this provision, including any impact on the related interest and penalties, in light of changing facts and circumstances, such as the progress of a tax audit. A number of years may elapse before a particular matter for which we have established a liability is audited and finally resolved. The number of years with open tax audits varies depending on the tax jurisdiction. Settlement of any particular issue would usually require the use of cash. We recognize favorable resolutions of tax matters for which we have previously established liabilities as a reduction to our income tax expense when the amounts involved become known.

Due to differences between federal and state tax law, and accounting principles generally accepted in the United States of America ("GAAP") certain items are included in the tax return at different times than when those items are reflected in the consolidated financial statements. Therefore, the annual tax rate reflected in our consolidated financial statements is different than that reported in our tax return. Some of these differences are permanent, such as expenses that are not deductible in our tax return. Some differences, such as depreciation expense, reverse over time and create deferred tax assets and liabilities. The tax rates used to determine deferred tax assets or liabilities are the enacted tax rates in effect for the year in which the differences are expected to reverse. Based on the evaluation of all available information, we recognize future tax benefits, such as net operating loss ("NOL") carryforwards, to the extent that realizing these benefits is considered more likely than not.

As of December 31, 2019, we were no longer in a three-year cumulative loss position, which required additional analysis to be performed in order to determine the likelihood of realizing the deferred tax assets in the foreseeable future. After further analysis, it was determined that a portion of the December 31, 2019 balance of deferred tax assets will be realized. Because the NOLs carried over from API are limited under Section 382, the deferred tax asset of \$1.2 million is expected to be realized over an extended period of time (with continued earnings realized ratably through 2034). The deferred tax asset related to the NOL carryovers of API Canada, Luna Analytics, Luna Nanomaterials, and Luna Quest will likely not be realized in the foreseeable future as these entities no longer have any activity.

Stock-Based Compensation

We recognize stock-based compensation expense based upon the fair value of the underlying equity award on the date of the grant. The calculation of the fair value of our awards requires certain inputs that are subjective and changes to the estimates used will cause the fair values of our stock awards and related stock-based compensation expense to vary. We have elected to use the Black-Scholes-Merton ("Black-Scholes") option pricing model to determine the fair value of stock options. The fair value of a stock option award is affected by our stock price on the date of the grant as well as other assumptions used as inputs in the valuation model including the estimated volatility of our stock price over the term of the awards, the estimate period of time that we expect employees to hold their stock options and the risk-free interest rate assumption. In addition, we are required to reduce stock-based compensation expense for the effects of actual forfeitures of unvested awards in the period they occur.

Long-lived and Intangible Assets

Long-lived assets and certain identifiable intangibles are reviewed for impairment whenever events or changes in circumstances indicate that the carrying amount of an asset might not be recoverable. Recoverability of assets to be held and used is measured by a comparison of the carrying amount of an asset to future un-discounted net cash flows expected to be generated by the asset. If such assets are considered to be impaired, the impairment to be recognized is measured by the amount by which the carrying amount of the asset exceeds the fair value of the asset. Assets to be disposed of are reported at the lower of the carrying amount or fair value, less cost to sell.

Goodwill

Goodwill is reviewed for impairment at least annually, or more frequently if events or circumstances indicate that goodwill might be impaired. We have established October 1 as our specified annual date for impairment testing.

Leases

In February 2016, the Financial Accounting Standards Board ("FASB") issued a new standard related to leases, Accounting Standards Update ("ASU") No. 2016-02, Leases (Topic 842) and subsequent amendments, which replaced existing GAAP and requires lessees to recognize right-of-use ("ROU") assets and corresponding lease liabilities that depict the rights and obligations arising from a lease agreement. We implemented ASU 2016-02 on January 1, 2019 and elected certain practical expedients available under the ASU. As a result of the adoption, we recognized ROU assets totaling \$3.5 million and lease liabilities totaling \$4.7 million as of the adoption date. For additional information related to the adoption of Topic 842, see Note 1 to our Consolidated Financial Statements elsewhere in this Annual Report on Form 10-K.

Business Combinations

We account for business combinations under the acquisition method of accounting, in accordance with ASC 805 - Business Combinations. Under ASC 805, the total estimated purchase consideration is allocated to the acquired tangible and intangible assets and assumed liabilities based on their estimated fair values as of the acquisition date. Any excess of the fair value of acquisition consideration over the fair value of identifiable assets acquired and liabilities assumed is recorded as goodwill.

Results of Operations

The following table shows information derived from our consolidated statements of operations expressed as a percentage of total revenues for the periods presented.

	Years ended December 31,	
	2019	2018
Revenues:		
Products and licensing	63.1%	51.1%
Technology development	36.9	48.9
Total revenues	100.0	100.0
Cost of revenues:		
Products and licensing	23.7	18.8
Technology development	26.4	35.9
Total cost of revenues	50.1	54.7
Gross profit	49.9	45.3
Operating expense	45.2	43.2
Operating income	4.7	2.1
Total other income	0.5	1.0
Income from continuing operations before income taxes	5.2	3.1
Income from continuing operations, net of income taxes	7.6	2.9
Income from discontinued operations, net of income taxes	—	22.8
Net income	7.6%	25.7%

Year Ended December 31, 2019 Compared to Year Ended December 31, 2018

Revenues

	Years ended December 31,		\$ Difference	% Difference
	2019	2018		
Products and licensing revenues	\$ 44,491,041	\$ 21,949,689	\$ 22,541,352	102.7%
Technology development revenues	26,024,674	20,967,556	5,057,118	24.1%
Total revenues	\$ 70,515,715	\$ 42,917,245	\$ 27,598,470	64.3%

Our Products and Licensing segment included revenues from sales of test and measurement systems, primarily representing sales of our Optical Backscatter Reflectometer, ODiSI, and Optical Vector Analyzer platforms, optical components and sub-assemblies and sales of our Hyperion and Terahertz sensing platforms. Our Products and Licensing segment revenues increased \$22.5 million to \$44.5 million for the year ended December 31, 2019 compared to \$21.9 million for the year ended December 31, 2018. The increase resulted primarily from \$10.8 million of revenues realized from the legacy business of MOI

and \$10.5 million of revenues realized from the legacy business of GP during the year ended December 31, 2019. Continued growth in sales of our fiber-optic sensing products, including our ODISI products directed toward the expanding use of composite materials and the need for improved means of testing their structural integrity, and our communications test instruments also contributed to this increase.

Our Technology Development segment revenues increased \$5.1 million to \$26.0 million for the year ended December 31, 2019 compared to \$21.0 million for the year ended December 31, 2018. Revenues within this segment increased due to additional contract awards, including higher value Phase 2 SBIR contracts. The increase continues a growth trend experienced over the past two years largely driven by successes in Phase 2 SBIR awards. The increase was realized primarily in our intelligent systems, advanced materials, optical systems and terahertz research groups. As Phase 2 SBIR contracts generally have a performance period of a year or more, we currently expect Technology Development segment revenues to remain at a similar level for the near term.

Cost of Revenues

	Years ended December 31,		\$ Difference	% Difference
	2019	2018		
Products and licensing costs	\$ 16,684,172	\$ 8,078,870	\$ 8,605,302	106.5%
Technology development costs	18,649,161	15,400,475	3,248,686	21.1%
Total costs of revenues	\$ 35,333,333	\$ 23,479,345	\$ 11,853,988	50.5%

Our Products and Licensing segment costs increased \$8.6 million to \$16.7 million for the year ended December 31, 2019 compared to \$8.1 million for the year ended December 31, 2018. This increase primarily resulted from \$3.9 million of cost of revenues from the legacy business of MOI and \$4.4 million of cost of revenues from the legacy business of GP during the year ended December 31, 2019, as well as an increase in sales volume.

Our Technology Development segment costs increased \$3.2 million, to \$18.6 million for the year ended December 31, 2019 compared to \$15.4 million for the year ended December 31, 2018. The overall increase in Technology Development segment costs was driven by increases in direct labor and subcontractor costs consistent with the rate of growth in Technology Development segment revenues.

Operating Expense

	Years ended December 31,		\$ Difference	% Difference
	2019	2018		
Selling, general and administrative expense	\$ 24,371,349	\$ 14,794,205	\$ 9,577,144	64.7%
Research, development and engineering expense	7,496,012	3,766,160	3,729,852	99.0%
Total operating expense	\$ 31,867,361	\$ 18,560,365	\$ 13,306,996	71.7%

Selling, general and administrative expense increased \$9.6 million to \$24.4 million for the year ended December 31, 2019 compared to \$14.8 million for the year ended December 31, 2018. Selling, general and administrative expense increased primarily due to \$4.4 million of expenses associated with the legacy business of MOI and \$2.0 million of expenses associated with the legacy business of GP, in addition to \$1.0 million in transaction costs associated with the acquisition of GP, a \$0.9 million increase in share-based compensation as a result of new awards, and a \$1.1 million increase in expenses related to sales and marketing as a result of increased revenue.

Research, development and engineering expenses increased \$3.7 million to \$7.5 million for the year ended December 31, 2019 compared to \$3.8 million for the year ended December 31, 2018 primarily due to \$1.1 million of research, development and engineering expense associated with the legacy business of MOI and \$2.7 million of research, development and engineering expense associated with the legacy business of GP during the year ended December 31, 2019.

Interest Expense, Net

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Our net interest expense was \$15,878 for the year ended December 31, 2019 compared to \$0.1 million for the year ended December 31, 2018, as a result of a decrease in debt partially offset by the increase in finance lease obligations.

Investment Income

Investment income was \$0.4 million for the year ended December 31, 2019, compared to \$0.5 million for the year ended December 31, 2018. During the years ended December 31, 2019 and 2018, we invested a portion of our cash in funds holding U.S. treasury securities.

Income Tax (Benefit)/Expense from Continuing Operations

For the year ended December 31, 2019, we recorded income tax benefit of \$1.7 million, or (44.9)% of our income from continuing operations, compared to an income tax expense of \$47,818, or 3.8% of our income from continuing operations for the year ended December 31, 2018. The income tax benefit recognized for the year ended December 31, 2019 was driven mostly by a partial release of our valuation allowances.

Net Income From Continuing Operations

For the year ended December 31, 2019, we recognized income from continuing operations before income taxes of \$3.7 million, compared to \$1.3 million for the year ended December 31, 2018. After tax, our net income from continuing operations was \$5.3 million for the year ended December 31, 2019, compared to \$1.2 million for the year ended December 31, 2018.

Income from Discontinued Operations, Net of Income Taxes

For the year ended December 31, 2018, we recognized income from discontinued operations, net of income taxes, of \$9.8 million. Net income from discontinued operations for the year ended December 31, 2018, included an after tax gain recognized on the sale of our optoelectronics business during 2018 of \$8.6 million in addition to \$1.2 million of after-tax income associated with the operations of the optoelectronics business prior to its sale. There were no results from discontinued operations for the year ended December 31, 2019.

Preferred Stock Dividend

In January 2010, we issued 1,321,514 shares of our newly designated Series A Convertible Preferred Stock to Carilion. The Series A Convertible Preferred Stock carried an annual cumulative dividend of 6%, or approximately 79,292 shares of common stock per year. During each of 2019 and 2018, we accrued \$0.3 million and \$0.3 million, respectively, for the dividends payable to Carilion. During 2019, the total accrued dividend of 770,454 shares of common stock were issued to Carilion as shown on our consolidated statements of changes in stockholders' equity.

Liquidity and Capital Resources

At December 31, 2019, our total cash and cash equivalents were \$25.0 million.

On October 10, 2019, we entered into an Amended and Restated Loan and Security Agreement (the "Loan Agreement") with Silicon Valley Bank ("SVB"), which amended and restated in its entirety our previous Loan and Security Agreement dated as of February 18, 2010, as amended. Under the Loan Agreement, SVB agreed to make advances available up to \$10.0 million (the "Revolving Line"). The Revolving Line terminates on October 10, 2020 unless earlier terminated by us. No amounts have been borrowed under this Loan Agreement.

We maintain a letter-of-credit in the amount of \$1.0 million as a condition of our lease on our Blacksburg office.

We believe that our cash and cash equivalents as of December 31, 2019 in addition to amounts available to us under our Revolving Line will provide adequate liquidity for us to meet our working capital needs over the next twelve months from the date of issuance of the consolidated financial statements included elsewhere in this Annual Report on Form 10-K. Additionally, we believe that should we have the need for increased capital spending to support our planned growth, we will be able to fund such growth through either third-party financing on competitive market terms or through our available cash and cash equivalents.

Discussion of Cash Flows

	Years ended December 31,	
	2019	2018
Net cash provided by/(used in) operating activities	\$ 4,798,201	\$ (3,308,826)
Net cash (used in)/provided by investing activities	(19,814,991)	10,037,123
Net cash used in financing activities	(2,437,560)	(1,249,564)
Net (decrease)/increase in cash and cash equivalents	\$ (17,454,350)	\$ 5,478,733

During 2019, the \$4.8 million of net cash provided by operating activities consisted of our net income of \$5.3 million, and included non-cash charges for depreciation and amortization of \$2.5 million, and stock-based compensation of \$1.5 million, offset by a tax benefit from a partial release of the valuation allowances of \$3.3 million and a net cash outflow of \$1.8 million from changes in working capital. The changes in working capital were principally driven by an increase in accounts receivable of \$2.2 million, an increase in inventory of \$0.7 million, an increase in contract assets of \$0.4 million, and an increase in other assets of \$0.2 million, all partially offset by decreases in accounts payable and accrued expenses of \$0.6 million and contract liabilities of \$1.2 million.

In 2018, the \$3.3 million of net cash used in operating activities consisted of our net income of \$11.0 million and included a gain recognized on the sale of our optoelectronic segment that was sold in July 2018 of \$8.6 million in addition to non-cash charges for depreciation and amortization of \$1.2 million and stock-based compensation of \$0.6 million, offset by a net cash outflow of \$7.6 million from changes in working capital. The changes in working capital were principally driven by an increase in inventory of \$1.0 million, and increase in accounts receivable of \$6.2 million, and increase in contract assets of \$0.8 million, and an increase in accounts payable and accrued liabilities of \$0.5 million, all partially offset by a \$1.8 million decrease in other assets.

Cash used in investing activities in 2019 consisted primarily of the \$19.0 million payment for our acquisition of GP, \$0.5 million of fixed asset additions and \$0.3 million of capitalized intellectual property costs.

Cash provided by investing activities in 2018 consisted primarily of the proceeds from the sale of our optoelectronic segment of \$15.8 million, partially offset by the \$5.0 million payment for our acquisition of MOI, \$0.4 million of fixed asset additions and \$0.4 million of capitalized intellectual property rights.

Cash used in financing activities for the year ended December 31, 2019 was \$2.4 million, compared to \$1.2 million in 2018. During 2019, we repaid \$0.6 million on our term loans with SVB and used \$2.2 million to repurchase our common stock under our stock repurchase program. These payments were partially offset by \$0.4 million received from exercises of stock options and warrants. During 2018, we repaid \$1.8 million on our outstanding term loan with SVB and used \$0.5 million to repurchase our common stock under our stock repurchase program. These payments were partially offset by \$1.1 million received from exercises of stock options and warrants.

Summary of Contractual Obligations

The following table sets forth information concerning our known contractual obligations as of December 31, 2019 that are fixed and determinable.

	Total	Less than 1 year	1 - 3 years	3 - 5 years	More than 5 years
Operating facility leases (1)	\$ 3,742,613	\$ 1,467,701	\$ 1,185,504	\$ 1,089,408	\$ —
Finance leases (2)	81,855	56,019	20,794	5,042	—
Purchase order obligation (3)	1,271,440	1,271,440	—	—	—
Other liabilities (4)	220,000	220,000	—	—	—
Total	\$ 5,315,908	\$ 3,015,160	\$ 1,206,298	\$ 1,094,450	\$ —

(1) We lease our facilities in Blacksburg, Charlottesville and Roanoke, Virginia, Ann Arbor, Michigan, Chino, California and Atlanta, Georgia under operating leases that as of December 31, 2019, are scheduled to expire between October

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2020 and December 2024. Upon expiration of our office leases, we may exercise certain renewal options as specified in the leases. Rental payments associated with these option periods are not included in the table above.

- (2) In January 2016, February 2018, and June 2018 we executed leases in the amounts of \$207,000, \$15,000, and \$75,000, respectively, for office equipment. These equipment leases expire in 2021, 2021 and 2023, respectively.
- (3) Purchase order obligations included outstanding orders for inventory purchases. In 2019, our Luna Technologies subsidiary executed non-cancelable purchase orders for a total amount of \$1.9 million for multiple shipments of tunable lasers to be delivered over an 18-month period beginning in July 2019.
- (4) Other liabilities include remaining amounts payable for minimum royalty payments for certain licensed technologies payable over the remaining patent terms of the underlying technology.

Off-Balance Sheet Arrangements

We have no off-balance sheet arrangements as of December 31, 2019.

Inflation

We do not believe that inflation has had a material effect on our business, financial condition or results of operations.

ITEM 7A. QUANTITATIVE AND QUALITATIVE DISCLOSURES ABOUT MARKET RISK

Market risk represents the risk of loss that may impact our financial position due to adverse changes in financial market prices and rates. We do not hold or issue financial instruments for trading purposes or have any derivative financial instruments. Our exposure to market risk is limited to interest rate fluctuations due to changes in the general level of U.S. interest rates.

Interest Rate Risk

We do not use derivative financial instruments as a hedge against interest rate fluctuations, and, as a result, interest income earned on our cash and cash equivalents and short-term investments is subject to changes in interest rates. However, we believe that the impact of these fluctuations does not have a material effect on our financial position due to the immediate available liquidity or short-term nature of these financial instruments.

Foreign Currency Exchange Rate Risk

As of December 31, 2019, all payments made under our research contracts have been denominated in U.S. dollars. Our product sales to foreign customers are also generally denominated in U.S. dollars, and we do not receive payments in foreign currency. As such, we are not directly exposed to significant currency gains or losses resulting from fluctuations in foreign exchange rates.

ITEM 8. FINANCIAL STATEMENTS AND SUPPLEMENTARY DATA

Luna Innovations Incorporated

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REPORT OF INDEPENDENT REGISTERED PUBLIC ACCOUNTING FIRM

Board of Directors and Stockholders
Luna Innovations Incorporated

Opinion on the financial statements

We have audited the accompanying consolidated balance sheets of Luna Innovations Incorporated (a Delaware corporation) and subsidiaries (the “Company”) as of December 31, 2019 and 2018, the related consolidated statements of operations, changes in stockholders’ equity, and cash flows for each of the two years in the period ended December 31, 2019, and the related notes and financial statement schedule included under Item 15(a) (collectively referred to as the “financial statements”). In our opinion, the financial statements present fairly, in all material respects, the financial position of the Company as of December 31, 2019 and 2018, and the results of its operations and its cash flows for each of the two years in the period ended December 31, 2019, in conformity with accounting principles generally accepted in the United States of America.

We also have audited, in accordance with the standards of the Public Company Accounting Oversight Board (United States) (“PCAOB”), the Company’s internal control over financial reporting as of December 31, 2019, based on criteria established in the 2013 Internal Control-Integrated Framework issued by the Committee of Sponsoring Organizations of the Treadway Commission (“COSO”), and our report dated March 13, 2020 expressed an unqualified opinion.

Change in accounting principle

As discussed in Note 1 to the financial statements, the Company has changed its method of accounting for leases as of January 1, 2019, in accordance with the adoption of Accounting Standards Codification (ASC) Topic 842, Leases.

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 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. 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 supporting 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.

/s/ GRANT THORNTON LLP

We have served as the Company’s auditor since 2005.

Arlington, Virginia
March 13, 2020

REPORT OF INDEPENDENT REGISTERED PUBLIC ACCOUNTING FIRM

Board of Directors and Stockholders
Luna Innovations Incorporated

Opinion on internal control over financial reporting

We have audited the internal control over financial reporting of Luna Innovations Incorporated (a Delaware corporation) and subsidiaries (the “Company”) as of December 31, 2019, based on criteria established in the 2013 Internal Control-Integrated Framework issued by the Committee of Sponsoring Organizations of the Treadway Commission (“COSO”). In our opinion, the Company maintained, in all material respects, effective internal control over financial reporting as of December 31, 2019, based on criteria established in the 2013 Internal Control-Integrated Framework issued by COSO.

We also have audited, in accordance with the standards of the Public Company Accounting Oversight Board (United States) (“PCAOB”), the consolidated financial statements of the Company as of and for the year ended December 31, 2019 and our report dated March 13, 2020 expressed an unqualified opinion on those financial statements.

Basis for opinion

The Company’s management is responsible for maintaining effective internal control over financial reporting and for its assessment of the effectiveness of internal control over financial reporting, included in the accompanying Management’s Report on Internal Control over Financial Reporting (“Management’s Report”). Our responsibility is to express an opinion on the Company’s internal control over financial reporting based on our audit. We are a public accounting firm registered with the 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 audit in accordance with the standards of the PCAOB. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether effective internal control over financial reporting was maintained in all material respects. Our audit included obtaining an understanding of internal control over financial reporting, assessing the risk that a material weakness exists, testing and evaluating the design and operating effectiveness of internal control based on the assessed risk, and performing such other procedures as we considered necessary in the circumstances. We believe that our audit provides a reasonable basis for our opinion.

Our audit of, and opinion on, the Company’s internal control over financial reporting does not include the internal control over financial reporting of General Photonics Corporation, a wholly-owned subsidiary, whose financial statements reflect total assets and revenues constituting 28 and 7 percent, respectively, of the related consolidated financial statement amounts as of and for the year ended December 31, 2019. As indicated in Management’s Report, General Photonics Corporation was acquired during 2019. Management’s assertion on the effectiveness of the Company’s internal control over financial reporting excluded internal control over financial reporting of General Photonics Corporation.

Definition and limitations of internal control over financial reporting

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

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

/s/ GRANT THORNTON LLP

Arlington, Virginia
March 13, 2020

Luna Innovations Incorporated
Consolidated Balance Sheets

	December 31, 2019	December 31, 2018
Assets		
Current assets:		
Cash and cash equivalents	\$ 25,005,917	\$ 42,460,267
Accounts receivable, net	16,268,645	13,037,068
Receivable from sale of HSOR business	2,501,386	2,500,000
Contract assets	2,758,946	2,422,495
Inventory, net	10,294,431	6,873,742
Prepaid expenses and other current assets	1,286,968	935,185
Total current assets	58,116,293	68,228,757
Property and equipment, net	3,465,612	3,627,886
Intangible assets, net	10,194,477	3,302,270
Goodwill	10,541,676	101,008
Long term contract assets	449,260	336,820
Other assets	2,341,179	1,995
Deferred tax asset	1,415,563	—
Total assets	\$ 86,524,060	\$ 75,598,736
Liabilities and stockholders' equity		
Current liabilities:		
Current portion of long-term debt obligations	\$ —	\$ 619,315
Current portion of capital lease obligations	—	40,586
Accounts payable	2,786,825	2,395,984
Accrued liabilities	10,369,545	6,597,458
Contract liabilities	3,887,685	2,486,111
Total current liabilities	17,044,055	12,139,454
Long-term portion of deferred rent	—	1,035,974
Other long-term liabilities	2,011,487	—
Long-term capital lease obligations	—	68,978
Total liabilities	19,055,542	13,244,406
Commitments and contingencies (Note 14)		
Stockholders' equity:		
Preferred stock, par value \$0.001, 1,321,514 shares authorized, 0 and 1,321,514 shares issued and outstanding at December 31, 2019 and 2018, respectively	—	1,322
Common stock, par value \$0.001, 100,000,000 shares authorized, 31,788,896 and 29,209,506 shares issued, 30,149,105 and 27,956,401 shares outstanding at December 31, 2019 and 2018, respectively	31,849	30,120
Treasury stock at cost, 1,639,791 and 1,253,105 shares at December 31, 2019 and 2018, respectively	(4,337,107)	(2,116,640)
Additional paid-in capital	88,021,903	85,744,750
Accumulated deficit	(16,248,127)	(21,305,222)
Total stockholders' equity	67,468,518	62,354,330
Total liabilities and stockholders' equity	\$ 86,524,060	\$ 75,598,736

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

Luna Innovations Incorporated
Consolidated Statements of Operations

	Years ended December 31,	
	2019	2018
Revenues:		
Products and licensing	\$ 44,491,041	\$ 21,949,689
Technology development	26,024,674	20,967,556
Total revenues	70,515,715	42,917,245
Cost of revenues:		
Products and licensing	16,684,172	8,078,870
Technology development	18,649,161	15,400,475
Total cost of revenues	35,333,333	23,479,345
Gross profit	35,182,382	19,437,900
Operating expense:		
Selling, general and administrative	24,371,349	14,794,205
Research, development and engineering	7,496,012	3,766,160
Total operating expense	31,867,361	18,560,365
Operating income	3,315,021	877,535
Other income/(expense):		
Other expense, net	(4,504)	(17,143)
Investment income	393,556	549,580
Interest expense, net	(15,878)	(124,344)
Total other income	373,174	408,093
Income from continuing operations before income taxes	3,688,195	1,285,628
Income tax benefit/(expense)	1,654,350	(47,818)
Net income from continuing operations	5,342,545	1,237,810
Operating income from discontinued operations, net of income tax expenses (\$183,921)	—	1,170,634
Gain on sale, net of income tax expenses (\$1,572,244)	—	8,595,797
Income from discontinued operations, net of income taxes	—	9,766,431
Net income	5,342,545	11,004,241
Less: Preferred stock dividend	285,450	257,302
Net income attributable to common stockholders	\$ 5,057,095	\$ 10,746,939
Net income per share from continuing operations:		
Basic	\$ 0.19	\$ 0.04
Diluted	\$ 0.17	\$ 0.04
Net income per share from discontinued operations:		
Basic	\$ —	\$ 0.35
Diluted	\$ —	\$ 0.30
Net income per share attributable to common stockholders:		
Basic	\$ 0.18	\$ 0.39
Diluted	\$ 0.16	\$ 0.33
Weighted average shares:		
Basic	28,688,867	27,596,401
Diluted	31,840,584	32,452,228

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

Luna Innovations Incorporated
Consolidated Statements of Changes in Stockholders' Equity

	Preferred Stock		Common Stock		Treasury Stock		Additional Paid in Capital	Accumulated Deficit	Total
	Shares	\$	Shares	\$	Shares	\$	\$	\$	\$
Adjusted balance as of January 1, 2018	1,321,514	\$ 1,322	27,283,918	\$ 29,186	1,070,904	\$ (1,649,746)	\$ 83,563,208	\$ (32,052,161)	\$ 49,891,809
Exercise of stock options and warrants	—	—	442,425	441	—	—	1,096,592	—	1,097,033
Stock-based compensation	—	—	282,394	282	—	—	627,857	—	628,139
Non-cash compensation	—	—	129,865	131	—	—	199,871	—	200,002
Stock dividends (1)	—	—	—	80	—	—	257,222	(257,302)	—
Purchase of treasury stock	—	—	(182,201)	—	182,201	(466,894)	—	—	(466,894)
Net income	—	—	—	—	—	—	—	11,004,241	11,004,241
Balance—December 31, 2018	1,321,514	\$ 1,322	27,956,401	\$ 30,120	1,253,105	\$ (2,116,640)	\$ 85,744,750	\$ (21,305,222)	\$ 62,354,330
Exercise of stock options and warrants	—	—	487,802	488	—	—	447,466	—	447,954
Stock-based compensation	—	—	16,286	16	—	—	1,544,140	—	1,544,156
Stock dividends (1)	—	—	770,454	60	—	—	285,390	(285,450)	—
Preferred stock to common stock conversion	(1,321,514)	(1,322)	1,321,514	1,322	—	—	—	—	—
Forfeitures of restricted stock grants	—	—	(16,666)	(157)	—	—	157	—	—
Purchase of treasury stock	—	—	(386,686)	—	386,686	(2,220,467)	—	—	(2,220,467)
Net income	—	—	—	—	—	—	—	5,342,545	5,342,545
Balance—December 31, 2019	—	\$ —	30,149,105	\$ 31,849	1,639,791	\$ (4,337,107)	\$ 88,021,903	\$ (16,248,127)	\$ 67,468,518

(1) The stock dividends payable in connection with the Series A Convertible Preferred Stock were issued at the request of Carilion. See Note 11 - Stockholders' Equity for more information.

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

Luna Innovations Incorporated
Consolidated Statements of Cash Flows

	Years ended December 31,	
	2019	2018
Cash flows provided by/(used in) operating activities:		
Net income	\$ 5,342,545	\$ 11,004,241
Adjustments to reconcile net income to net cash provided by/(used in) operating activities:		
Depreciation and amortization	2,503,291	1,218,559
Stock-based compensation	1,544,156	627,856
Loss on disposal of fixed assets	—	(1,000)
Gain on sale of discontinued operations, net of income taxes	—	(8,595,798)
Tax benefit from release of valuation allowance	(3,349,032)	—
Bad debt	538,298	6,000
Changes in operating assets and liabilities:		
Accounts receivable	(2,248,925)	(6,240,377)
Contract assets	(448,891)	(761,714)
Inventory	(722,690)	(967,797)
Other assets	(242,112)	1,849,629
Other long-term assets	44,976	—
Accounts payable and accrued expenses	591,585	(461,927)
Contract liabilities	1,245,000	(986,498)
Net cash provided by/(used in) operating activities	4,798,201	(3,308,826)
Cash flows (used in)/provided by investing activities:		
Acquisition of property and equipment	(540,635)	(386,890)
Proceeds from sale of property and equipment	—	1,000
Intangible property costs	(270,106)	(374,766)
Acquisition of Micron Optics, net	—	(5,001,750)
Acquisition of General Photonics Corporation, net	(19,004,250)	—
Proceeds from sale of discontinued operations, net	—	15,799,529
Net cash (used in)/provided by investing activities	(19,814,991)	10,037,123
Cash flows used in financing activities:		
Payments on debt obligations	(625,000)	(1,833,333)
Payments on finance lease obligations	(40,047)	(46,653)
Purchase of treasury stock	(2,220,467)	(466,894)
Proceeds from the exercise of options and warrants	447,954	1,097,316
Net cash used in financing activities	(2,437,560)	(1,249,564)
Net change in cash and cash equivalents	(17,454,350)	5,478,733
Cash and cash equivalents—beginning of period	42,460,267	36,981,534
Cash and cash equivalents—end of period	<u>\$ 25,005,917</u>	<u>\$ 42,460,267</u>
Supplemental disclosure of cash flow information		
Cash paid for interest	\$ 18,359	\$ 117,616
Cash paid for income taxes	\$ 1,160,276	\$ 1,828,203
Non-cash investing and financing activity:		
Contingent liability for business combination	\$ 900,000	\$ —
Common stock issued pursuant to restricted stock vesting	\$ —	\$ 200,202
Dividend on preferred stock	\$ 285,450	\$ 257,302

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

NOTES TO CONSOLIDATED FINANCIAL STATEMENTS**1. Organization and Summary of Significant Accounting Policies**

Luna Innovations Incorporated ("we" or the "Company"), headquartered in Roanoke, Virginia, was incorporated in the Commonwealth of Virginia in 1990 and reincorporated in the State of Delaware in April 2003.

We are a leader in advanced optical technology, providing high performance fiber optic test, measurement and control products for the telecommunications and photonics industries and distributed fiber optic sensing products for industries utilizing composite and other advanced materials, such as the automotive, aerospace, energy and infrastructure industries.

Consolidation Policy

Our consolidated financial statements are prepared in accordance with accounting principles generally accepted in the United States ("GAAP") and include our accounts and the accounts of our wholly owned subsidiaries. We eliminate from our financial results all intercompany transactions.

Use of Estimates

The preparation of our consolidated financial statements in accordance with GAAP requires us to make estimates and assumptions that affect the reported amounts of assets, liabilities, revenues and expenses and the disclosure of contingent assets and liabilities in our consolidated financial statements and accompanying notes.

Although these estimates are based on our knowledge of current events and actions we may undertake in the future, actual results may differ from such estimates and assumptions.

*Revenue Recognition**Products and Licensing Revenues*

Revenues from product sales are generated by the sale of commercial products and services under various sales programs to the end user and through distribution channels. We sell fiber optic test and sensing systems to end users for use in numerous fiber optic-based measurement applications. Revenues are recorded net of applicable sales taxes collected from customers and payable to state or local governmental entities.

For Products and Licensing contracts, we evaluate whether two or more contracts should be combined and accounted for as one single contract and whether the combined or single contract should be accounted for as more than one performance obligation. We recognize revenue when the performance obligation has been satisfied by transferring the control of the product or service to the customer. For tangible products that contain software that is essential to the tangible product's functionality, we consider the product and software to be a single performance obligation. For contracts with multiple performance obligations, we allocate the contract's transaction price to each performance obligation based on their relative stand-alone selling prices. In such circumstances, we use the observable price of goods or services which are sold separately in similar circumstances to similar customers. If these prices are not observable, then we will estimate the stand-alone selling price using information that is reasonably available. For the majority of our standard products and services, price list and discount structures related to customer type are available. For products and services that do not have price list and discount structures, we may use one or more of the following: (i) adjusted market assessment approach, (ii) expected cost-plus a margin approach, and (iii) residual approach. The adjusted market approach requires us to evaluate the market in which we sell goods or services and estimate the price that a customer in that market would be willing to pay for those goods or services. The expected cost plus margin approach requires us to forecast our expected costs of satisfying the performance obligation and then add a reasonable margin for that good or service. The residual approach decreases the total transaction price by the sum of the observable standalone selling prices if either the company sells the same good or services to different customers for a broad range of amounts or the company has not established a price for the good or service and that good or service has not been sold on a standalone basis. Shipping and handling activities primarily occur after a customer obtains control and are considered fulfillment cost rather than separate performance obligations. Similarly, sales and similar taxes assessed by a governmental authority that are both imposed on and concurrent with a specific revenue-producing transaction and collected by the entity from a customer are excluded from the measurement of the transaction price.

For standard products, we recognize revenue at a point in time when control passes to the customer. Absent substantial product acceptance clauses, this is based on the shipping terms. For custom products that require engineering and development based on customer requirements, we will recognize revenue over time using the output method for any items shipped and any

finished goods or work in process that is produced for balances of open sales orders. For any finished goods or work in process that has been produced for the balance of open sales orders we recognize revenue by applying the average selling price for such open order to the lesser of the on-hand balance in finished goods or open sales order quantity which we present as a contract asset on the balance sheet. Cost of sales is recognized based on the standard cost of the finished goods and work in process associated with this revenue and inventory balances are reduced accordingly. For extended warranties and product rentals, revenue is recognized over time using the output method based on the time elapsed for the warranty or service period. In the case of warranties, we record a contract liability for amounts billed but that are not recognized until subsequent periods. A separate contract liability is recorded for the cost associated with warranty repairs based on our estimate of future expense. For testing services where we are performing testing on an asset the customer controls, revenue is recognized over time by the output method using the performance to date. For training where the customer is receiving the benefit of training as it is occurring and for repairs to a customer-controlled asset, revenue is recognized over time by the output method using the performance to date. For royalty revenue, we apply the practical expedient "royalty exception" recognizing revenue based on the royalty agreement which specifies an amount based on sales or minimum amount, whichever is greater.

In some product rental contracts, a customer may be offered a discount on the purchase of an item that would provide for a material right. When a material right has been provided to a customer, a separate performance obligation is established, and a portion of the rental revenue will be deferred until the future product is purchased or the option expires. This deferred revenue is recognized as a contract liability on the balance sheet.

Technology Development Revenues

We perform research and development for U.S. Federal government agencies, educational institutions and commercial organizations. We account for a research contract when a contract has been executed, the rights of the parties are identified, payment terms are identified, the contract has commercial substance, and collectability of the contract price is considered probable. Revenue is earned under cost reimbursable, time and materials and fixed price contracts. Direct contract costs are expensed as incurred.

Our contracts with agencies of the U.S. government are subject to periodic funding by the respective contracting agency. Funding for a contract may be provided in full at inception of the contract or ratably throughout the contract as the services are provided. In evaluating the probability of funding for purposes of assessing collectability of the contract price, we consider our previous experience with our customers, communication with our customers regarding funding status and our knowledge of available funding for the contract or program. If funding is not assessed as probable, revenue recognition is deferred until realization is reasonably assured.

Under the typical payment terms of our U.S. government contracts, the customer pays us either performance-based payments ("PBPs") or progress payments. PBPs, which are typically used in the firm fixed price contracts, are interim payments based on quantifiable measures of performance or on the achievement of specified events or milestones. Progress payments, which are typically used in our cost type contracts, are interim payments based on costs incurred as the work progresses. For our U.S. government cost-type contracts, the customer generally pays us during the performance period for 80% to 90% of our actual costs incurred. Because the customer retains a small portion of the contract price until completion of the contract and audit of allowable costs, cost type contracts generally result in revenue recognized in excess of billings which we present as contract assets on the balance sheet. Amounts billed and due from our customers are classified as receivables on the balance sheet. For non-U.S. government contracts, we typically receive interim payments as work progresses, although for some contracts, we may be entitled to receive an advance payment. We recognize a liability for these advance payments and PBPs paid in advance which are in excess of the revenue recognized and present these amounts as contract liabilities on the balance sheet.

To determine the proper revenue recognition method for research and development contracts, we evaluate whether two or more contracts should be combined and accounted for as one single modified contract and whether the combined or single contract should be accounted for as more than one performance obligation. For instances where a contract has options that were bid with the initial contract and awarded at a later date, we combine the options with the original contract when options are awarded. For most of our contracts, the customer contracts for research with multiple milestones that are interdependent. Consequently, the entire contract is accounted for as one performance obligation. The effect of the combined or modified contract on the transaction price and measure of progress for the performance obligation to which it relates, is recognized as an adjustment to revenue (either as an increase in or a reduction of revenue) on a cumulative catch-up basis.

Contract revenue recognition is measured over time as we perform because of continuous transfer of control to the customer. For U.S. government contracts which are typically subject to the Federal Acquisition Regulation, this continuous

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transfer of control to the customer is supported by clauses in the contract that allow the customer to unilaterally terminate the contract for convenience, pay us for cost incurred plus a reasonable profit and take control of any work in process. From time to time, as part of normal management processes, facts may change, causing revisions to estimated total costs or revenues expected. The cumulative impact of any revisions to estimates and the full impact of anticipated losses on any type of contract are recognized in the period in which they become known.

Because of control transferring over time, revenue is recognized based on the extent of progress towards completion of the performance obligation. The selection of the method to measure progress towards completion requires judgment and is based on the nature of the services to be provided. We generally use the input method, more specifically the cost-to-cost measure of progress for our contracts because it best depicts the transfer of control to the customer, which occurs as we incur costs on our contracts. Under the cost-to-cost measure of progress, the extent of progress towards completion is measured based on the ratio of costs incurred to date to the total estimated costs at completion of the performance obligation. The underlying bases for estimating our contract research revenues are measurable expenses, such as labor, subcontractor costs and materials, and data that are updated on a regular basis for purposes of preparing our cost estimates. Our research contracts generally have a period of performance of six months to three years, and our estimates of contract costs have historically been consistent with actual results. Revisions in these estimates between accounting periods to reflect changing facts and circumstances have not had a material impact on our operating results, and we do not expect future changes in these estimates to be material. The cumulative impact of any revisions to estimates and the full impact of anticipated losses on any type of contract are recognized in the period in which they become known.

Under cost reimbursable contracts, we are reimbursed for costs that are determined to be reasonable, allowable and allocable to the contract and paid a fixed fee representing the profit negotiated between us and the contracting agency. Revenue from cost reimbursable contracts is recognized as costs are incurred plus an estimate of applicable fees earned. We consider fixed fees under cost reimbursable contracts to be earned in proportion to the allowable costs incurred in performance of the contract.

Revenue from time and materials contracts is recognized based on direct labor hours expended at contract billing rates plus other billable direct costs.

Fixed price contracts may include either a product delivery or specific service performance throughout a period. For fixed price contracts that are based on the proportional performance method and involve a specified number of deliverables, we recognize revenue based on the proportion of the cost of the deliverables compared to the cost of all deliverables included in the contract as this method more accurately measures performance under these arrangements. For fixed price contracts that provide for the development and delivery of a specific prototype or product, revenue is recognized based upon the percentage of completion method.

Whether certain costs under government contracts are allowable is subject to audit by the government. Certain indirect costs are charged to contracts using provisional or estimated indirect rates, which are subject to later revision based on government audits of those costs. Management is of the opinion that costs subsequently disallowed, if any, would not likely have a significant impact on revenues recognized for those contracts.

Allowance for Uncollectible Receivables

Accounts receivable are recorded at their face amount, less an allowance for doubtful accounts. We review the status of our uncollected receivables on a regular basis. In determining the need for an allowance for uncollectible receivables, we consider our customers' financial stability, past payment history and other factors that bear on the ultimate collection of such amounts. The allowance was \$0.9 million and \$0.3 million at each of December 31, 2019 and 2018, respectively.

Cash Equivalents

We consider all highly liquid investments with maturities of three months or less when purchased to be cash equivalents. To date, we have not incurred losses related to cash and cash equivalents. Cash equivalents at December 31, 2019 and 2018 included \$19.8 million and \$38.3 million, respectively, invested in U.S. Treasury obligations through a sweep account with our bank. The full value of amounts invested through the sweep account are convertible to cash on a daily basis. Our cash transactions are processed through reputable commercial banks. We regularly maintain cash balances with financial institutions which exceed Federal Deposit Insurance Corporation ("FDIC") insurance limits. At December 31, 2019 and 2018, we had approximately \$5.0 million and \$4.0 million, respectively, in excess of FDIC insured limits.

Fair Value Measurements

Our financial assets and liabilities are measured at fair value, which is defined as the price that would be received to sell an asset, or paid to transfer a liability, in an orderly transaction between market participants. Valuation techniques are based on observable or unobservable inputs. Observable inputs reflect market data obtained from independent sources, while unobservable inputs reflect our market assumptions. These two types of inputs have created the following fair value hierarchy:

- Level 1—Quoted prices for identical instruments in active markets.
- Level 2—Quoted prices for similar instruments in active markets; quoted prices for identical or similar instruments in markets that are not active; and model-derived valuations in which significant value drivers are observable.
- Level 3—Valuations derived from valuation techniques in which significant value drivers are unobservable.

The carrying values of cash and cash equivalents, accounts receivable, accounts payable and accrued liabilities approximate fair value because of the short-term nature of these instruments. The carrying amount of lease liabilities approximate fair value because these financial instruments bear interest at rates that approximate current market rates for similar agreements with similar maturities and credit. We consider the terms of the Silicon Valley Bank ("SVB") debt facility including its interest rate of prime plus 1%, to be at market based upon similar instruments that would be available to us.

Property and Equipment, net

Property and equipment are stated at cost less accumulated depreciation. We record depreciation using the straight-line method over the following estimated useful lives:

Equipment	3 – 7 years
Furniture and fixtures	7 years
Software	3 years
Leasehold improvements	Lesser of lease term or life of improvements

Intangible Assets

Intangible assets consist of patents related to certain intellectual property that we have developed or acquired, and identifiable intangible assets recognized in connection with our merger with Advanced Photonix, Inc. ("API"), Micron Optics, Inc. ("MOI"), and General Photonics, Inc. ("GP"). We amortize our identified intangible assets over their estimated useful lives ranging between one and fifteen years and analyze the reasonableness of the remaining useful life whenever events or circumstances indicate that the carrying amount may not be recoverable to determine whether their carrying value has been impaired.

Goodwill

Goodwill is tested annually for impairment in the fourth quarter (October 1st) and whenever events or changes in circumstances indicate the carrying value of goodwill may not be recoverable. Goodwill is tested for impairment at the reporting unit level. A qualitative assessment can be performed to determine whether it is more likely than not the fair value of the reporting unit is less than its carrying value. If the reporting unit does not pass the qualitative assessment, we compare the fair value of each reporting unit to its carrying value using a quantitative assessment. If the fair value of the reporting unit exceeds its carrying value, goodwill is considered not impaired. If the fair value of the reporting unit is less than the carrying value, the difference is recorded as an impairment loss.

For the quantitative assessment, we estimate the fair value of each reporting unit using a combination of an income approach using a discounted cash flow ("DCF") analysis and a market-based valuation approach based on comparable public company trading values. Determining the fair value of a reporting unit requires the exercise of significant management judgments, including the amount and timing of projected future revenues, earnings and cash flows after considering factors such as recent operating performance, general market and industry conditions, existing and expected future contracts, changes in working capital and long-term business plans and growth initiatives. The carrying value of each reporting unit includes the assets and liabilities employed in its operations and goodwill. There are no significant allocations of amounts held at the corporate level to the reporting units.

Based on our annual goodwill impairment analysis we performed in the fourth quarter of 2019, the fair value of our reporting units more likely than not exceed the carrying values.

Research, Development and Engineering

Research, development and engineering expense not related to contract performance are expensed as incurred. We expensed \$7.5 million and \$3.8 million of non-contract related research, development and engineering expense for the year ended December 31, 2019 and 2018, respectively.

Impairment of Long-Lived Assets

We review our long-lived assets for impairment whenever events or changes in circumstances indicate that the carrying amount of an asset may not be recoverable. Recoverability of assets is measured by comparing the carrying amount of an asset to future undiscounted net cash flows expected to be generated by the asset. If such assets are considered to be impaired, the impairment to be recognized is measured by the amount by which the carrying amount of the assets exceeds their fair value. Assets to be disposed of by sale are reflected at the lower of their carrying amount or fair value less cost to sell.

Inventory

Inventory consists of finished goods, work in process and raw materials valued at the lower of cost (determined on the first-in, first-out basis) or net realizable value.

Net Income per Share

Basic per share data is computed by dividing net income attributable to common stockholders by the weighted average number of shares outstanding during the period. Diluted per share data is computed by dividing net income attributable to common stockholders by the weighted average shares outstanding during the period increased to include, if dilutive, the number of additional common share equivalents that would have been outstanding if potential common shares had been issued using the treasury stock method. Diluted per share data would also include the potential common share equivalents relating to convertible securities by application of the if-converted method.

The effect of 3.2 million and 4.9 million common stock equivalents are included for the diluted per share data for the year ended December 31, 2019 and 2018, respectively. Accrued stock dividends and stock options are included in our common stock equivalents for the year ended December 31, 2019, while preferred stock is also included for the year ended December 31, 2018.

Stock-Based Compensation

We have two stock-based compensation plans, which are described further in Note 11. We recognize compensation expense based upon the fair value of the underlying equity award as of the date of grant. We have elected to use the Black-Scholes option pricing model to value any stock options granted. Restricted stock and restricted stock units awarded are valued at the closing price of our common stock on the date of the award. We recognize stock-based compensation for such awards on a straight-line method over the requisite service period of the awards taking into account the effects of the expected exercise. We reduce stock-based compensation expense for the value of any forfeitures of unvested awards as such forfeitures occur.

Advertising

We expense the cost of advertising as incurred. Advertising expenses were \$0.1 million for each of the years ended December 31, 2019 and 2018.

Income Taxes

We account for income taxes using the liability method. Deferred tax assets or liabilities are determined based on the difference between the financial statement and tax basis of assets and liabilities as measured by the enacted tax rates, which will be in effect when the differences reverse. A valuation allowance against net deferred tax assets is provided unless we conclude it is more likely than not that the deferred tax assets will be realized.

We recognize deferred tax assets and liabilities for the expected future tax consequences of temporary differences between the financial statement carrying amounts of existing assets and liabilities and their respective tax bases. Deferred tax assets and liabilities are measured using enacted tax rates in effect for the year in which those temporary differences are expected to be recovered or settled. We evaluate our ability to benefit from all deferred tax assets and establish valuation allowances for amounts we believe are not more-likely-than-not to be realizable. For uncertain tax positions, we use a more-likely-than-not threshold, 51% or greater, based on the technical merits of the income tax position taken. Income tax positions that meet the more-likely-than-not recognition threshold are measured in order to determine the tax benefit recognized in the financial statements. Penalties, if probable and reasonably estimable, and interest expense related to uncertain tax positions are recognized as a component of the tax provision.

Recently Issued Accounting Pronouncements

In February 2016, the Financial Accounting Standards Board ("FASB") issued a new standard related to Leases, Accounting Standards Update ("ASU") No. 2016-02, *Leases (Topic 842)* and subsequent amendments, based on previously defined GAAP, and requires lessees to recognize right-of-use ("ROU") assets and lease liabilities on the balance sheet for those leases classified as operating leases for greater transparency. We, using a modified retrospective adoption approach, are required to recognize and measure leases existing at the beginning of the adoption period, with certain practical expedients available.

We adopted the standard effective January 1, 2019. The standard allows a number of optional practical expedients to use for transition. We chose the certain practical expedients allowed under the transition guidance which permitted us to not to reassess any existing or expired contracts to determine if they contain embedded leases, to not reassess our lease classification on existing leases, to account for lease and non-lease components as a single lease component for equipment leases, and whether initial direct costs previously capitalized would qualify for capitalization under FASB ASC 842. The new standard also provides practical expedients and recognition exemptions for an entity's ongoing accounting policy elections. We have elected the short-term lease recognition for all leases that qualify, which means that we do not recognize a ROU asset and lease liability for any lease with a term of twelve months or less.

The most significant impact of adopting the standard was the recognition of ROU assets and lease liabilities for operating leases on our consolidated balance sheet but it did not have an impact on our consolidated statements of operations or consolidated statements of cash flows. Upon the adoption of the new lease standard on January 1, 2019, we recorded the following adjustments:

	Balance at December 31, 2018	Adjustment for ASC 842	Adjusted balance at January 1, 2019
Assets:			
Property and equipment, net	\$ 3,627,886	\$ (90,494)	\$ 3,537,392
Other assets, net	1,995	3,536,133	3,538,128
Liabilities:			
Accrued liabilities	6,597,458	1,242,669	7,840,127
Current portion of capital lease obligations	40,586	(40,586)	—
Long-term deferred rent	1,035,974	(1,035,974)	—
Long-term operating lease liability	—	3,271,705	3,271,705
Long-term capital lease obligations	68,978	(68,978)	—
Long-term finance lease liability	—	76,803	76,803

Recently Issued Pronouncements not yet adopted

In June 2016, the FASB issued ASU 2016-13: *Financial Instruments - Credit Losses (Topic 326) - Measurement of Credit Losses on Financial Instruments*. The ASU requires companies to measure credit losses by using a methodology that reflects the expected credit losses based on historical information current economic conditions, and reasonable and supportable information. This standard was amended under ASU 2019-10 to allow an extension on the adoption date for entities that qualify as a small reporting company. We have elected this extension and the effective date for us to adopt this standard will be for fiscal years beginning after December 15, 2022. We do not expect the adoption of ASU 2016-13 to have a significant impact on our consolidated financial statements.

In January 2017, the FASB issued ASU 2017-04: *Simplifying the Test for Goodwill Impairment*, which simplifies the test for goodwill impairment. The guidance is effective for us beginning in the first quarter of fiscal year 2020. Early adoption is permitted for interim or annual goodwill impairments tests after January 1, 2017. We have assessed the impact of adopting ASU 2017-04 and the adoption on January 1, 2020 should not have a significant impact on our consolidated financial statements.

In August 2018, the FASB issued ASU No. 2018-13 *Fair Value Measurement (Topic 820): Changes to the Disclosure Requirements for Fair Value Measurement*, which amends the disclosure requirements in ASC 820 by adding, changing, or

removing certain disclosures. The ASU applies to all entities that are required under this guidance to provide disclosures about recurring or nonrecurring fair value measurements. These amendments are effective for us beginning in the first quarter of fiscal year 2020. Early adoption is permitted. We have assessed the impact of adopting ASU 2018-13 and the adoption on January 1, 2020 should not have a significant impact on our consolidated financial statements.

In August 2018, the FASB issued ASU 2018-15 *Customer's Accounting for Implementation Costs Incurred in a Cloud Computing Arrangement That is a Service Contract*, which aligns the requirements for capitalizing implementation costs incurred in a hosting arrangement that is a service contract with the requirements for capitalizing implementation costs incurred to develop or obtain internal-use software. The guidance is effective for us beginning in the first quarter of fiscal year 2020. Early adoption is permitted. We have assessed the impact of adopting ASU 2018-15 and the adoption on January 1, 2020 should not have a significant impact on our consolidated financial statements.

In December 2019, the FASB issued ASU 2019-12 *Simplifying the Accounting for Income Taxes*, which removes certain exceptions to the general principles of the accounting for income taxes and also improves consistent application of and simplification of other areas when accounting for income taxes. The guidance is effective for us beginning in the first quarter of fiscal year 2021. Early adoption is permitted. We do not expect the adoption of ASU 2019-12 will have a significant impact on our consolidated financial statements.

2. Business Acquisitions

Micron Optics, Inc.

On October 15, 2018, we acquired substantially all of the assets, other than cash, of the United States operations of Micron Optics, Inc. ("MOI") for cash consideration of \$5.5 million. For the year ended December 31, 2019, we recognized revenue of \$10.8 million and operating income of \$1.8 million associated with the acquired operations of MOI. For the period from the closing of the MOI acquisition through December 31, 2018, we recognized revenue of \$2.6 million and operating income of \$1.1 million.

General Photonics Corporation

On March 1, 2019, we acquired the outstanding stock of General Photonics Corporation ("GP") for cash consideration of \$19.0 million. Of the purchase price, \$17.1 million was paid at closing and \$1.9 million was placed into escrow for possible working capital adjustments to the purchase price and potential satisfaction of certain post-closing indemnification obligations. Additionally, we may become obligated to pay additional cash consideration of up to \$1.0 million if certain revenue targets for the GP historical business are met for the twelve-month period following the closing. We currently estimate the fair value of the contingent obligation to be \$1.0 million, which is shown in accrued liabilities on the consolidated balance sheet. The fair value of the contingent obligation was determined using the present value of estimated likely future payments.

For the period from the closing of the GP acquisition through December 31, 2019, we recognized revenue of \$10.5 million and operating income of \$1.4 million. Operating income for the period from the closing of the acquisition through December 31, 2019 included \$1.6 million in amortization expense for the acquired intangibles and step-up in value of acquired inventory associated with the acquisition of GP. Operating income for the year ended December 31, 2019 also included \$0.9 million of costs associated with the acquisition of GP. The amortization expense for the acquired intangibles as well as the costs associated with the acquisition of GP are included in the cost of goods sold and selling, general and administrative expense in our consolidated statements of operations.

These acquisitions have been accounted for under the acquisition method of accounting in accordance with ASC 805 - Business Combinations. Under ASC 805, the total estimated purchase consideration is allocated to the acquired tangible and intangible assets and assumed liabilities based on their estimated fair values as of the acquisition date. Any excess of the fair value of the acquisition consideration over the identifiable assets acquired and liabilities assumed is recognized as goodwill. We have completed our allocation of the purchase consideration for the MOI and GP acquisitions.

The following table summarizes the allocation of the purchase consideration of each acquisition:

	MOI		GP	
Accounts receivable	\$	1,742,693	\$	1,520,950
Inventory		1,435,606		2,698,000
Other current assets		69,951		763,873
Property and equipment		996,460		286,000
Identifiable intangible assets		1,650,000		8,200,000
Goodwill		29,760		10,511,916
Accounts payable and accrued expenses		(379,737)		(4,076,489)
Total purchase consideration	\$	5,544,733	\$	19,904,250

The identifiable intangible assets and their estimated useful lives were as follows:

	Estimated Useful Life	Estimated Fair Value	
		MOI	GP
Developed technology	5 - 8 years	\$ 1,200,000	\$ 7,200,000
In-process research and development	7 years	200,000	—
Trade names and trademarks	3 years	150,000	400,000
Customer base	7 - 15 years	100,000	600,000
		\$ 1,650,000	\$ 8,200,000

Developed technologies acquired primarily consist of MOI's technologies related to fiber optic sensing instruments, modules, and components and GP's technologies relating to the measurement and control of the polarization of light. The developed technologies were valued using the "multi-period excess earnings" method, under the income approach. The multi-period excess earnings method reflects the present value of the projected cash flows that are expected by the developed technologies less charges representing the contribution of other assets to those cash flows. Discount rates of 24.5% and 17% were used to discount these cash flows of MOI and GP, respectively, to present value.

In-process research and development represents the fair value of an incomplete MOI research and development project that had not reached technological feasibility as of the closing date of the acquisition. In the fourth quarter of 2019, the fair value of this project at the closing date of the acquisition will begin being amortized following the project's completion. The fair value of in process research and development was determined using the multi-period excess earnings method. A discount rate of 29.5% was used to discount these cash flows to the present value.

Customer base represents the fair value of projected cash flows that will be derived from the sale of products to existing customers of MOI and GP as of the respective closing dates of their acquisitions. Customer relationships were valued using the "distributor" method, under the income approach. Under this premise, the margin of a distributor within the industry is deemed to be the margin attributable to customer relationships. This isolates the cash flows attributable to the customer relationships for which a market participant would be willing to pay. Discount rates of 24.5% and 16% were used to discount these cash flows of MOI and GP, respectively, to present value.

Trade names and trademarks are considered a type of guarantee of a certain level of quality or performance represented by the MOI and GP brands. Trade names and trademarks were valued using the "relief from royalty" method of the income approach. This method is based on the assumption that in lieu of ownership, a market participant would be willing to pay a royalty in order to exploit the related benefits of this asset. Discount rates of 17% and 16% were used to discount these cash flows of MOI and GP, respectively, to the present value.

Goodwill represents the excess of consideration transferred over the net of the acquisition date fair values of the assets acquired and the liabilities assumed in connection with the acquisition. Goodwill generated from our business acquisitions was primarily attributable to expected synergies from future growth.

Pro forma consolidated results of operations

The following unaudited pro forma financial information presents combined results of operations for each of the periods presented as if the acquisitions of MOI and GP had been completed on January 1, 2018. The pro forma information includes adjustments to depreciation expense for property and equipment acquired and amortization expense for the intangible assets acquired and the elimination of transaction expenses recognized in each period. Transaction-related expenses associated with the acquisition and excluded from pro forma income from continuing operations were \$1.0 million for the year ended December 31, 2019. There were no transaction-related expenses associated with the acquisition for the year ended December 31, 2018. The pro forma data are for informational purposes only and are not necessarily indicative of the consolidated results of operations or the combined business had the acquisitions of MOI and GP occurred on January 1, 2018, or the results of future operations of the combined business. For instance, planned or expected operational synergies following the acquisition are not reflected in the pro forma information. Consequently, actual results will differ from the unaudited pro forma information presented below.

	Years Ended December 31,	
	2019	2018
	(unaudited)	(unaudited)
Revenue	\$ 72,576,902	\$ 60,249,896
Income from continuing operations	\$ 6,912,802	\$ 1,559,008

3. Accounts Receivable, net

Accounts receivable, net consist of the following:

	December 31,	
	2019	2018
Billed	\$ 17,193,742	\$ 13,289,790
Other	5,182	31,361
	17,198,924	13,321,151
Less: allowance for doubtful accounts	(930,279)	(284,083)
Accounts receivable, net	\$ 16,268,645	\$ 13,037,068

4. Property and Equipment, net

Property and equipment, net, consists of the following:

	December 31,	
	2019	2018
Building	\$ 69,556	\$ 69,556
Equipment	9,564,426	9,341,007
Furniture and fixtures	684,812	640,890
Software	1,178,210	1,122,231
Leasehold improvements	5,287,935	4,950,510
	16,784,939	16,124,194
Less—accumulated depreciation	(13,319,327)	(12,496,308)
Property and equipment, net	\$ 3,465,612	\$ 3,627,886

Depreciation for the years ended December 31, 2019 and 2018 was approximately \$1.0 million and \$0.5 million, respectively, and is included primarily in selling, general and administrative expense in our consolidated statements of operations.

5. Intangible Assets, net

Intangible assets, net consist of the following:

	Estimated Life	December 31,	
		2019	2018
Patent costs	1 - 18 years	\$ 5,291,245	\$ 4,991,460
Developed technology	5 years	9,800,000	2,600,000
In-process research and development	N/A	1,580,000	200,000
Customer base	7 years	700,000	100,000
Trade names	3 years	550,000	150,000
		17,921,245	8,041,460
Accumulated amortization		(7,726,768)	(4,739,190)
Intangible assets, net		\$ 10,194,477	\$ 3,302,270

Amortization for the years ended December 31, 2019 and 2018 was approximately \$1.6 million and \$0.4 million, respectively, and is included primarily in selling, general and administrative expense in our consolidated statements of operations.

Estimated aggregate amortization, based on the net value of intangible assets at December 31, 2019, for each of the next five years and beyond is as follows:

Year Ending December 31,	
2020	\$ 1,640,851
2021	1,660,112
2022	1,509,418
2023	1,437,195
2024	1,247,195
2025 and beyond	2,699,706
	\$ 10,194,477

We did not recognize any intangible asset impairment charges during the years ended December 31, 2019 or 2018.

6. Inventory

Inventory consists of finished goods, work-in-process and raw materials valued at the lower of cost (determined on the first-in, first-out basis) or net realizable value.

Components of inventory are as follows:

	December 31,	
	2019	2018
Finished goods	\$ 1,695,461	\$ 1,339,832
Work-in-process	1,007,719	643,420
Raw materials	7,591,251	4,890,490
Inventory, net	\$ 10,294,431	\$ 6,873,742

7. Goodwill

As of December 31, 2019, goodwill has been allocated to the Products and Licensing segment. The changes in the carrying value of goodwill during the year ended December 31, 2019 were as follows:

Balance as of December 31, 2018	\$	101,008
Goodwill resulting from business combination - GP		10,511,916
Measurement Period Adjustment - MOI		(71,248)
Balance as of December 31, 2019	\$	10,541,676

We concluded the carrying value of goodwill was not impaired as of December 31, 2019 as we determined that it was not more likely than not that the fair value of the reporting units was less than its carrying value.

8. Accrued Liabilities

Accrued liabilities consist of the following:

	December 31,	
	2019	2018
Accrued compensation	\$ 6,416,163	\$ 4,467,587
Contingent consideration - GP	1,000,000	—
Accrued professional fees	113,303	198,062
Accrued income tax	715,916	236,636
Deferred rent	—	146,542
Current operating lease liability	1,283,310	—
Current finance lease liability	50,307	—
Accrued royalties	364,951	302,428
Accrued liabilities-other	425,595	404,752
Working capital payable - MOI	—	542,983
Customer deposits	—	298,468
Total accrued liabilities	\$ 10,369,545	\$ 6,597,458

9. Debt

Silicon Valley Bank Facility

We maintained a Loan and Security Agreement with SVB (the "Credit Facility") under which we had a term loan with an original borrowing amount of \$6.0 million (the "Original Term Loan"). The Original Term Loan carried a floating annual interest rate equal to SVB's prime rate then in effect plus 2%. The Original Term Loan matured and was repaid in May 2019.

On October 10, 2019, we entered into an Amended and Restated Loan and Security Agreement (the "Loan Agreement") with SVB, which amended and restated in its entirety our previous Credit Facility. Under the Loan Agreement, SVB agreed to make advances available up to \$10.0 million (the "Revolving Line"). If we borrow from the Revolving Line, such borrowing would carry a floating annual interest rate equal to the greater of (i) the Prime Rate (as defined in the Loan Agreement) then in effect plus 1% or (ii) 6%. Amounts borrowed under the Revolving Line may be repaid and, prior to the Revolving Line Maturity Date (defined below), reborrowed. The Revolving Line terminates on October 10, 2020 (the "Revolving Line Maturity Date"), unless earlier terminated by us. No amounts have been borrowed under this Loan Agreement.

Amounts due under the Loan Agreement are secured by our assets, including all personal property, inventory and bank accounts; however, intellectual property is not secured under the Loan Agreement. The inventory used to secure the amount due does not include demo or loaner equipment with an aggregate book value up to \$1.0 million. The Loan Agreement requires us to observe a number of financial and operational covenants, including maintenance of a specified Liquidity Coverage Ratio (as defined in the Loan Agreement), protection and registration of intellectual property rights and customary negative covenants. If any event of default occurs SVB may declare due immediately all borrowings under the Credit Facility and foreclose on the collateral. Furthermore, an event of default under the Credit Facility would result in an increase in the interest rate on any amounts outstanding. As of December 31, 2019, there were no events of default on the Credit Facility.

Interest expense, net for the years ended December 31, 2019 and 2018 consisted of the following:

	Years ended December 31,	
	2019	2018
Interest expense on Term Loans	\$ 8,073	\$ 101,087
Amortization of debt issuance costs	5,685	16,308
Other interest expense	2,120	6,949
Total interest expense, net	\$ 15,878	\$ 124,344

10. Leases

We have operating leases for our facilities, which have remaining terms ranging from 1 to 5 years. Our leases do not have an option to extend the lease period beyond the stated term unless the new term is agreed by both parties. They also do not have an early termination clause included. Our operating lease agreements do not contain any material restrictive covenants. Some of our operating lease agreements contain variable payment provisions that provide for rental increases based on consumer price indices. The change in rent expense resulting from changes in these indices are included within variable rent.

We also have finance leases for equipment which have remaining terms ranging from 1 to 4 years. These lease agreements are for general office equipment with a 5-year useful life. These lease agreements do not have an option to extend the lease beyond the stated terms nor do they have an early termination clause. These lease agreements do not have any variable payment provisions included. The finance lease costs consist of interest expense and amortization, and are included primarily in selling, general and administrative expense in our consolidated statement of operations.

The discount rate for both our operating and finance leases was not readily determinable in the specific lease agreements. As a result, our incremental borrowing rate was used as the discount rate when establishing the ROU assets and corresponding lease liabilities.

As of December 31, 2019, our lease components included in the consolidated balance sheet were as follows:

Lease component	Classification	December 31, 2019	
Assets			
ROU assets - operating lease	Other assets	\$	2,235,731
ROU assets - finance lease	Other assets		70,183
Total ROU assets		\$	2,305,914
Liabilities			
Current operating lease liability	Accrued liabilities	\$	1,283,310
Current finance lease liability	Accrued liabilities		50,307
Long-term operating lease liability	Other liabilities		1,988,395
Long-term finance lease liability	Other liabilities		23,092
Total lease liabilities		\$	3,345,104

Rent expense is recognized on a straight-line basis over the life of the lease. Rent expense consists of the following:

	Year Ended	
	December 31, 2019	
Operating lease costs	\$	1,622,476
Variable rent costs		(146,542)
Total rent expense	\$	1,475,934

Future minimum lease payments under non-cancelable operating leases were as follows as of December 31, 2019:

Year Ending December 31,	
2020	\$ 1,467,701
2021	640,800
2022	544,704
2023	544,704
2024 and beyond	544,704
Total future minimum lease payments	3,742,613
Less: Interest	470,908
Total operating lease liabilities	\$ 3,271,705
Current operating lease liability	\$ 1,283,310
Long-term operating lease liability	1,988,395
Total operating lease liabilities	\$ 3,271,705

Future minimum lease payments under non-cancelable finance leases were as follows as of December 31, 2019:

Year Ending December 31,		
2020	\$	56,020
2021		10,710
2022		10,083
2023		5,042
2024 and beyond		—
Total future minimum lease payments		81,855
Less: Interest		8,456
Total finance lease liabilities	\$	73,399
Current finance lease liability	\$	50,307
Long-term finance lease liability		23,092
Total finance lease liabilities	\$	73,399

Other information related to leases is as follows:

	Year Ended	
	December 31, 2019	
Finance lease cost:		
Amortization of right-of-use assets	\$	46,498
Interest on lease liabilities		4,926
Total finance lease cost	\$	51,424
Other information:		
Cash paid for amounts included in the measurement of lease liabilities:		
Operating cash flows from operating leases	\$	1,622,476
Finance cash flows from finance leases	\$	40,047
Right-of-use assets obtained in exchange for new finance lease liabilities	\$	14,541
Weighted-average remaining lease term (years) - operating leases		3.7
Weighted-average remaining lease term (years) - finance leases		2.1
Weighted-average discount rate - operating leases		7%
Weighted-average discount rate - finance leases		7%

At December 31, 2019, we had no operating or finance leases that have not yet commenced.

Prior to the adoption of ASC 842, lease expense of approximately \$1.0 million was recognized in our consolidated statement of operations for the year ended December 31, 2018.

11. Stockholders' Equity

Series A Convertible Preferred Stock

In January 2010, we entered into a transaction with Carilion, in which Carilion agreed to exchange all of its Senior Convertible Promissory Notes with an original principal amount of \$5.0 million plus all accrued but unpaid interest, totaling \$1.2 million, for 1,321,514 shares of our newly designated Series A Convertible Preferred Stock. The Series A Convertible

Preferred Stock is non-voting, carries a dividend of 6% payable in shares of common stock and maintains a liquidation preference up to \$6.2 million. In September 2019, Carilion elected to convert the 1,321,514 shares of preferred stock into an equal number of shares of our common stock. In addition, we issued 770,454 shares of our common stock in satisfaction of the accrued dividends earned on the preferred stock prior to its conversion.

Equity Incentive Plans

In April 2016, we adopted our 2016 Equity Incentive Plan (the "2016 Plan") as a successor to the 2006 Plan. Under the 2016 Plan, our Board of Directors is authorized to grant both incentive and non-statutory stock options to purchase common stock and restricted stock awards to our employees, directors, and consultants. The 2016 Plan provides for the issuance of 3,500,000 shares plus any amounts forfeited from grants under the 2006 Plan after the expiration date of the 2006 Plan. Options generally have a life of 10 years and exercise price equal to or greater than the fair market value of the Common Stock as determined by the Board of Directors. Vesting typically occurs over a four-year period.

The following table sets forth the activity of the options to purchase common stock under the 2006 Plan and the 2016 Plan. The prices represent the closing price of our Common Stock on the Nasdaq Capital Market on the respective dates.

	Options Outstanding				Options Exercisable		
	Number of Shares	Price per Share Range	Weighted Average Exercise Price	Aggregate Intrinsic Value (1)	Number of Shares	Weighted Average Exercise Price	Aggregate Intrinsic Value (1)
Balance at January 1, 2018	2,714,561	\$0.61 - 6.55	\$ 1.88	\$ 2,098,195	2,590,030	\$ 1.89	\$ 2,013,034
Forfeited	(675,607)	\$1.15 - 6.55	1.90				
Exercised	(96,425)	\$0.65 - 2.46	2.07				
Granted	1,166,339	\$2.67 - 3.53	3.09				
Balance at December 31, 2018	3,108,868	\$0.61 - 6.55	\$ 2.26	\$ 3,669,794	1,986,740	\$ 1.81	\$ 3,314,494
Forfeited	(14,707)	\$1.47 - 3.37	2.51				
Exercised	(558,834)	\$0.61 - 1.81	1.21				
Granted	625,070	\$3.21 - 7.37	3.63				
Balance at December 31, 2019	3,160,397	\$1.18 - 7.37	\$ 2.72	\$ 14,459,884	1,835,799	\$ 2.28	\$ 9,197,775

(1) The intrinsic value of an option represents the amount by which the market value of the stock exceeds the exercise price of the option of in-the-money options only.

The fair value of each option granted is estimated as of the grant date using the Black-Scholes option pricing model with the following assumptions:

	Years ended December 31,	
	2019	2018
Risk-free interest rate range	2.5%	3.04%
Expected life of option-years	7	7
Expected stock price volatility	65%	67%
Expected dividend yield	—%	—%

The risk-free interest rate is based on U.S. Treasury interest rates, the terms of which are consistent with the expected life of the stock options. Expected volatility is based upon the average historical volatility of our common stock over the period commensurate with the expected term of the related instrument. The expected life and estimated post-employment termination behavior is based upon historical experience of homogeneous groups, executives and non-executes, within our company. We do not currently pay dividends on our common stock nor do we expect to in the foreseeable future.

	Options Outstanding				Options Exercisable		
	Range of Exercise Prices	Options Outstanding	Weighted Average Remaining Life in Years	Weighted Average Exercise Price	Options Exercisable	Weighted Average Remaining Life in Years	Weighted Average Exercise Price of Options Exercisable
Year ended December 31, 2018	\$0.61 - 6.55	3,108,868	5.72	\$2.26	1,986,740	3.46	\$1.81
Year ended December 31, 2019	\$1.18 - 7.37	3,160,397	6.24	\$2.72	1,835,799	4.30	\$2.28
					Total Intrinsic Value of Options Exercised		Total Fair Value of Options Vested
Year ended December 31, 2018					\$ 112,213	\$	2,980,110
Year ended December 31, 2019					\$ 1,641,687	\$	3,267,672

For the years ended December 31, 2019 and 2018, the weighted average grant date fair value of options granted was \$2.32 and \$2.07 per share, respectively. We estimate the fair value of options at the grant date using the Black-Scholes model. For all stock options granted through December 31, 2019, the weighted average remaining service period is 3.4 years.

Unamortized stock option expense at December 31, 2019 that will be amortized over the weighted-average remaining service period of 2.9 years totaled \$2.8 million.

Restricted Stock and Restricted Stock Units

Historically, we have granted shares of restricted stock to certain employees that have vested in three equal annual installments on the anniversary dates of their grant. However, beginning in 2019, we altered our approach for these grants to replace the grant of restricted stock subject to time-based vesting with the grant of a combination of restricted stock units ("RSUs") subject to time-based vesting and performance-based vesting. Each RSU represents the contingent right to receive a single share of our common stock upon the vesting of the award. For the year ended December 31, 2019, we granted an aggregate of 280,000 RSUs to certain employees. Of the RSUs granted during 2019, 217,000 of such RSUs are subject to time-based vesting and are scheduled to vest in three equal annual installments on the anniversary dates of the grant. The remaining 63,000 RSUs are performance-based awards that will vest based on our achievement of long-term performance goals, in particular, based on our levels of 2021 revenue and operating income. The 63,000 shares issuable upon vesting of the performance-based RSUs represent the maximum payout under our performance-based awards, based upon 150% of our target performance for 2021 revenue and operating income (the payout of such awards based on target performance for 2021 revenue and operating income would be 42,000 shares). In the case of the time-based and performance-based RSUs, vesting is also subject to the employee's continuous service with us through vesting. In 2018, we granted 280,000 shares of restricted stock to certain employees. Shares issued to employees vest in three equal annual installments on the anniversary dates of their grant. In 2019 and 2018, 194,333 and 182,500 shares of restricted stock vested, respectively.

In addition, in conjunction with our 2018 and 2019 Annual Meetings of Stockholders, we granted RSUs to certain members of our Board of Directors in respect of the annual equity compensation under our non-employee director compensation policy (other members of our Board of Directors elected to receive their annual equity compensation for Board service in the form of stock units under our Deferred Compensation Plan as described below). In 2019 and 2018, we granted 11,600 and 16,286, respectively, RSUs to members of our Board of Directors in respect of the annual equity compensation under our non-employee director compensation policy. RSUs issued to our Board of Directors vest at the earlier of the one-year anniversary of their grant or the next annual stockholders' meeting. In 2019 and 2018, 16,286 and 129,865 RSUs, respectively, vested.

The following table summarizes our aggregate restricted stock awards and RSU activity in 2019 and 2018:

	Number of Unvested Shares	Weighted Average Grant Date Fair Value	Aggregate Grant Date Fair Value of Unvested Shares
Balance at January 1, 2017	489,698	\$1.51	\$ 738,345
Granted	296,287	\$3.07	\$ 909,600
Vested	(312,365)	\$1.45	\$ (454,339)
Forfeitures	(15,000)	\$1.41	\$ (21,150)
Balance at December 31, 2018	458,620	\$2.56	\$ 1,172,456
Granted	291,600	\$3.75	\$ 1,094,430
Vested	(210,619)	\$2.33	\$ (490,769)
Forfeitures	(37,499)	\$2.96	\$ (111,115)
Balance at December 31, 2019	502,102	\$3.32	\$ 1,665,002

We recognized \$1.5 million and \$0.6 million in stock-based compensation expense, which is recorded in selling, general and administrative expense on the consolidated statement of operations for the years ended December 31, 2019 and 2018, respectively, and we will recognize \$4.0 million over the remaining requisite service period for unamortized restricted stock, RSUs and stock options.

Unamortized restricted stock and RSUs expense at December 31, 2019 that will be amortized over the weighted-average remaining service period of 2 years totaled \$1.2 million.

Non-employee Director Deferred Compensation Plan

We maintain a non-employee director deferred compensation plan (the “Deferred Compensation Plan”) that permits our non-employee directors to defer receipt of certain compensation that they receive for serving on our board and board committees. The Deferred Compensation Plan has historically permitted the participants to elect to defer cash fees to which they were entitled for board and committee service. For participating directors, in lieu of payment of cash fees, we credit their accounts under the Deferred Compensation Plan with a number of stock units based on the trading price of our common stock as of the date of the deferral. These stock units vest immediately, although the participating directors do not receive the shares represented by such units until a future qualifying event.

In December 2017, we amended and restated our Deferred Compensation Plan to also permit participants to defer the annual equity compensation for board service (which would otherwise be issued in the form of restricted stock units) under our non-employee director compensation policy. For participating directors, we credit their accounts under the Deferred Compensation Plan with a number of stock units based on the trading price of our common stock as of the date of the deferral. These stock units are vested upon the earlier of the one-year anniversary date of the grant or next annual meeting of stockholders, although the participating directors do not receive the shares represented by such units until a future qualifying event. A summary of stock unit activity under the Deferred Compensation Plan for 2019 and 2018 is as follows.

	Number of Stock Units	Weighted Average Grant Date Fair Value per Share	Intrinsic Value Outstanding
January 1, 2018	466,702	\$1.40	\$ 1,134,086
Granted	40,588	\$2.99	
December 31, 2018	507,290	\$1.40	\$ 1,699,422
Granted	121,713	\$4.41	
December 31, 2019	629,003	\$2.09	\$ 4,585,432

As of December 31, 2019, 37,546 of the outstanding stock units had not yet vested.

Stock Repurchase Program

In September 2017, our board of directors authorized a new stock repurchase program providing for the repurchase of up to \$2.0 million of our common stock through September 19, 2018. Our stock repurchase program did not obligate us to acquire any specific number of shares. Under the program, shares may be repurchased in privately negotiated or open market transactions, including under plans complying with Rule 10b5-1 under the Securities Exchange Act of 1934, as amended. As of September 19, 2018, we had repurchased a total of 565,629 shares, respectively, for an aggregate purchase price of \$1.1 million under this stock repurchase program. We currently maintain all repurchased shares under these stock repurchase programs as treasury stock.

In August 2019, our board of directors authorized a new stock repurchase program which allowed us to repurchase up to \$2.0 million of our common stock through August 2020. As of September 30, 2019, we had repurchased a total of 333,953 shares for an aggregate purchase price of \$2.0 million under this new stock repurchase program, and accordingly the program expired. We currently maintain all repurchased shares under this stock repurchase program as treasury stock.

12. Revenue Recognition

Our operations are divided into two operating segments—"Products and Licensing" and "Technology Development".

The Products and Licensing segment derives its revenues from product sales, funded product development and technology licenses.

The Technology Development segment provides applied research to customers in our areas of focus. Our engineers and scientists collaborate with our network of government, academic and industry experts to identify technologies and ideas with promising market potential. We then compete to win fee-for-service contracts from government agencies and industrial customers who seek innovative solutions to practical problems that require new technology. The Technology Development segment derives its revenues primarily from services.

Disaggregation of Revenue

We disaggregate our revenue from contracts with customers by geographic locations, customer-type, contract type, timing of recognition, and major categories for each of our segments, as we believe it best depicts how the nature, amount, timing and uncertainty of our revenue and cash flows are affected by economic factors.

The details are listed in the table below for the years ended December 31, 2019 and 2018:

	Years ended December 31,					
	2019			2018		
	Products and Licensing	Technology Development	Total	Products and Licensing	Technology Development	Total
Total Revenue by Geographic Location						
United States	\$ 21,782,692	\$ 26,024,674	\$ 47,807,366	\$ 11,585,296	\$ 20,967,556	\$ 32,552,852
Asia	13,669,304	—	13,669,304	5,977,563	—	5,977,563
Europe	7,277,234	—	7,277,234	3,873,161	—	3,873,161
Canada, Central and South America	1,432,082	—	1,432,082	382,797	—	382,797
All Others	329,729	—	329,729	130,872	—	130,872
Total	\$ 44,491,041	\$ 26,024,674	\$ 70,515,715	\$ 21,949,689	\$ 20,967,556	\$ 42,917,245
Total Revenue by Major Customer Type						
Sales to the U.S. government	\$ 2,601,069	\$ 25,377,961	\$ 27,979,030	\$ 1,834,289	\$ 20,703,338	\$ 22,537,627
U.S. direct commercial sales and other	19,181,625	646,713	19,828,338	9,737,720	264,218	10,001,938
Foreign commercial sales & other	22,708,347	—	22,708,347	10,377,680	—	10,377,680
Total	\$ 44,491,041	\$ 26,024,674	\$ 70,515,715	\$ 21,949,689	\$ 20,967,556	\$ 42,917,245
Total Revenue by Contract Type						
Fixed-price contracts	\$ 44,491,041	\$ 14,111,092	\$ 58,602,133	\$ 21,949,689	\$ 9,388,770	\$ 31,338,459
Cost-type contracts	—	11,913,582	11,913,582	—	11,578,786	11,578,786
Total	\$ 44,491,041	\$ 26,024,674	\$ 70,515,715	\$ 21,949,689	\$ 20,967,556	\$ 42,917,245
Total Revenue by Timing of Recognition						
Goods transferred at a point in time	\$ 43,129,361	\$ —	\$ 43,129,361	\$ 21,330,000	\$ —	\$ 21,330,000
Goods/services transferred over time	1,361,680	26,024,674	27,386,354	619,689	20,967,556	21,587,245
Total	\$ 44,491,041	\$ 26,024,674	\$ 70,515,715	\$ 21,949,689	\$ 20,967,556	\$ 42,917,245
Total Revenue by Major Products/Services						
Technology development	\$ —	\$ 26,024,674	\$ 26,024,674	\$ —	\$ 20,967,556	\$ 20,967,556
Test, measurement and sensing systems	41,787,613	—	41,787,613	19,641,434	—	19,641,434
Other	2,703,428	—	2,703,428	2,308,255	—	2,308,255
Total	\$ 44,491,041	\$ 26,024,674	\$ 70,515,715	\$ 21,949,689	\$ 20,967,556	\$ 42,917,245

Contract Balances

Our contract assets consist of unbilled amounts for technology development contracts as well as custom product contracts. Also included in contract assets are royalty revenue and carrying amounts of right of returned inventory. Long-term contract assets include the fee withholding on cost reimbursable contracts that will not be billed within a year. Contract liabilities include excess billings, subcontractor accruals, warranty expense, extended warranty revenue, right of return refund, and customer deposits. The net contract (liabilities)/assets changed by \$1.0 million, due primarily to increased contract liabilities in addition to a slight increase in contract assets. The increase in contract liabilities is a result of the increased number of government research programs in addition to an increase in the number of our fixed-price contracts that have reached milestones as designated in their respective contracts, but revenue has not yet been recognized. The increase in contract assets is primarily driven by the unbilled fee required by our cost-reimbursable government contracts, which cannot be fully billed until after the specific contract is complete.

The following table shows the components of our contract balances as of December 31, 2019 and 2018:

	December 31,	
	2019	2018
Contract assets	\$ 3,208,206	\$ 2,759,315
Contract liabilities	(3,887,685)	(2,486,111)
Net contract assets	\$ (679,479)	\$ 273,204

Performance Obligations

Unfulfilled performance obligations represent amounts expected to be earned on executed contracts. Indefinite delivery and quantity contracts and unexercised options are not reported in total unfulfilled performance obligations. Unfulfilled performance obligations include funded obligations, which is the amount for which money has been directly authorized by the U.S. government and for which a purchase order has been received by a commercial customer, and unfunded obligations represent firm orders for which funding has not yet been appropriated. The approximate value of our Products and Licensing segment's unfulfilled performance obligations was \$16.1 million at December 31, 2019. We expect to satisfy 63% of the performance obligations in 2020, 13% in 2021 and the remainder by 2024. The approximate value of our Technology Development segment's unfulfilled performance obligations was \$31.3 million at December 31, 2019. We expect to satisfy 70% of the performance obligations in 2020, 24% in 2021 and the remainder by 2022.

13. Income Taxes

Income tax (benefit)/expense from continuing operations consisted of the following for the periods indicated:

	Years ended December 31,	
	2019	2018
Current:		
Federal	\$ 1,466,770	\$ (44,727)
State	227,912	92,545
Deferred federal	(2,849,371)	—
Deferred state	(499,661)	—
Income tax (benefit)/expense	\$ (1,654,350)	\$ 47,818

Deferred tax assets and liabilities consist of the following components:

	December 31, 2019	December 31, 2018
	Long-Term	Long-Term
Bad debt and inventory reserve	\$ 376,331	\$ 332,721
Inventory adjustment	—	(21,785)
UNICAP	4,828	2,804
Deferred revenue	130,058	115,676
ASC842 Lease Accounting (DTA)	796,864	288,017
ASC842 Lease Accounting (DTL)	(544,539)	—
Depreciation and amortization	(2,134,569)	(838,540)
Net operating loss carryforwards- Luna	349,421	349,421
Net operating loss carryforwards- API	1,169,671	1,265,538
Net operating loss carryforwards - state	150,050	179,149
Net operating loss carryforwards- Canada	10,503	10,503
Accrued liabilities	594,450	394,118
Deferred compensation	294,190	216,944
Stock-based compensation	373,658	803,757
Restricted stock	102,741	60,681
State bonus	33,791	44,861
Performance based compensation	9,499	—
Transaction costs	58,540	63,668
Total	1,775,487	3,267,533
Valuation allowance	(359,924)	(3,267,533)
Net deferred tax asset	\$ 1,415,563	\$ —

The net deferred tax asset is included in other non-current assets on the consolidated balance sheet.

The (benefit)/expense from income taxes from continuing operations differs from the amount computed by applying the federal statutory income tax rate to our loss from continuing operations before income taxes as follows for the periods indicated:

	Years ended December 31,	
	2019	2018
Income tax expense at federal statutory rate	21.00 %	21.00 %
State taxes, net of federal tax effects	(8.67)%	— %
Change in valuation allowance	(67.39)%	(27.65)%
Incentive stock options	(1.75)%	(1.05)%
Provision to return adjustments	7.26 %	21.24 %
Meals and entertainment	0.50 %	0.97 %
AMT credit	— %	(9.83)%
Other permanent differences	4.20 %	(0.88)%
Income tax (benefit)/expense	(44.85)%	3.80 %

The realization of our deferred income tax assets is dependent upon sufficient taxable income in future periods. In assessing whether deferred tax assets may be realized, we consider whether it is more likely than not that some portion, or all,

of the deferred tax asset will be realized. We consider scheduled reversals of deferred tax liabilities, projected future taxable income and tax planning strategies that we can implement in making our assessment. We have net operating loss ("NOL") carryforwards of approximately \$6.0 million for API expiring at varying dates through 2035.

In 2015, we performed a formal Section 382 study and determined that we do not have a limitation on our NOLs available to offset future income. As a result of the acquisition of API, the API NOL carryover and research and development credits will be subject to the Section 382 limitation. A formal Section 382 study was prepared in 2019, and it was determined that there was no ownership changes in 2019 resulting in a limitation on NOLs, but a portion of the NOLs will expire unutilized.

The U.S. federal statute of limitations remains open for the year 2016 and onward. We currently have no federal income tax returns under examination. U.S. state jurisdictions have statutes of limitation generally ranging from three to seven years. We currently have no state income or franchise tax returns under examination. We currently do not file tax returns in any foreign tax jurisdiction other than Canada.

As of December 31, 2019, we are no longer in a three-year cumulative loss position, which required additional analysis to be performed in order to determine the likelihood of realizing the deferred tax assets in the foreseeable future. After further analysis, it was determined that a portion of the December 31, 2019 balance of deferred tax assets will be realized. Because the NOLs carried over from API are limited under Section 382, the deferred tax asset of \$1.2 million is expected to be realized over an extended period of time (with continued earnings realized ratably through 2034). The deferred tax asset related to the NOL carryovers of API Canada, Luna Analytics, Luna Nanomaterials, and Luna Quest will likely not be realized in the foreseeable future as these entities no longer have any activity. As of December 31, 2019, valuation allowances of \$3.3 million were released and a tax benefit has been recognized in our consolidated statement of operations.

14. Commitments and Contingencies

Litigation and other contingencies

From time to time, we may become involved in litigation in relation to claims arising out of our operations in the normal course of business. While management currently believes it is not reasonably possible the amount of ultimate liability, if any, with respect to these actions will have a material adverse effect on our financial position, results of operations or liquidity, the ultimate outcome of any litigation is uncertain.

In December 2018, we received a notice of claim (the "Claim") from Macom Technology Solutions, Inc. ("Macom"), who acquired our HSOR business in August 2017 pursuant to an asset purchase agreement. Under the asset purchase agreement, we agreed to indemnify Macom for certain matters, including, among other things, the collection of accounts receivable from certain major customers, and placed \$4.0 million of the purchase price into an escrow account for the potential settlement of any valid indemnity claims. The Claim received from Macom totaled \$2.1 million under various indemnity provisions. We have disputed Macom's assertion of right to payment for the matters described in the Claim. It is uncertain what amount, if any, will be owed in settlement of the Claim. As of December 31, 2019, \$1.5 million of the escrow balance had been received with the remaining \$2.5 million in the escrow account pending resolution of the dispute.

On July 31, 2018, we sold the assets associated with our optoelectronic components and sub-assemblies ("Opto") business to an unaffiliated third party. The asset purchase agreement provides for additional consideration of up to \$1.0 million contingent upon the achievement of a specified revenue level by the sold business during the 18 months following the sale. There have been no amounts recorded in reference to the above matter in the financial statements as of December 31, 2019. It is uncertain what amount, if any, will be received with respect to this potential adjustment.

We have made, and will continue to make, efforts to comply with current and future environmental laws. We anticipate that we could incur additional capital and operating costs in the future to comply with existing environmental laws and new requirements arising from new or amended statutes and regulations. In addition, because the applicable regulatory agencies have not yet promulgated final standards for some existing environmental programs, we cannot at this time reasonably estimate the cost for compliance with these additional requirements. The amount of any such compliance costs could be material. We cannot predict the impact that future regulations will impose upon our business.

Obligation under Operating Leases

See Note 10 - Leases for discussion of our lease obligations.

Purchase Commitment

We executed a non-cancelable purchase order totaling \$1.1 million in the first quarter of 2018 and a non-cancelable purchase order totaling \$1.9 million in the third quarter of 2019 for multiple shipments of tunable lasers to be delivered over an 18-month period. At December 31, 2019, approximately \$1.3 million of these commitments remained and is expected to be delivered by December 31, 2020.

Royalty Agreement

We have licensed certain third-party technologies from vendors for which we owe minimum royalties aggregating \$0.2 million payable over the remaining patent terms of the underlying technology.

15. Employee Profit Sharing Plan

We maintain a salary reduction/profit-sharing plan under provisions of Section 401(k) of the Internal Revenue Code. The plan is offered to all permanent employees. We contribute 30% of the salary deferral elected by each employee up to a maximum deferral of 10% of annual salary.

We contributed approximately \$0.4 million and \$0.3 million to the plan for the years ended December 31, 2019 and December 31, 2018, respectively.

16. Relationship with Major Customers

During the years ended December 31, 2019 and 2018, approximately 40% and 53%, respectively, of our consolidated revenues were attributable to contracts with the U.S. government.

At December 31, 2019 and 2018, receivables with respect to contracts with the U.S. government represented 12% and 23% of total trade receivables, respectively.

17. Financial Information About Segments

Our operations are divided into two reportable segments: Products and Licensing and Technology Development. The Products and Licensing segment develops and sells products or licenses technologies based on commercially viable concepts developed by the Technology Development segment. The Products and Licensing segment derives its revenue from product sales, funded product development and technology licenses.

Our engineers and scientists collaborate with our network of government, academic and industry experts to identify technologies and ideas with promising market potential. We then compete to win fee-for-service contracts from government agencies and industrial customers who seek innovative solutions to practical problems that require new technology. The Technology Development segment derives its revenue primarily from services. The Technology Development segment provides applied research to customers in our areas of focus.

Our President and Chief Executive Officer and his direct reports collectively represent our chief operating decision makers, and they evaluate segment performance based primarily on revenue and operating income or loss.

Information about the results of operations for each segment is set forth in the table below. There were no significant inter-segment sales during the years ended December 31, 2019 and 2018.

During the years ended December 31, 2019 and 2018, 32% and 24%, respectively, of our total sales took place outside the United States. Customers in China represented 11% of total revenues in the year ended December 31, 2019, while no other single country, outside of the United States, represented more than 10% of total revenues in the year ended December 31, 2018.

	Years ended December 31,	
	2019	2018
Products and Licensing revenue	\$ 44,491,041	\$ 21,949,689
Technology Development revenue	26,024,674	20,967,556
Total revenue	\$ 70,515,715	\$ 42,917,245
Products and Licensing operating income	\$ 1,807,616	\$ 499,323
Technology Development operating income	1,507,405	378,212
Total operating income	\$ 3,315,021	\$ 877,535
Depreciation, Technology Development	\$ 397,296	\$ 379,952
Depreciation, Products and Licensing	\$ 552,285	\$ 273,185
Amortization, Technology Development	\$ 91,185	\$ 130,765
Amortization, Products and Licensing	\$ 1,462,525	\$ 418,349

Additional segment information is as follows:

	December 31,	
	2019	2018
Total segment assets:		
Products and Licensing	\$ 48,723,810	\$ 40,775,211
Technology Development	37,800,250	34,823,525
Total	\$ 86,524,060	\$ 75,598,736
Property plant and equipment and intangible assets, Technology Development	\$ 2,079,486	\$ 2,103,711
Property plant and equipment and intangible assets, Products and Licensing	\$ 22,122,279	\$ 4,927,453

18. Quarterly Results (unaudited)

The following table sets forth our unaudited historical revenues, operating (loss)/income and net income by quarter during 2019 and 2018.

(Dollars in thousands, except per share amounts)	Three Months Ended							
	March 31, 2019	June 30, 2019	September 30, 2019	December 31, 2019	March 31, 2018	June 30, 2018	September 30, 2018	December 31, 2018
Revenues:								
Products and licensing	\$ 8,192	\$ 11,373	\$ 11,894	\$ 13,032	\$ 4,131	\$ 4,457	\$ 5,371	\$ 7,990
Technology development	6,641	6,441	6,495	6,448	4,637	5,466	5,316	5,548
Total revenues	14,833	17,814	18,389	19,480	8,768	9,923	10,687	13,538
Gross margin	6,768	8,752	9,275	10,388	3,840	4,231	4,689	6,572
Operating (loss)/income	(898)	1,014	1,481	1,718	(373)	205	581	423
Net income/(loss) from continuing operations	1,126	840	1,231	2,146	(272)	299	1,293	(122)
Income from discontinued operations net of income taxes	—	—	—	—	421	768	7,556	1,062
Net income	1,126	840	1,231	2,146	149	1,067	8,849	940
Net income attributable to common stockholders	\$ 1,043	\$ 751	\$ 1,117	\$ 2,146	\$ 84	\$ 1,004	\$ 8,785	\$ 873
Net income/(loss) per share from continuing operations:								
Basic	\$ 0.04	\$ 0.03	\$ 0.04	\$ 0.07	\$ (0.01)	\$ 0.01	\$ 0.05	\$ —
Diluted	\$ 0.03	\$ 0.02	\$ 0.04	\$ 0.07	\$ (0.01)	\$ 0.01	\$ 0.04	\$ —
Net income per share from discontinued operations:								
Basic	\$ —	\$ —	\$ —	\$ —	\$ 0.02	\$ 0.03	\$ 0.27	\$ 0.04
Diluted	\$ —	\$ —	\$ —	\$ —	\$ 0.02	\$ 0.02	\$ 0.23	\$ 0.04
Net income attributable to common stockholders:								
Basic	\$ 0.04	\$ 0.03	\$ 0.04	\$ 0.07	\$ —	\$ 0.04	\$ 0.31	\$ 0.03
Diluted	\$ 0.03	\$ 0.02	\$ 0.03	\$ 0.07	\$ —	\$ 0.03	\$ 0.27	\$ 0.03
Weighted average shares:								
Basic	28,039,080	28,246,840	28,291,297	30,159,322	27,204,989	27,531,361	27,901,631	28,067,348
Diluted	33,479,935	33,650,790	32,115,847	32,211,847	27,204,989	31,506,745	33,055,881	28,067,348

19. Discontinued Operations

On July 31, 2018, we sold the assets and operations related to our Opto business, which was part of our Products and Licensing segment, to an unaffiliated third party for an initial purchase price up to \$18.5 million, of which \$17.5 million was received at closing and has been properly recorded in the financial statements with the remaining purchase price adjustment up to \$1.0 million which is contingent upon the attainment of specified revenue targets during the eighteen months following the closing of the sale. The Opto business was a component of the operations of API, which we acquired in May 2015, and represented all of our operations in our Camarillo, California and Montreal, Quebec facilities.

We have reported the results of operations of the Opto business as discontinued operations in our consolidated financial statements for the year ended December 31, 2018. There was no income or loss from discontinued operations for the year ended December 31, 2019. We allocated a portion of the consolidated tax expense to discontinued operations based on the ratio of the discontinued business's loss before allocations.

The following table presents a summary of the transactions related to the sales of Opto in the year ended December 31, 2018:

	Year Ended December 31,	
	2018	
Sale price	\$	17,500,000
Adjusted purchase price		17,500,000
Assets held for sale		(8,193,184)
Liabilities held for sale		989,453
Transaction costs		(858,227)
Return of working capital		730,000
Income tax expense		(1,572,245)
Gain on sale of discontinued operations	\$	8,595,797

The key components of net income from discontinued operations were as follows:

	Year Ended December 31,	
	2018	
Net revenues	\$	8,363,606
Cost of revenues		5,294,268
Operating expenses		1,728,113
Other (income)/expenses		(13,330)
Income before income taxes		1,354,555
Allocated tax expense		183,921
Operating income from discontinued operations		1,170,634
Gain on sale, net of related income taxes		8,595,797
Net income from discontinued operations	\$	9,766,431

For the year ended December 31, 2018, the acquisition of property plant and equipment was \$0.1 million, intangible property costs were \$0.01 million, and depreciation and amortization was \$0.2 million, all related to discontinued operations. For the year ended December 31, 2018, proceeds from the sale of the Opto business which were included in cash flows from investing activities \$16.0 million. The gain on sale of discontinued operations included in non-cash adjustments to cash flows from operating activities for 2018 was \$8.6 million.

ITEM 9. CHANGES IN AND DISAGREEMENTS WITH ACCOUNTANTS ON ACCOUNTING AND FINANCIAL DISCLOSURE.

None.

ITEM 9A. CONTROLS AND PROCEDURES.

Evaluation of Disclosure Controls and Procedures

We maintain “disclosure controls and procedures,” as defined in Rules 13a-15(e) and 15d-15(e) under the Securities Exchange Act of 1934, as amended (the “Exchange Act”), which are controls and other procedures that are designed to provide reasonable assurance that information required to be disclosed by a company in the reports that it files or submits under the Exchange Act is recorded, processed, summarized and reported within the time periods specified in the SEC’s rules and forms. Disclosure controls and procedures include, without limitation, controls and procedures designed to ensure that information required to be disclosed by a company in the reports that it files or submits under the Exchange Act is accumulated and communicated to the company’s management, including its principal executive and principal financial officers, as appropriate to allow timely decisions regarding required disclosure. Management recognizes that any controls and procedures, no matter how well designed and operated, can provide only reasonable assurance of achieving their objectives and management

necessarily applies its judgment in evaluating the cost-benefit relationship of possible controls and procedures. In addition, the design of any system of controls also is based in part upon certain assumptions about the likelihood of future events, and there can be no assurance that any design will succeed in achieving its stated goals under all potential future conditions. Over time, controls may become inadequate because of changes in conditions, or the degree of compliance with policies or procedures may deteriorate. Because of the inherent limitations in a control system, misstatements due to error or fraud may occur and not be detected.

Under the supervision and with the participation of our management, including our President and Chief Executive Officer and our Chief Financial Officer, we evaluated the effectiveness of the design and operation of our disclosure controls and procedures as of the end of the period covered by this report. Based on this evaluation, our President and Chief Executive Officer and our Chief Financial Officer have concluded that, as of December 31, 2019, our disclosure controls and procedures were effective at the reasonable assurance level.

Changes in Internal Control over Financial Reporting

There have been no changes in our internal control over financial reporting identified in connection with the evaluation required by paragraph (d) of Securities Exchange Act Rule 13a-15(e) and Rule 15d-15(e) that occurred in the quarter ended December 31, 2019 that have materially affected, or are reasonably likely to materially affect, our internal control over financial reporting.

Management's Report on Internal Control over Financial Reporting

Our management is responsible for establishing and maintaining adequate internal control over financial reporting as defined in Rules 13a-15(f) and 15d-15(f) under the Exchange Act. Our internal control over financial reporting is designed, under the supervision of our principal executive and principal financial officers, and effected by our board of directors, management and other personnel 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 of America ("GAAP"). Our internal control over financial reporting includes those policies and procedures that: (i) pertain to the maintenance of records that, in reasonable detail, accurately and fairly reflect the transactions and dispositions of our assets; (ii) provide reasonable assurance that transactions are recorded as necessary to permit preparation of financial statements in accordance with GAAP, and that our receipts and expenditures are being made only in accordance with authorizations of our management and directors; and (iii) provide reasonable assurance regarding prevention or timely detection of unauthorized acquisition, use or disposition of our assets that could have a material effect on our financial statements.

There are inherent limitations in the effectiveness of any internal control over financial reporting, including the possibility of human error and the circumvention or overriding of controls. Accordingly, even effective internal control over financial reporting can provide only reasonable assurance with respect to financial statement preparation and may not prevent or detect all misstatements. Further, because of changes in conditions, effectiveness of internal control over financial reporting may vary over time. Our internal control system was designed to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with GAAP.

Under the supervision and with the participation of our management, including our President and Chief Executive Officer, and our Chief Financial Officer, we conducted an evaluation of the effectiveness of our internal control over financial reporting as of December 31, 2019. This evaluation was based on the criteria established in the 2013 *Internal Control—Integrated Framework* issued by the Committee of Sponsoring Organizations of the Treadway Commission. As permitted by SEC rules, management's assessment and conclusion on the effectiveness of our internal control over financial reporting as of December 31, 2019, excludes an assessment of the internal control over financial reporting of General Photonics Corporation ("GP"), which were acquired on March 1, 2019. The total acquired assets, based on the preliminary purchase allocation is approximately 6% of our consolidated total assets, excluding the preliminary value of goodwill and intangible assets related to GP, at December 31, 2019. Revenues and income from continuing operations from GP for the period from March 2, 2019 through December 31, 2019, were approximately 7% and 26%, respectively, of our consolidated operations.

Based on our evaluation under the framework established in the 2013 *Internal Control—Integrated Framework*, our President and Chief Executive officer, and our Chief Financial Officer concluded that our internal control over financial reporting was effective as of December 31, 2019 to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with GAAP.

This Annual Report on Form 10-K includes an attestation report of our independent registered public accounting firm regarding internal control over financial reporting, which appears in Part II, Item 8 of this Annual Report on Form 10-K.

ITEM 9B. OTHER INFORMATION.

None

PART III

ITEM 10. DIRECTORS, EXECUTIVE OFFICERS AND CORPORATE GOVERNANCE

The information required by Item 10 of Form 10-K will be included in the proxy statement related to our 2020 Annual Meeting of Stockholders, (the "2020 Proxy Statement"), anticipated to be filed with the SEC within 120 days after December 31, 2019, and is incorporated into this report by reference.

ITEM 11. EXECUTIVE COMPENSATION.

The information required by Item 11 of Form 10-K is incorporated into this report by reference to the information to be provided in our 2020 Proxy Statement.

ITEM 12. SECURITY OWNERSHIP OF CERTAIN BENEFICIAL OWNERS AND MANAGEMENT AND RELATED STOCKHOLDER MATTERS

The information required by Item 12 of Form 10-K is incorporated into this report by reference to the information to be provided in our 2020 Proxy Statement.

ITEM 13. CERTAIN RELATIONSHIPS AND RELATED TRANSACTIONS, AND DIRECTOR INDEPENDENCE

The information required by Item 13 of Form 10-K is incorporated into this report by reference to the information to be provided in our 2020 Proxy Statement.

ITEM 14. PRINCIPAL ACCOUNTING FEES AND SERVICES

The information required by Item 14 of Form 10-K is incorporated into this report by reference to the information to be provided in our 2020 Proxy Statement.

PART IV

ITEM 15. EXHIBITS, FINANCIAL STATEMENT SCHEDULE

(a) The following documents are filed as part of this Annual Report on Form 10-K:

- (1) Financial Statements. See Index to Consolidated Financial Statements at Item 8 of this Report on Form 10-K.
- (2) Schedules.

Schedule II

**Luna Innovations Incorporated
Valuation and Qualifying Accounts**

Column A	Column B Balance at beginning of Period	Column C Additions	Column D Deductions	Column E Balance at end of period
Year Ended December 31, 2018				
Reserves deducted from assets to which they apply:				
Deferred tax valuation allowance	\$ 5,020,744	\$ —	\$ (1,753,211)	\$ 3,267,533
Allowances for doubtful accounts	286,717	3,500	(6,134)	284,083
	<u>\$ 5,307,461</u>	<u>\$ 3,500</u>	<u>\$ (1,759,345)</u>	<u>\$ 3,551,616</u>
Year Ended December 31, 2019				
Reserves deducted from assets to which they apply:				
Deferred tax valuation allowance	\$ 3,267,533	\$ —	\$ (2,907,609)	\$ 359,924
Allowances for doubtful accounts	284,083	646,196	—	930,279
	<u>\$ 3,551,616</u>	<u>\$ 646,196</u>	<u>\$ (2,907,609)</u>	<u>\$ 1,290,203</u>

All other schedules are omitted as the required information is inapplicable or the information is presented in the Consolidated Financial Statements and notes thereto in Item 8 of Part II of this Annual Report on Form 10-K.

- (3) Exhibits. The exhibits filed as part of this report are listed under “Exhibits” at subsection (b) of this Item 15.
- (b) Exhibits

EXHIBIT INDEX

<u>Exhibit No.</u>	<u>Exhibit Document</u>
2.1#	Agreement and Plan of Merger and Reorganization dated as of January 30, 2015, by and among Luna Innovations Incorporated, API Merger Sub, Inc. and Advanced Photonix, Inc. (incorporated by reference to Exhibit 2.1 to the Registrant's Current Report on Form 8-K (File No. 000-52008) filed on February 2, 2015).
2.2#	Asset Purchase Agreement, dated July 31, 2018 by and among Luna Innovations Incorporated, Advanced Photonix, Inc., Advanced Photonix Canada, Inc. and OSI Optoelectronics, Inc. (incorporated by reference to Exhibit 2.1 to the Registrant's Quarterly Report on Form 10-Q (File No. 000-52008) filed on August 1, 2018).
2.3#	Asset Purchase Agreement, dated October 15, 2018 by and among Luna Innovations Incorporated, Luna Technologies, Inc. and Micron Optics, Inc. (incorporated by reference to Exhibit 2.1 to the Registrant's Current Report on Form 8-K (File No. 000-52008) filed on October 16, 2018).
2.4#	Stock Purchase Agreement, dated March 1, 2019 by and among Luna Innovations Incorporated, Luna Technologies, Inc., Steve Yao and General Photonics Corporation (incorporated by reference to Exhibit 2.1 to the Registrant's Current Report on Form 8-K (File No. 000-52008) filed on March 4, 2019).
3.1	Amended and Restated Certificate of Incorporation of the Registrant (incorporated by reference to Exhibit 3.2 to the Registrant's Current Report on Form 8-K (File No. 000-52008) filed on June 8, 2006).
3.2	Certificate of Designations of the Series A Convertible Preferred Stock (incorporated by reference to Exhibit 3.1 to the Registrant's Current Report on Form 8-K (File No. 000-52008) filed on January 15, 2010).
3.3	Amended and Restated Bylaws of the Registrant (incorporated by reference to Exhibit 3.4 to the Registrant's Registration Statement on Form S-1 (File No. 333-131764) filed on February 10, 2006).
3.4	Amendment to Amended and Restated Bylaws (incorporated by reference to Exhibit 3.1 to the Registrant's Registration Statement on Form 8-K (File No. 000-52008) filed on May 10, 2010).
3.4	Amendment to Amended and Restated Bylaws (incorporated by reference to Exhibit 3.1 to the Registrant's Current Report on Form 8-K (File No. 000-52008) filed on February 2, 2015).
4.1	Specimen Common Stock certificate of the Registrant (incorporated by reference to the Exhibit 4.1 to Amendment No. 5 of the Registrant's Registration Statement on Form S-1 (File No. 333-131764) filed on May 19, 2006).
4.2	2006 Equity Incentive Plan (incorporated by reference to Exhibit 10.9 to Amendment No. 3 of the Registrant's Registration Statement on Form S-1 (File No. 333-131764) filed on April 28, 2006).
4.3	Form of Stock Option Agreement under 2006 Equity Incentive Plan (incorporated by reference to Exhibit 4.7 to the Registrant's Registration Statement on Form S-1 (File No. 333-131764) filed on February 10, 2006).
4.4	2016 Equity Incentive Plan (incorporated by reference to Exhibit 4.7 to the Registrant's Registration Statement on Form S-8 (File No. 333-211802) filed on June 3, 2016).
4.5	Form of Stock Option Grant Notice and Stock Option Agreement under 2016 Equity Incentive Plan (incorporated by reference to Exhibit 4.8 of the Registrant's Registration Statement on Form S-8 (File No. 333-211802) filed on June 3, 2016).
4.6	Form of Restricted Stock Unit Grant Notice and Restricted Stock Unit Award Agreement under 2016 Equity Incentive Plan (incorporated by reference to Exhibit 4.1 to the Registrant's Current Report on Form 8-K (File No. 000-52008) filed on January 16, 2019).
4.7	Form of Restricted Stock Award Grant Notice and Restricted Stock Award Agreement under 2016 Equity Incentive Plan (incorporated by reference to Exhibit 10.1 to the Registrant's Quarterly Report on Form 10-Q (File No. 000-52008) filed on August 10, 2016).
4.8*	Description of the Registrant's Securities Registered Pursuant to Section 12 of the Securities Exchange Act of 1934.
10.1	Form of Indemnification Agreement for directors and executive officers (incorporated by reference to Exhibit 10.1 to the Registrant's Current Report on Form 8-K (File No. 000-52008) filed on July 17, 2009).
10.2**	License Agreement No. DN-982, dated June 10, 2002, by and between the National Aeronautics and Space Administration (NASA) and Luna Innovations Incorporated; Modification No. 1 to License Agreement No. DN-982, dated January 23, 2006, by and between NASA and Luna Innovations Incorporated (incorporated by reference to Exhibit 10.22 to Amendment No. 5 of the Registrant's Registration Statement on Form S-1 (File No. 333-131764) filed on May 19, 2006).

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10.3**	License Agreement No. DN-951, dated December 20, 2000, by and between NASA and Luna Technologies, Inc. (incorporated by reference to Exhibit 10.23 to Amendment No. 5 of the Registrant's Registration Statement on Form S-1 (File No. 333-131764) filed on May 19, 2006).
10.4**	Amended and Restated License Agreement, dated March 19, 2004, by and between Virginia Tech Intellectual Properties, Inc. and Luna Innovations Incorporated (incorporated by reference to Exhibit 10.26 to Amendment No. 5 of the Registrant's Registration Statement on Form S-1 (File No. 333-131764) filed on May 19, 2006).
10.5	Asset Transfer and License Agreement by and between Luna Innovations Incorporated and Coherent, Inc. (incorporated by reference to Exhibit 10.21 to Amendment No. 1 to Registrant's Annual Report on Form 10-K (File No. 000-52008) filed on April 6, 2007).
10.6**	Development and Supply Agreement, dated December 12, 2006, by and between Luna Innovations Incorporated and Intuitive Surgical, Inc. dated June 11, 2007 (incorporated by reference to Exhibit 10.1 to the Registrant's Current Report on Form 8-K (File No. 000-52008) filed on June 14, 2007).
10.7	Amendment to Commercial Lease, by and between Luna Innovations Incorporated and Canvasback Real Estate & Investments LLC dated March 18, 2008 (incorporated by reference to Exhibit 10.5 to the Registrant's Quarterly Report on Form 10-Q (File No. 000-52008) filed on May 9, 2008).
10.8	Securities Purchase and Exchange Agreement, dated January 12, 2010, by and between Luna Innovations Incorporated and Carilion Clinic (incorporated by reference to Exhibit 10.1 to the Registrant's Current Report on Form 8-K (File No. 000-52008) filed on January 15, 2010).
10.9	Amended and Restated Investor Rights Agreement, dated January 13, 2010, by and among Luna Innovations Incorporated, Carilion Clinic, and certain stockholders of Luna Innovations Incorporated (incorporated by reference to Exhibit 10.4 to the Registrant's Current Report on Form 8-K (File No. 000-52008) filed on January 15, 2010).
10.10	Non-Employee Directors' Deferred Compensation Plan (incorporated by reference to Exhibit 10.13 to the Registrant's Annual Report on Form 10-K (File No. 000-52008) filed on March 21, 2018).
10.11**	License Agreement, effective January 12, 2010, by and among Luna Innovations Incorporated, Luna Technologies, Inc. and Hansen Medical, Inc. (incorporated by reference to Exhibit 10.6 of the Registrant's Quarterly Report on Form 10-Q (File No. 000-52008) filed on May 17, 2010).
10.12**	License Agreement, effective January 12, 2010, by and among Luna Innovations Incorporated, Luna Technologies, Inc. and Intuitive Surgical, Inc. (incorporated by reference to Exhibit 10.8 to Registrant's Quarterly Report on Form 10-Q (File No. 000-52008) file on May 17, 2010).
10.13	Industrial Lease Agreement, dated as of March 21, 2006, by and between Luna Innovations Incorporated and the Economic Development Authority of Montgomery County, Virginia, as amended by a First Amendment effective as of May 11, 2006, a Second Amendment effective as of July 15, 2009 and a Third Amendment effective as of March 23, 2010 (incorporated by reference to Exhibit 10.14 to Registrant's Quarterly Report on Form 10-Q (File No. 000-52008) filed on May 17, 2010).
10.14	Third Amendment to Commercial Lease dated June 21, 2010, by and between Canvasback Real Estate & Investments, LLC and Luna Innovations, Incorporated (incorporated by reference to Exhibit 10.5 to Registrant's Quarterly Report on Form 10-Q (File No. 000-52008) filed on August 16, 2010).
10.15	Fourth Amendment to Industrial Lease Agreement, dated as of March 1, 2011, by and between The Economic Development Authority of Montgomery County and Luna Innovations Incorporated (incorporated by reference to Exhibit 10.3 to Registrant's Quarterly Report on Form 10-Q (File No. 000-52008) filed on May 16, 2011).
10.16	Fifth Amendment to Industrial Lease Agreement, dated as of November 1, 2011, by and between The Economic Development Authority of Montgomery County and Luna Innovations Incorporated (incorporated by reference to Exhibit 10.39 to the Registrant's Annual Report on Form 10-K (File No. 000-52008) filed on March 29, 2012).
10.17	Employment Agreement dated December 5, 2017, by and between Scott A. Graeff and Luna Innovations Incorporated (incorporated by reference to Exhibit 10.25 to the Registrant's Annual Report on Form 10-K (File No. 000-52008) filed on March 21, 2018).
10.18	Fourth Amendment to Commercial Lease, dated as of April 15, 2012, by and between Canvasback Real Estate & Investments, LLC and Luna Innovations Incorporated (incorporated by reference to Exhibit 10.3 to the Registrant's Quarterly Report on Form 10-Q (File No. 000-52008) filed on August 9, 2012).
10.19**	Cross-License Agreement by and among Luna Innovations Incorporated and Luna Technologies, Inc. and Intuitive Surgical Operations, Inc. and Intuitive Surgical International, Ltd., dated as of January 17, 2014 (incorporated by reference to Exhibit 10.2 to the Registrant's Quarterly Report on Form 10-Q (File No. 000-52008) filed on May 13, 2014).

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10.20	<u>Sixth Amendment to Industrial Lease Agreement by and between the Economic Development Authority of Montgomery County, Virginia and Luna Innovations Incorporated dated October 1, 2014 (incorporated by reference to Exhibit 10.47 to the Registrant's Annual Report on Form 10-K (File No. 000-52008) filed on March 16, 2015).</u>
10.21	<u>Industrial Lease Agreement by and between The Economic Development Authority of Montgomery County, Virginia and Luna Innovations Incorporated dated October 1, 2014 (incorporated by reference to Exhibit 10.48 to the Registrant's Annual Report on Form 10-K (File No. 000-52008) filed on March 16, 2015).</u>
10.22	<u>Lease Agreement by and between SBA Tenant, LLC and Luna Innovations Incorporated dated November 2014 (incorporated by reference to Exhibit 10.49 to the Registrant's Annual Report on Form 10-K (File No. 000-52008) filed March 16, 2015).</u>
10.23	<u>First Amendment to Industrial Lease Agreement by and between the Economic Development Authority of Montgomery County, Virginia and Luna Innovation Incorporated, dated January 20, 2015 (incorporated by reference to Exhibit 10.3 to the Registrant's Quarterly Report on Form 10-Q (File No. 000-52008) filed on May 14, 2015).</u>
10.24	<u>Amended and Restated Non-Employee Director Compensation Policy, as amended as of February 26, 2019 (incorporated by reference to Exhibit 10.1 to the Registrant's Quarterly Report on Form 10-Q (File No. 000-52008) filed on May 13, 2019).</u>
10.25	<u>Fifth Amendment to Commercial Lease by and between Canvasback Real Estate and Investments, LLC and the Registrant, dated as of August 5, 2015 (incorporated by reference to Exhibit 10.2 to the Registrant's Quarterly Report on Form 10-Q (File No. 000-52008) filed on November 13, 2015).</u>
10.26	<u>Employment Agreement, dated May 1, 2018 by and between the Registrant and Dale E. Messick (incorporated by reference to Exhibit 10.1 to the Registrant's Quarterly Report on Form 10-Q (File No. 000-52008) filed on August 1, 2018).</u>
10.27*	<u>Amended and Restated Loan and Security Agreement, dated October 10, 2019, by and between Luna Innovations Incorporated, Luna Technologies, Inc., Former Luna Subsidiary, Inc., Teramatrix, LLC, and General Photonics Corp. and Silicon Valley Bank.</u>
10.28*	<u>Separation Agreement, dated November 25, 2019, by and between the Registrant and Dale E. Messick.</u>
10.29*	<u>Employment Agreement, dated December 2, 2019, by and between the Registrant and Eugene J. Nestro.</u>
10.30*	<u>First Amendment to Commercial Lease, dated as of February 21, 2020, by and between SBA Tenant, LLC and Luna Innovations Incorporated.</u>
21.1	<u>List of Subsidiaries</u>
23.1	<u>Consent of Grant Thornton LLP, Independent Registered Public Accounting Firm</u>
24.1	Power of Attorney (see signature page)
31.1*	<u>Certification of the Principal Executive Officer pursuant to Rule 13a-14(a) and Rule 15d-14(a) of the Securities Exchange Act of 1934, as adopted pursuant to Section 302 of the Sarbanes-Oxley Act of 2002.</u>
31.2*	<u>Certification of the Principal Financial Officer pursuant to Rule 13a-14(a) and Rule 15d-14(a) of the Securities Exchange Act of 1934, as adopted pursuant to Section 302 of the Sarbanes-Oxley Act of 2002.</u>
32.1***	<u>Certification of Principal Executive Officer pursuant to 18 U.S.C. Section 1350, as adopted pursuant to Section 906 of the Sarbanes-Oxley Act of 2002.</u>
32.2***	<u>Certification of Principal Financial Officer pursuant to 18 U.S.C. Section 1350, as adopted pursuant to Section 906 of the Sarbanes-Oxley Act of 2002.</u>
101	The following materials from the Registrant's Annual Report on Form 10-K for the year ended December 31, 2019, are formatted in XBRL (eXtensible Business Reporting Language): (i) Consolidated Balance Sheets at December 31, 2019 and 2018, (ii) Consolidated Statements of Operations for the years ended December 31, 2019 and 2018, (iii) Consolidated Statements of Changes in Stockholder's Equity for the years ended December 31, 2019 and 2018 (iv) Consolidated Statements of Cash Flows for the years ended December 31, 2019 and 2018, and (v) Notes to Audited Consolidated Financial Statements.

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- * Filed herewith
- # Pursuant to Item 601(b)(2) of Regulation S-K, the schedules and exhibits to this agreement are omitted, but will be furnished to the Securities and Exchange Commission upon request.
- ** Confidential treatment has been granted with respect to portions of this exhibit, indicated by asterisks, which has been filed separately with the Securities and Exchange Commission.
- *** These certifications are being furnished solely to accompany this annual report pursuant to 18 U.S.C. Section 1350, and are not being filed for purposes of Section 18 of the Securities Exchange Act of 1934 and are not to be incorporated by reference into any filing of the registrant, whether made before or after the date hereof, regardless of any general incorporation language in such filing.

ITEM 16. FORM 10-K SUMMARY

Not applicable.

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.

LUNA INNOVATIONS INCORPORATED

By: _____ /s/ Eugene J. Nestro
Eugene J. Nestro
Chief Financial Officer

March 13, 2020

KNOW ALL PERSONS BY THESE PRESENTS, that each person whose signature appears below hereby constitutes and appoints Scott A. Graeff and Eugene J. Nestro, and each of them acting individually, as his true and lawful attorneys-in-fact and agents, with full power of each to act alone, with full powers of substitution and resubstitution, for him and in his name, place and stead, in any and all capacities, to sign any and all amendments to this Annual Report on Form 10-K with all exhibits thereto and all documents in connection therewith, with the Securities and Exchange Commission, granting unto said attorneys-in-fact and agents, with full power of each to act alone, full power and authority to do and perform each and every act and thing requisite and necessary to be done in connection therewith, as fully for all intents and purposes as he might or could do in person, hereby ratifying and confirming all that said attorneys-in-fact and agents, or his or their substitutes, may lawfully do or cause to be done by virtue hereof.

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

<u>Signature</u>	<u>Title</u>	<u>Date</u>
_____ /s/ Scott A. Graeff Scott A. Graeff	President, Chief Executive Officer and Director (Principal Executive Officer)	March 13, 2020
_____ /s/ Eugene J. Nestro Eugene J. Nestro	Chief Financial Officer (Principal Financial Officer and Principal Accounting Officer)	March 13, 2020
_____ /s/ Michael W. Wise Michael W. Wise	Director	March 13, 2020
_____ /s/ Donald Pastor Donald Pastor	Director	March 13, 2020
_____ /s/ John B. Williamson III John B. Williamson III	Director	March 13, 2020
_____ /s/ N. Leigh Anderson N. Leigh Anderson	Director	March 13, 2020
_____ /s/ Warren B. Phelps, III Warren B. Phelps, III	Director	March 13, 2020
_____ /s/ Gary Spiegel Gary Spiegel	Director	March 13, 2020
_____ /s/ Mary Beth Vitale Mary Beth Vitale	Director	March 13, 2020
_____ /s/ Richard W. Roedel Richard W. Roedel	Chairman of the Board of Directors	March 13, 2020

Description of Capital Stock of Luna Innovations Incorporated

The following description of the common stock of Luna Innovations Incorporated (the “Company”) is a summary and does not purport to be complete. This summary is qualified in its entirety by reference to the provisions of the Delaware General Corporation Law (the “DGCL”) and the complete text of the Company’s amended and restated certificate of incorporation (the “restated certificate”), the Amended and Restated Certificate of Designations of the Series A Convertible Preferred Stock (the “certificate of designations”), and the amended and restated bylaws (the “bylaws”), each as currently in effect, which are incorporated by reference as Exhibits 3.1, 3.2 and 3.3, respectively, of the Company’s Annual Report on Form 10-K, to which this description is also an exhibit. The Company encourages you to read that law and those documents carefully.

Authorized Capital Stock

The restated certificate authorizes the issuance of up to 100,000,000 shares of common stock, \$0.001 par value per share, and 5,000,000 shares of preferred stock with a \$0.001 par value per share. The certificate of designations designates the issuance of up to 1,321,514 shares of series A convertible preferred stock, par value \$0.001 per share (the “Series A Preferred Stock”). The Company’s board of directors may establish the rights and preferences of the preferred stock from time to time.

Common Stock

Voting Rights

Holders of common stock are entitled to one vote for each share held of record on all matters submitted to a vote of the stockholders. Common stockholders do not have cumulative voting rights in the election of directors. Accordingly, holders of a majority of the shares voting are able to elect all directors being elected at such time. Subject to preferences that may be granted to any then outstanding preferred stock, holders of common stock are entitled to receive ratably only those dividends as may be declared by the board of directors out of funds legally available therefor. See “Dividend policy.” In the event of the Company’s liquidation, dissolution or winding up, holders of common stock are entitled to share ratably in all of the Company’s assets remaining after the Company pays its liabilities and distribute the liquidation preference of any then outstanding preferred stock. Holders of common stock have no preemptive or other subscription or conversion rights.

Dividends

Holders of common stock are entitled to receive ratably those dividends, if any, as may be declared from time to time by the board of directors out of legally available funds.

Liquidation

In the event of the Company’s liquidation, dissolution or winding up, holders of common stock will be entitled to share ratably in the net assets legally available for distribution to stockholders.

Rights and Preferences

Holders of common stock have no preemptive, conversion or subscription rights and there are no redemption or sinking fund provisions applicable to the common stock. The rights, preferences and privileges of the holders of common stock are subject to, and may be adversely affected by, the rights of the holders of shares of any series of preferred stock that the Company may designate in the future.

Preferred Stock

Voting Rights

Holders of Series A Preferred Stock shall have no voting rights. The consent of the holders of a majority of the outstanding shares of Series A Preferred Stock shall be required for any action which: (i) changes the rights, preferences or privileges of the Series A Preferred Stock, or amends, alters or repeals any provision of the restated certificate or bylaws, including by merger or consolidation, in a manner that adversely affects the rights, preferences or privileges of the Series A Preferred Stock; (ii) increases or decreases the authorized number of shares of any class or series of capital stock including, without limitation, the Series A Preferred Stock; or (iii) creates or issues any class or series of capital stock (including any security convertible into or exercisable for any capital stock) which ranks superior to or pari passu with the Series A Preferred Stock in any respect.

Dividends

The Series A Preferred Stock shall accrue cumulative dividends ("Dividends") for each share of Series A Preferred Stock at the rate of six percent (6%) of \$4.69159 per annum (the "Dividend Rate"). Dividends on the shares of Series A Preferred Stock shall commence accruing on the original issue date and shall be computed on the basis of a 360-day year consisting of twelve 30-day months and shall be payable in arrears for each quarter on the first day of the succeeding quarter during the period beginning on the original issue date (each, a "Dividend Date") with the first Dividend Date being April 1, 2010. Dividends accrued during a partial Calendar Quarter shall be appropriately pro rated by the actual number of days such Dividends accrued during such Calendar Quarter. Dividends shall not be payable in cash but shall be payable only in fully paid and non-assessable shares of Common Stock ("Dividend Shares"), unless a Liquidation Event (as defined in the restated certificate) occurs, in which case, the Dividend Shares shall be payable in cash. The number of Dividend Shares payable in respect of each share of Series A Preferred Stock on any Dividend Date shall be equal to the quotient obtained by dividing (i) the cumulative aggregate balance of accrued but unpaid Dividends on such share of Series A Preferred Stock as of such Dividend Date (the "Dividend Balance"), by (ii) the Conversion Price (as defined in the certificate of designations). The accrual of Dividends shall terminate ("Dividend Termination") on the earlier of the conversion of the Series A Preferred Stock into common stock or at any time after December 31, 2012, provided that: (a) the Closing Price of the Company's common stock at the time of the proposed termination has been greater than one hundred ten percent (110%) of the Conversion Price, for the immediately preceding 30 consecutive Trading Days (as defined in the certificate of designations, the "Dividend Termination Event"), and (b) the Company has delivered written notice of the Dividend Termination Event ("Dividend Termination Notice") to holder. Upon satisfaction of the conditions for a Dividend Termination Event, Dividend Termination shall occur on the last day of the month in which the Dividend Termination Notice is provided. In connection with the issuance of Dividend Shares on a Dividend Date, the Company shall upon written request of the holder, (i) provided Company's designated transfer agent (the "Transfer Agent") is participating in The Depository Trust Company ("DTC") Fast Automated Securities Transfer Program, credit such aggregate number of shares of common stock to which the holder shall be entitled to the holder's or its designee's balance account with DTC through its Deposit Withdrawal Agent Commission system, within two (2) Business Days of the applicable Dividend Date, or (Y) if the Transfer Agent is not participating in the DTC Fast Automated Securities Transfer Program, issue and deliver to such holder, a certificate, registered in the name of the holder or its designee, for the number of shares of common stock to which the holder shall be entitled within three (3) Business Days of the applicable Dividend Date. The Dividend Balance shall be appropriately reduced by the issuance of any Dividend Shares to the holder. In addition to payment of the foregoing Dividends, in the event dividends are declared and paid on the common stock (or any other class of capital stock of the Company), an equivalent dividend shall be paid on each share of Series A Preferred Stock.

Liquidation

In the event of any Liquidation Event, the holders of Series A Preferred Stock shall be entitled to receive, prior and in preference to any distribution of any of the assets or surplus funds of the Company to the holders of Junior Securities (as defined in the certificate of designations) by reason of their ownership thereof, an amount per share in cash equal to the sum of (i) Stated Value for each share of Series A Preferred Stock then held by them, plus (ii) the aggregate dollar amount of all accrued but unpaid Dividends on such Series A Preferred Stock as of the date of such event (such sum, the "Series A Stock Liquidation Preference"). If, upon the occurrence of a Liquidation Event, the assets and funds thus distributed among the holders of the Series A Preferred Stock shall be insufficient to permit the payment to such holders of the full Series A Stock Liquidation Preference, then the holders of the Series A Preferred Stock shall share ratably in any such distribution of the assets and funds of the Company in proportion to the aggregate Series A Stock Liquidation Preference that would otherwise be payable to each of such holders.

Conversion

At the option of any holder, each share of Series A Preferred Stock held by such holder may be converted into that number of shares of common stock equal to the Conversion Rate (as defined in the certificate of designations). A holder may convert shares of Series A Preferred Stock into common stock pursuant to this paragraph at any time.

Rights and Preferences

Holders of Series A Preferred Stock have no preemptive or subscription rights and there are no redemption or sinking fund provisions applicable to the Series A Preferred Stock. The rights, preferences and privileges of the holders of Series A Preferred Stock are subject to, and may be adversely affected by, the rights of the holders of shares of any series of preferred stock that the Company may designate in the future.

Anti-Takeover Effects of Provisions of the Amended and Restated Certificate of Incorporation and Bylaws

The restated certificate provides for the Company's board of directors to be divided into three classes, with staggered three-year terms. Only one class of directors will be elected at each annual meeting of stockholders, with the other classes continuing for the remainder of their respective three-year terms. Because common stockholders do not have cumulative voting rights, common stockholders representing a majority of the shares of common stock outstanding will be able to elect all of the Company's directors. The restated certificate and bylaws provide that only the Company's board of directors, chairman of the board, chief executive officer or president (in the absence of a chief executive officer) may call a special meeting of stockholders. The restated certificate requires a 66 2/3% stockholder vote for the amendment, repeal or modification of certain provisions of the restated certificate and bylaws relating to the absence of cumulative voting, the classification of the Company's board of directors, and the designated parties entitled to call a special meeting of the stockholders.

The combination of a classified board, the lack of cumulative voting and the 66 2/3% stockholder voting requirements will make it more difficult for existing stockholders to replace the Company's board of directors as well as for another party to obtain control of the Company by replacing the Company's board of directors. Since the Company's board of directors has the power to retain and discharge the Company's officers, these provisions could also make it more difficult for existing stockholders or another party to effect a change in management. In addition, the authorization of undesignated preferred stock makes it possible for the Company's board of directors to issue preferred stock with voting or other rights or preferences that could impede the success of any attempt to change the Company's control.

These provisions may have the effect of deterring hostile takeovers or delaying changes in the Company's control or management. These provisions are intended to enhance the likelihood of continued stability in the composition of the Company's board of directors and in the policies they implement, and to discourage certain types of transactions that may involve an actual or threatened change of the Company's control. These provisions are designed to reduce the Company's vulnerability to an unsolicited acquisition proposal. The provisions also are

intended to discourage certain tactics that may be used in proxy fights. However, such provisions could have the effect of discouraging others from making tender offers for the Company's shares and, as a consequence, they also may inhibit fluctuations in the market price of the Company's shares that could result from actual or rumored takeover attempts. Such provisions may also have the effect of preventing changes in the Company's management.

Section 203 of the General Corporation Law of the State of Delaware

The Company is subject to Section 203 of the DGCL, which regulates acquisitions of some Delaware corporations. Section 203 generally prohibits a publicly held Delaware corporation from engaging in a "business combination" with an "interested stockholder" for a period of three years following the date of the transaction in which the person became an interested stockholder, unless:

- the board of directors of the corporation approved the business combination or the other transaction in which the person became an interested stockholder prior to the date of the business combination or other transaction;
- upon consummation of the transaction that resulted in the person becoming an interested stockholder, the person owned at least 85% of the voting stock of the corporation outstanding at the time the transaction commenced, excluding shares owned by persons who are directors and also officers of the corporation and shares issued under employee stock plans under which employee participants do not have the right to determine confidentially whether shares held subject to the plan will be tendered in a tender or exchange offer; or
- on or subsequent to the date the person became an interested stockholder, the board of directors of the corporation approved the business combination and the stockholders of the corporation authorized the business combination at an annual or special meeting of stockholders by the affirmative vote of at least 66-2/3% of the outstanding stock of the corporation not owned by the interested stockholder.

Section 203 of the DGCL defines a "business combination" to include any of the following:

- any merger or consolidation involving the corporation and the interested stockholder;
 - any sale, transfer, pledge or other disposition of 10% or more of the corporation's assets or outstanding stock involving the interested stockholder;
 - subject to exceptions, any transaction that results in the issuance or transfer by the corporation of any of its stock to the interested stockholder;
 - any transaction involving the corporation that has the effect of increasing the proportionate share of its stock owned by the interested stockholder; or
 - the receipt by the interested stockholder of the benefit of any loans, advances, guarantees, pledges or other financial benefits provided by or through the corporation.
- In general, Section 203 defines an "interested stockholder" as any person who, together with the person's affiliates and associates, owns, or within three years prior to the determination of interested stockholder status did own, 15% or more of a corporation's voting stock.

Section 203 of the DGCL could depress the Company's stock price and delay, discourage or prohibit transactions not approved in advance by the board of directors, such as takeover attempts that might otherwise involve the payment to the Company's stockholders of a premium over the market price of the its common stock.

Nasdaq National Market Listing

The common stock is listed on the Nasdaq Capital Market under the symbol “LUNA.”

Transfer Agent and Registrar

The transfer agent and registrar for the Company’s common stock is American Stock Transfer & Trust Company. The transfer Agent’s address is 6201 15th Avenue, Brooklyn New York 11219.



AMENDED AND RESTATED LOAN AND SECURITY AGREEMENT

THIS AMENDED AND RESTATED LOAN AND SECURITY AGREEMENT (this “**Agreement**”) dated as of October 10, 2019 (the “**Effective Date**”) among (i) **SILICON VALLEY BANK**, a California corporation (“**Bank**”), and (ii) **LUNA INNOVATIONS INCORPORATED**, a Delaware corporation (“**Innovations**”), **LUNA TECHNOLOGIES, INC.**, a Delaware corporation (“**Technologies**”), **FORMER LUNA SUBSIDIARY, INC. (f/k/a ADVANCED PHOTONIX, INC.)**, a Delaware corporation (“**API**”), **TERAMETRIX, LLC**, a Delaware limited liability company (“**TeraMetrix**”), and **GENERAL PHOTONICS CORP.**, a California corporation (“**Photonics**”); Innovations, Technologies, API, TeraMetrix, and Photonics are referred to herein, individually and collectively, jointly and severally, as “**Borrower**”), each with offices located at 301 1st Street SW, Suite 200, Roanoke, Virginia 24011, provides the terms on which Bank shall lend to Borrower and Borrower shall repay Bank. This Agreement amends and restates in its entirety that certain Loan and Security Agreement dated as of February 18, 2010 by and among Bank, Innovations, Technologies, and API, among others (as amended and in effect, the “**Prior Loan Agreement**”). The parties agree as follows:

1 ACCOUNTING AND OTHER TERMS

Accounting terms not defined in this Agreement shall be construed following GAAP. Calculations and determinations must be made following GAAP. Notwithstanding the foregoing, all financial covenant and other financial calculations shall be computed with respect to Borrower only, and not on a consolidated basis. Capitalized terms not otherwise defined in this Agreement shall have the meanings set forth in Section 13. All other terms contained in this Agreement, unless otherwise indicated, shall have the meaning provided by the Code to the extent such terms are defined therein.

2 LOAN AND TERMS OF PAYMENT

2.1 Promise to Pay. Borrower hereby unconditionally, jointly and severally, promises to pay Bank the outstanding principal amount of all Credit Extensions and accrued and unpaid interest thereon as and when due in accordance with this Agreement.

2.2 Revolving Advances.

(a) Availability. Subject to the terms and conditions of this Agreement and to deduction of Reserves, Bank shall make Advances not exceeding the Availability Amount. Amounts borrowed under the Revolving Line may be repaid and, prior to the Revolving Line Maturity Date, reborrowed, subject to the applicable terms and conditions precedent herein.

(b) Termination; Repayment. The Revolving Line terminates on the Revolving Line Maturity Date, when the principal amount of all Advances, the unpaid interest thereon, and all other Obligations relating to the Revolving Line shall be immediately due and payable.

2.3 Letters of Credit Sublimit.

(a) As part of the Revolving Line and subject to deduction of Reserves, Bank shall issue or have issued Letters of Credit denominated in Dollars or a Foreign Currency for Borrower’s account. The aggregate Dollar Equivalent amount utilized for the issuance of Letters of Credit shall at all times reduce the amount otherwise available for Advances under the Revolving Line. The aggregate Dollar Equivalent of the face amount of outstanding Letters of Credit (including drawn but unreimbursed Letters of Credit and any Letter of Credit Reserve) may not exceed the lesser of (A) Three Million Dollars (\$3,000,000), minus (i) the sum of all amounts used for Cash Management Services, and minus (ii) the FX Reduction Amount, or (B) the Revolving Line, minus (i) the sum of all outstanding principal amounts of any Advances (including any amounts used for Cash Management Services), and minus (ii) the FX Reduction Amount.

(b) If, on the Revolving Line Maturity Date (or the effective date of any termination of this Agreement), there are any outstanding Letters of Credit, then on such date Borrower shall provide to Bank cash

collateral in an amount equal to at least one hundred five percent (105.0%) for Letters of Credit denominated in Dollars or at least one hundred ten percent (110.0%) for Letters of Credit denominated in a Foreign Currency, in each case of the aggregate Dollar Equivalent of the face amount of all such Letters of Credit plus all interest, fees, and costs due or estimated by Bank to become due in connection therewith, to secure all of the Obligations relating to such Letters of Credit. All Letters of Credit shall be in form and substance acceptable to Bank in its sole discretion and shall be subject to the terms and conditions of Bank's standard Application and Letter of Credit Agreement (the "**Letter of Credit Application**"). Borrower agrees to execute any further documentation in connection with the Letters of Credit as Bank may reasonably request. Borrower further agrees to be bound by the regulations and interpretations of the issuer of any Letters of Credit guaranteed by Bank and opened for Borrower's account or by Bank's interpretations of any Letter of Credit issued by Bank for Borrower's account, and Borrower understands and agrees that Bank shall not be liable for any error, negligence, or mistake, whether of omission or commission, in following Borrower's instructions or those contained in the Letters of Credit or any modifications, amendments, or supplements thereto.

(c) The obligation of Borrower to immediately reimburse Bank for drawings made under Letters of Credit shall be absolute, unconditional, and irrevocable, and shall be performed strictly in accordance with the terms of this Agreement, such Letters of Credit, and the Letter of Credit Application.

(d) Borrower may request that Bank issue a Letter of Credit payable in a Foreign Currency. If a demand for payment is made under any such Letter of Credit, Bank shall treat such demand as an Advance to Borrower of the Dollar Equivalent of the amount thereof (plus fees and charges in connection therewith such as wire, cable, SWIFT or similar charges).

(e) To guard against fluctuations in currency exchange rates, upon the issuance of any Letter of Credit payable in a Foreign Currency, Bank shall create a reserve (the "**Letter of Credit Reserve**") under the Revolving Line in an amount equal to ten percent (10%) of the face amount of such Letter of Credit (which percentage may be adjusted by Bank in its sole discretion). The amount of the Letter of Credit Reserve may be adjusted by Bank from time to time to account for fluctuations in the exchange rate. The availability of funds under the Revolving Line shall be reduced by the amount of such Letter of Credit Reserve for as long as such Letter of Credit remains outstanding.

2.4 Foreign Exchange Sublimit. As part of the Revolving Line and subject to the deduction of Reserves, Borrower may enter into foreign exchange contracts with Bank under which Borrower commits to purchase from or sell to Bank a specific amount of Foreign Currency (each, a "**FX Contract**") on a specified date (the "**Settlement Date**"). FX Contracts shall have a Settlement Date of at least one (1) FX Business Day after the contract date and shall be subject to a reserve of ten percent (10%) of each outstanding FX Contract. The aggregate amount of FX Contracts at any one time may not exceed the lesser of (A) Three Million Dollars (\$3,000,000), minus (i) the sum of all amounts used for Cash Management Services, and minus (ii) the aggregate Dollar Equivalent of the face amount of any outstanding Letters of Credit (including drawn but unreimbursed Letters of Credit and any Letter of Credit Reserve), or (B) the Revolving Line, minus (i) the sum of all outstanding principal amounts of any Advances (including any amounts used for Cash Management Services), and minus (ii) the aggregate Dollar Equivalent of the face amount of any outstanding Letters of Credit (including drawn but unreimbursed Letters of Credit and any Letter of Credit Reserve). The amount otherwise available for Credit Extensions under the Revolving Line shall be reduced by an amount equal to ten percent (10%) of each outstanding FX Contract (the "**FX Reduction Amount**"). Any amounts needed to fully reimburse Bank for any amounts not paid by Borrower in connection with FX Contracts will be treated as Advances under the Revolving Line and will accrue interest at the interest rate applicable to Advances.

2.5 Cash Management Services Sublimit. Borrower may use the Revolving Line for Bank's cash management services, which may include merchant services, direct deposit of payroll, business credit card, and check cashing services identified in Bank's various cash management services agreements (collectively, the "**Cash Management Services**"), in an aggregate amount not to exceed the lesser of (A) Three Million Dollars (\$3,000,000), minus (i) the aggregate Dollar Equivalent of the face amount of any outstanding Letters of Credit (including drawn but unreimbursed Letters of Credit and any Letter of Credit Reserve), and minus (ii) the FX Reduction Amount, or (B) the Revolving Line, minus (i) the sum of all outstanding principal amounts of any Advances, minus the aggregate Dollar Equivalent of the face amount of any outstanding Letters of Credit (including drawn but unreimbursed Letters of Credit and any Letter of Credit Reserve), and minus (ii) the FX Reduction Amount. Any amounts Bank pays on

behalf of Borrower for any Cash Management Services will be treated as Advances under the Revolving Line and will accrue interest at the interest rate applicable to Advances.

2.6 Overadvances. If, at any time, the sum of (a) the outstanding principal amount of any Advances (including any amounts used for Cash Management Services), plus (b) the face amount of any outstanding Letters of Credit (including drawn but unreimbursed Letters of Credit and any Letter of Credit Reserve), plus (c) the FX Reduction Amount, exceeds the Revolving Line, Borrower shall immediately pay to Bank in cash the amount of such excess (such excess, the “**Overadvance**”). Without limiting Borrower’s obligation to repay Bank any Overadvance, Borrower agrees to pay Bank interest on the outstanding amount of any Overadvance, on demand, at a per annum rate equal to the rate that is otherwise applicable to Advances plus five percent (5.0%).

2.7 Payment of Interest on the Credit Extensions.

(a) **Interest Rate.** Subject to Section 2.7(b), the principal amount outstanding under the Revolving Line shall accrue interest at a floating per annum rate equal to the greater of (i) one percent (1.0%) above the Prime Rate, and (ii) Six Percent (6.0%), which interest shall be payable monthly in accordance with Section 2.7(d) below.

(b) **Default Rate.** Immediately upon the occurrence and during the continuance of an Event of Default, Obligations shall bear interest at a rate per annum which is five percent (5.0%) above the rate that is otherwise applicable thereto (the “**Default Rate**”). Fees and expenses which are required to be paid by Borrower pursuant to the Loan Documents (including, without limitation, Bank Expenses) but are not paid when due shall bear interest until paid at a rate equal to the highest rate applicable to the Obligations. Payment or acceptance of the increased interest rate provided in this Section 2.7(b) is not a permitted alternative to timely payment and shall not constitute a waiver of any Event of Default or otherwise prejudice or limit any rights or remedies of Bank.

(c) **Adjustment to Interest Rate.** Changes to the interest rate of any Credit Extension based on changes to the Prime Rate shall be effective on the effective date of any change to the Prime Rate and to the extent of any such change.

(d) **Payment; Interest Computation.** Interest is payable monthly on the Payment Date of each month and shall be computed on the basis of a 360-day year for the actual number of days elapsed. In computing interest, (i) all payments received after 12:00 p.m. Eastern time on any day shall be deemed received at the opening of business on the next Business Day, and (ii) the date of the making of any Credit Extension shall be included and the date of payment shall be excluded; provided, however, that if any Credit Extension is repaid on the same day on which it is made, such day shall be included in computing interest on such Credit Extension.

2.8 Fees. Borrower shall pay to Bank:

(a) **Revolving Line Commitment Fee.** A fully earned, non-refundable commitment fee of Twenty Thousand Dollars (\$20,000.00) is earned and payable as of the Effective Date; and

(b) **Bank Expenses.** All Bank Expenses (including reasonable attorneys’ fees and expenses for documentation and negotiation of this Agreement) incurred through and after the Effective Date, when due (or, if no stated due date, upon demand by Bank).

Unless otherwise provided in this Agreement or in a separate writing by Bank, Borrower shall not be entitled to any credit, rebate, or repayment of any fees earned by Bank pursuant to this Agreement notwithstanding any termination of this Agreement or the suspension or termination of Bank’s obligation to make loans and advances hereunder. Bank may deduct amounts owing by Borrower under the clauses of this Section 2.8 pursuant to the terms of Section 2.9(c). Bank shall provide Borrower written notice of deductions made from the Designated Deposit Account pursuant to the terms of the clauses of this Section 2.8.

2.9 Payments; Application of Payments; Debit of Accounts.

(a) All payments to be made by Borrower under any Loan Document shall be made in immediately available funds in Dollars, without setoff or counterclaim, before 12:00 p.m. Eastern time on the date when due. Payments of principal and/or interest received after 12:00 p.m. Eastern time are considered received at the opening of business on the next Business Day. When a payment is due on a day that is not a Business Day, the payment shall be due the next Business Day, and additional fees or interest, as applicable, shall continue to accrue until paid.

(b) Bank has the exclusive right to determine the order and manner in which all payments with respect to the Obligations may be applied. Borrower shall have no right to specify the order or the accounts to which Bank shall allocate or apply any payments required to be made by Borrower to Bank or otherwise received by Bank under this Agreement when any such allocation or application is not specified elsewhere in this Agreement.

(c) Bank may debit any of Borrower's deposit accounts, including the Designated Deposit Account, for principal and interest payments or any other amounts Borrower owes Bank when due. These debits shall not constitute a set-off.

2.10 Withholding. Payments received by Bank from Borrower under this Agreement will be made free and clear of and without deduction for any and all present or future taxes, levies, imposts, duties, deductions, withholdings, assessments, fees or other charges imposed by any Governmental Authority (including any interest, additions to tax or penalties applicable thereto). Specifically, however, if at any time any Governmental Authority, applicable law, regulation or international agreement requires Borrower to make any withholding or deduction from any such payment or other sum payable hereunder to Bank, Borrower hereby covenants and agrees that the amount due from Borrower with respect to such payment or other sum payable hereunder will be increased to the extent necessary to ensure that, after the making of such required withholding or deduction, Bank receives a net sum equal to the sum which it would have received had no withholding or deduction been required, and Borrower shall pay the full amount withheld or deducted to the relevant Governmental Authority. Borrower will, upon request, furnish Bank with proof reasonably satisfactory to Bank indicating that Borrower has made such withholding payment; provided, however, that Borrower need not make any withholding payment if the amount or validity of such withholding payment is contested in good faith by appropriate and timely proceedings and as to which payment in full is bonded or reserved against by Borrower. The agreements and obligations of Borrower contained in this Section 2.10 shall survive the termination of this Agreement.

3 CONDITIONS OF LOANS

3.1 Conditions Precedent to Initial Credit Extension. Bank's obligation to make the initial Credit Extension is subject to the condition precedent that Bank shall have received, in form and substance satisfactory to Bank, such documents, and completion of such other matters, as Bank may reasonably deem necessary or appropriate, including, without limitation:

- (a) duly executed signatures to the Loan Documents;
- (b) duly executed signatures to any Control Agreement(s) required by Bank;
- (c) the Operating Documents and long-form good standing certificates of Borrower certified by the Secretary of State (or equivalent agency) of Delaware and each jurisdiction in which Borrower is qualified to conduct business, each as of a date no earlier than thirty (30) days prior to the Effective Date;
- (d) duly executed subordination agreements in a form and substance acceptable to Bank in all respects;
- (e) a secretary's certificate of Borrower with respect to such Borrower's Operating Documents, incumbency, specimen signatures and resolutions authorizing the execution and delivery of this Agreement and the other Loan Documents to which it is a party;
- (f) duly executed signatures to the completed Borrowing Resolutions for Borrower;

(g) certified copies, dated as of a recent date, of Lien searches (including, without limitation, UCC searches), as Bank may request, accompanied by written evidence (including any termination statements) that the Liens indicated in any such financing statements either constitute Permitted Liens or have been or, in connection with the initial Credit Extension, will be terminated or released;

(h) the Perfection Certificate of Borrower, together with the duly executed signature thereto;
and

(i) payment of the fees and Bank Expenses then due as specified in Section 2.8 hereof.

3.2 Conditions Precedent to all Credit Extensions. Bank's obligations to make each Credit Extension, including the initial Credit Extension, is subject to the following conditions precedent:

(a) timely receipt of the Credit Extension request and any materials and documents required by Section 3.4;

(b) the representations and warranties in this Agreement shall be true, accurate, and complete in all material respects on the date of the proposed Credit Extension and on the Funding Date of each Credit Extension; provided, however, that such materiality qualifier shall not be applicable to any representations and warranties that already are qualified or modified by materiality in the text thereof; and provided, further that those representations and warranties expressly referring to a specific date shall be true, accurate and complete in all material respects as of such date, and no Event of Default shall have occurred and be continuing or result from the Credit Extension. Each Credit Extension is Borrower's representation and warranty on that date that the representations and warranties in this Agreement remain true, accurate, and complete in all material respects; provided, however, that such materiality qualifier shall not be applicable to any representations and warranties that already are qualified or modified by materiality in the text thereof; and provided, further that those representations and warranties expressly referring to a specific date shall be true, accurate and complete in all material respects as of such date; and

(c) Bank determines to its satisfaction that there has not been a Material Adverse Change.

3.3 Covenant to Deliver.

(a) Borrower agrees to deliver to Bank each item required to be delivered to Bank under this Agreement as a condition precedent to any Credit Extension. Borrower expressly agrees that a Credit Extension made prior to the receipt by Bank of any such item shall not constitute a waiver by Bank of Borrower's obligation to deliver such item, and the making of any Credit Extension in the absence of a required item shall be in Bank's sole discretion.

(b) Within thirty (30) days after the Effective Date, Bank shall have received, in form and substance satisfactory to Bank, evidence satisfactory to Bank that the insurance policies and endorsements required by Section 6.7 hereof are in full force and effect, together with appropriate evidence showing lender loss payable and/or additional insured clauses or endorsements in favor of Bank.

3.4 Procedures for Borrowing. Subject to the prior satisfaction of all other applicable conditions to the making of an Advance set forth in this Agreement, to obtain an Advance, Borrower (via an individual duly authorized by an Administrator) shall notify Bank (which notice shall be irrevocable) by electronic mail by 12:00 p.m. Eastern time on the Funding Date of the Advance. Such notice shall be made by Borrower through Bank's online banking program, provided, however, if Borrower is not utilizing Bank's online banking program, then such notice shall be in a written format acceptable to Bank that is executed by an Authorized Signer. Bank shall have received satisfactory evidence that the Board has approved that such Authorized Signer may provide such notices and request Advances. In connection with any such notification, Borrower must promptly deliver to Bank by electronic mail or through Bank's online banking program such reports and information, including without limitation, sales journals, cash receipts journals, accounts receivable aging reports, as Bank may request in its sole discretion. Bank shall credit proceeds of an Advance to the Designated Deposit Account. Bank may make Advances under this Agreement based

on instructions from an Authorized Signer or without instructions if the Advances are necessary to meet Obligations which have become due.

4 CREATION OF SECURITY INTEREST

4.1 Grant of Security Interest. Borrower hereby grants Bank, to secure the payment and performance in full of all of the Obligations, a continuing security interest in, and pledges to Bank, the Collateral, wherever located, whether now owned or hereafter acquired or arising, and all proceeds and products thereof.

Borrower acknowledges that it previously has entered, and/or may in the future enter, into Bank Services Agreements with Bank. Regardless of the terms of any Bank Services Agreement, Borrower agrees that any amounts Borrower owes Bank thereunder shall be deemed to be Obligations hereunder and that it is the intent of Borrower and Bank to have all such Obligations secured by the first priority perfected security interest in the Collateral granted herein (subject only to Permitted Liens that expressly have superior priority to Bank's Lien in this Agreement).

If this Agreement is terminated, Bank's Lien in the Collateral shall continue until the Obligations (other than inchoate indemnity obligations) are repaid in full in cash. Upon payment in full in cash of the Obligations (other than inchoate indemnity obligations) and at such time as Bank's obligation to make Credit Extensions has terminated, Bank shall, at the sole cost and expense of Borrower, release its Liens in the Collateral and all rights therein shall revert to Borrower. In the event (x) all Obligations (other than inchoate indemnity obligations), except for Bank Services, are satisfied in full, and (y) this Agreement is terminated, Bank shall terminate the security interest granted herein upon Borrower providing cash collateral acceptable to Bank in its good faith business judgment for Bank Services, if any. In the event such Bank Services consist of outstanding Letters of Credit, Borrower shall provide to Bank cash collateral in an amount equal to (x) if such Letters of Credit are denominated in Dollars, then at least one hundred five percent (105.0%); and (y) if such Letters of Credit are denominated in a Foreign Currency, then at least one hundred ten percent (110.0%), of the Dollar Equivalent of the face amount of all such Letters of Credit plus all interest, fees, and costs due or to become due in connection therewith (as estimated by Bank in its business judgment), to secure all of the Obligations relating to such Letters of Credit.

4.2 Priority of Security Interest. Borrower represents, warrants, and covenants that the security interest granted herein is and shall at all times continue to be a first priority perfected security interest in the Collateral (subject only to Permitted Liens that are permitted pursuant to the terms of this Agreement to have superior priority to Bank's Lien under this Agreement). If Borrower shall acquire a commercial tort claim in an amount of One Hundred Thousand Dollars (\$100,000.00) or more, Borrower shall promptly notify Bank in a writing signed by Borrower of the general details thereof and grant to Bank in such writing a security interest therein and in the proceeds thereof, all upon the terms of this Agreement, with such writing to be in form and substance reasonably satisfactory to Bank.

4.3 Authorization to File Financing Statements. Borrower hereby authorizes Bank to file financing statements, without notice to Borrower, with all appropriate jurisdictions to perfect or protect Bank's interest or rights hereunder, including a notice that any disposition of the Collateral, by either Borrower or any other Person, shall be deemed to violate the rights of Bank under the Code. Such financing statements may indicate the Collateral as "all assets of the Debtor" or words of similar effect, or as being of an equal or lesser scope, or with greater detail, all in Bank's discretion.

5 REPRESENTATIONS AND WARRANTIES

Borrower represents and warrants as follows:

5.1 Due Organization; Authorization; Power and Authority. Borrower and each of its Subsidiaries are duly existing and in good standing as a Registered Organization in its jurisdiction of formation and each is qualified and licensed to do business and each is in good standing in any jurisdiction in which the conduct of each of its business or its ownership of property requires that it be qualified except where the failure to do so could not reasonably be expected to have a material adverse effect on Borrower's business. In connection with this Agreement, each Borrower has delivered to Bank a completed certificate signed by Borrower, entitled "Perfection Certificate" (the "**Perfection Certificate**"). Borrower represents and warrants to Bank that (a) each Borrower's exact legal name is that indicated

on the Perfection Certificate and on the signature page hereof; (b) each Borrower is an organization of the type and is organized in the jurisdiction set forth in the Perfection Certificate; (c) each Perfection Certificate accurately sets forth Borrower's organizational identification number or accurately states that Borrower has none; (d) the Perfection Certificate accurately sets forth Borrower's place of business, or, if more than one, its chief executive office as well as Borrower's mailing address (if different than its chief executive office); (e) each Borrower (and each of its predecessors) has not, in the past five (5) years, changed its jurisdiction of formation, organizational structure or type, or any organizational number assigned by its jurisdiction; and (f) all other information set forth on the Perfection Certificate pertaining to each Borrower and each of its Subsidiaries is accurate and complete (it being understood and agreed that Borrower may from time to time update certain information in the Perfection Certificate after the Effective Date to the extent permitted by one or more specific provisions in this Agreement). If any Borrower is not now a Registered Organization but later becomes one, such Borrower shall promptly notify Bank of such occurrence and provide Bank with Borrower's organizational identification number.

The execution, delivery and performance by Borrower of the Loan Documents to which it is a party have been duly authorized, and do not (i) conflict with any of Borrower's organizational documents, (ii) contravene, conflict with, constitute a default under or violate any material Requirement of Law, (iii) contravene, conflict or violate any applicable order, writ, judgment, injunction, decree, determination or award of any Governmental Authority by which Borrower or any of its Subsidiaries or any of their property or assets may be bound or affected, (iv) require any action by, filing, registration, or qualification with, or Governmental Approval from, any Governmental Authority (except such Governmental Approvals which have already been obtained and are in full force and effect) other than filing by Bank to perfect its security interest in the Collateral or (v) constitute an event of default under any material agreement by which Borrower is bound. Borrower is not in default under any agreement to which it is a party or by which it is bound in which the default could reasonably be expected to have a material adverse effect on Borrower's business.

5.2 Collateral. Borrower has good title to, rights in, and the power to transfer each item of the Collateral upon which it purports to grant a Lien hereunder, free and clear of any and all Liens except Permitted Liens. Borrower has no Collateral Accounts at or with any bank or financial institution other than Bank or Bank's Affiliates except for the Collateral Accounts described in the Perfection Certificate delivered to Bank in connection herewith and which Borrower has taken such actions as are necessary to give Bank a perfected security interest therein, pursuant to the terms of Section 6.8(b). The Accounts are bona fide, existing obligations of the Account Debtors.

The Collateral is not in the possession of any third party bailee (such as a warehouse) except as otherwise provided in the Perfection Certificate. Other than demo or loaner equipment with an aggregate book value of up to One Million Dollars (\$1,000,000.00) that is used in the sales and clinical trial process, none of the components of the Collateral shall be maintained at locations other than as provided in the Perfection Certificate or as permitted pursuant to Section 7.2.

All Inventory is in all material respects of good and marketable quality, free from material defects.

Borrower is the sole owner of the Intellectual Property which it owns or purports to own except for (a) licenses granted to its customers in the ordinary course of business consistent with Borrower's past practices, (b) over-the-counter software that is commercially available to the public, and (c) material Intellectual Property licensed to Borrower and noted on the Perfection Certificate. Each Patent which it owns or purports to own and which is material to Borrower's business is valid, and no part of the Intellectual Property which Borrower owns or purports to own and which is material to Borrower's business has been judged invalid or unenforceable, in whole or in part. To the best of Borrower's knowledge, no written claim is pending that any part of the Intellectual Property violates the rights of any third party except to the extent such claim would not have a material adverse effect on Borrower's business.

Except as noted on the Perfection Certificate, Borrower is not a party to, nor is it bound by, any Restricted License.

5.3 Reserved.

5.4 Litigation. Except as disclosed in the Perfection Certificate, there are no actions or proceedings pending or, to the knowledge of any Responsible Officer, threatened in writing by or against Borrower or any of its

Subsidiaries involving more than, individually Fifty Thousand Dollars (\$50,000), or in the aggregate Two Hundred Fifty Thousand Dollars (\$250,000).

5.5 Financial Statements; Financial Condition. All consolidated financial statements for Borrower and any of its Subsidiaries delivered to Bank fairly present in all material respects Borrower's consolidated financial condition and Borrower's consolidated results of operations. There has not been any material deterioration in Borrower's consolidated financial condition since the date of the most recent financial statements submitted to Bank.

5.6 Solvency. The fair salable value of Borrower's consolidated assets (including goodwill minus disposition costs) exceeds the fair value of Borrower's liabilities; Borrower is not left with unreasonably small capital after the transactions in this Agreement; and Borrower is able to pay its debts (including trade debts) as they mature.

5.7 Regulatory Compliance. Borrower is not an "investment company" or a company "controlled" by an "investment company" under the Investment Company Act of 1940, as amended. Borrower is not engaged as one of its important activities in extending credit for margin stock (under Regulations X, T and U of the Federal Reserve Board of Governors). Borrower (a) has complied in all material respects with all Requirements of Law, and (b) has not violated any Requirements of Law the violation of which could reasonably be expected to have a material adverse effect on its business. None of Borrower's or any of its Subsidiaries' properties or assets has been used by Borrower or any Subsidiary or, to the best of Borrower's knowledge, by previous Persons, in disposing, producing, storing, treating, or transporting any hazardous substance other than legally. Borrower and each of its Subsidiaries have obtained all consents, approvals and authorizations of, made all declarations or filings with, and given all notices to, all Governmental Authorities that are necessary to continue their respective businesses as currently conducted.

5.8 Subsidiaries; Investments. Borrower does not own any stock, partnership, or other ownership interest or other equity securities except for Permitted Investments.

5.9 Tax Returns and Payments; Pension Contributions. Borrower has timely filed all required tax returns and reports, and Borrower has timely paid all foreign, federal, state and local taxes, assessments, deposits and contributions owed by Borrower. Borrower may defer payment of any contested taxes, provided that Borrower (a) in good faith contests its obligation to pay the taxes by appropriate proceedings promptly and diligently instituted and conducted, (b) notifies Bank in writing of the commencement of, and any material development in, the proceedings, (c) posts bonds or takes any other steps required to prevent the governmental authority levying such contested taxes from obtaining a Lien upon any of the Collateral that is other than a "Permitted Lien".

Borrower is unaware of any claims or adjustments, in excess of \$20,000, proposed for any of Borrower's prior tax years which could result in additional taxes becoming due and payable by Borrower. Borrower has paid all amounts necessary to fund all present pension, profit sharing and deferred compensation plans in accordance with their terms, and Borrower has not withdrawn from participation in, and has not permitted partial or complete termination of, or permitted the occurrence of any other event with respect to, any such plan which could reasonably be expected to result in any liability of Borrower, including any liability to the Pension Benefit Guaranty Corporation or its successors or any other governmental agency.

5.10 Use of Proceeds. Borrower shall use the proceeds of the Credit Extensions solely as working capital and to fund its general business requirements and not for personal, family, household or agricultural purposes.

5.11 Full Disclosure. No written representation, warranty or other statement of Borrower in any certificate or written statement given to Bank, as of the date such representation, warranty, or other statement was made, taken together with all such written certificates and written statements given to Bank, contains any untrue statement of a material fact or omits to state a material fact necessary to make the statements contained in the certificates or statements not misleading (it being recognized by Bank that the projections and forecasts provided by Borrower in good faith and based upon reasonable assumptions are not viewed as facts and that actual results during the period or periods covered by such projections and forecasts may differ from the projected or forecasted results).

5.12 Definition of "Knowledge." For purposes of the Loan Documents, whenever a representation or warranty is made to Borrower's knowledge or awareness, to the "best of" Borrower's knowledge, or with a similar qualification, knowledge or awareness means the actual knowledge, after reasonable investigation, of any Responsible Officer.

6 AFFIRMATIVE COVENANTS

Borrower shall do all of the following:

6.1 **Government Compliance.**

(a) Maintain its and all its Subsidiaries' legal existence and good standing in their respective jurisdictions of formation and maintain qualification in each jurisdiction in which the failure to so qualify would reasonably be expected to have a material adverse effect on Borrower's business or operations. Borrower shall comply, and have each Subsidiary comply, with all laws, ordinances and regulations to which it is subject, the noncompliance with which could have a material adverse effect on Borrower's business.

(b) Obtain all of the Governmental Approvals necessary for the performance by Borrower of its obligations under the Loan Documents to which it is a party and the grant of a security interest to Bank in all of the Collateral. Borrower shall promptly provide copies of any such obtained Governmental Approvals to Bank.

6.2 **Financial Statements, Reports, Certificates.** Provide Bank with the following:

(a) as soon as available, but no later than thirty (30) days after the last day of each month, (A) monthly accounts receivable agings, aged by invoice date, (B) monthly accounts payable agings, aged by invoice date, and outstanding or held check registers, if any, and (C) monthly reconciliations of accounts receivable agings (aged by invoice date), including without limitation, project identifiers for the purposes of tracking the status of assignments under the Federal Assignment of Claims Act of 1940, Deferred Revenue report, and general ledger;

(b) as soon as available, but no later than thirty (30) days after the last day of each month, a company prepared consolidated balance sheet and income statement covering Borrower's consolidated operations for such month certified by a Responsible Officer and in a form reasonably acceptable to Bank (the "**Monthly Financial Statements**");

(c) as soon as available, but no later than thirty (30) days following the end of each fiscal year of Borrower, and contemporaneously with any updates or amendments thereto, (A) annual operating budgets (including income statements, balance sheets and cash flow statements, by month) for the upcoming fiscal year of Borrower, and (B) annual financial projections for the following fiscal year (on a quarterly basis), in each case as approved by the Board, together with any related business forecasts used in the preparation of such annual financial projections;

(d) as soon as available, and in any event within one hundred eighty (180) days following the last day of Borrower's fiscal year, audited consolidated financial statements prepared under GAAP, consistently applied, together with an unqualified opinion on the financial statements from an independent certified public accounting firm reasonably acceptable to Bank;

(e) in the event that Borrower becomes subject to the reporting requirements under the Exchange Act within five (5) days of filing, copies of all periodic and other reports, proxy statements and other materials filed by Borrower with the SEC, any Governmental Authority succeeding to any or all of the functions of the SEC or with any national securities exchange, or distributed to its shareholders, as the case may be. Documents required to be delivered pursuant to the terms hereof (to the extent any such documents are included in materials otherwise filed with the SEC) may be delivered electronically and if so delivered, shall be deemed to have been delivered on the date on which Borrower posts such documents, or provides a link thereto, on Borrower's website on the internet at Borrower's website address; provided, however, Borrower shall promptly notify Bank in writing (which may be by electronic mail) of the posting of any such documents;

(f) within five (5) days of delivery, copies of all proxy statements, financial statements and reports made available to all of Borrower's security holders (in such capacity) or to any holders of Subordinated Debt;

(g) a prompt report of any legal actions pending or threatened in writing against Borrower or any of its Subsidiaries that could result in damages or costs to Borrower or any of its Subsidiaries of, individually, Fifty Thousand Dollars (\$50,000) or more, or in the aggregate Two Hundred Fifty Thousand Dollars (\$250,000);

(h) prompt written notice of any changes to the beneficial ownership information set out in Section 14 of the Perfection Certificate. Borrower understands and acknowledges that Bank relies on such true, accurate and up-to-date beneficial ownership information to meet Bank's regulatory obligations to obtain, verify and record information about the beneficial owners of its legal entity customers; and

(i) promptly, from time to time, such other information regarding Borrower or compliance with the terms of any Loan Documents as reasonably requested by Bank.

6.3 Accounts Receivable.

(a) Schedules and Documents Relating to Accounts. Borrower shall deliver to Bank transaction reports and schedules of collections, as provided in Section 6.2, on Bank's standard forms; provided, however, that Borrower's failure to execute and deliver the same shall not affect or limit Bank's Lien and other rights in all of Borrower's Accounts, nor shall Bank's failure to advance or lend against a specific Account affect or limit Bank's Lien and other rights therein. If requested by Bank, Borrower shall furnish Bank with copies (or, at Bank's request, originals) of all contracts, orders, invoices, and other similar documents, and all shipping instructions, delivery receipts, bills of lading, and other evidence of delivery, for any goods the sale or disposition of which gave rise to such Accounts. In addition, Borrower shall deliver to Bank, on its request, the originals of all instruments, chattel paper, security agreements, guarantees and other documents and property evidencing or securing any Accounts, in the same form as received, with all necessary indorsements, and copies of all credit memos.

(b) Disputes. Borrower shall promptly notify Bank of all disputes or claims relating to Accounts. Borrower may forgive (completely or partially), compromise, or settle any Account for less than payment in full, or agree to do any of the foregoing so long as (i) Borrower does so in good faith, in a commercially reasonable manner, in the ordinary course of business, in arm's-length transactions, and reports the same to Bank in the regular reports provided to Bank; (ii) no Event of Default has occurred and is continuing; and (iii) after taking into account all such discounts, settlements and forgiveness, the total outstanding Advances will not exceed the Availability Amount.

(c) Collection of Accounts. Borrower shall direct Account Debtors to deliver or transmit all proceeds of Accounts into a lockbox account, or a "blocked account" as specified by Bank (either such account, the "**Cash Collateral Account**"). Whether or not an Event of Default has occurred and is continuing, Borrower shall immediately deliver all payments on and proceeds of Accounts to the Cash Collateral Account. Subject to Bank's right to maintain a reserve pursuant to Section 6.3(d), all amounts received in the Cash Collateral Account shall be (i) when an Event of Default exists, applied to immediately reduce the Obligations (unless Bank, in its sole discretion, elects not to so apply such amounts), and (ii) when no Event of Default exists, transferred on a daily basis to Borrower's operating account with Bank. Borrower hereby authorizes Bank to transfer to the Cash Collateral Account any amounts that Bank reasonably determines are proceeds of the Accounts (provided that Bank is under no obligation to do so and this allowance shall in no event relieve Borrower of its obligations hereunder).

(d) Reserves. Notwithstanding any terms in this Agreement to the contrary, at times when an Event of Default exists, Bank may hold any proceeds of the Accounts and any amounts in the Cash Collateral Account that are not applied to the Obligations pursuant to Section 6.3(c) above) as a reserve to be applied to any Obligations regardless of whether such Obligations are then due and payable.

(e) Returns. Provided no Event of Default has occurred and is continuing, if any Account Debtor returns any Inventory to Borrower, Borrower shall promptly (i) determine the reason for such return, (ii) issue a credit memorandum to the Account Debtor in the appropriate amount, and (iii) provide a copy of such credit memorandum to Bank, upon request from Bank. In the event any attempted return occurs after the occurrence and during the continuance of any Event of Default, Borrower shall hold the returned Inventory in trust for Bank, and immediately notify Bank of the return of the Inventory.

(f) **Verifications; Confirmations; Credit Quality; Notifications.** Bank may, from time to time, (i) verify and confirm directly with the respective Account Debtors the validity, amount and other matters relating to the Accounts, either in the name of Borrower or Bank or such other name as Bank may choose, and notify any Account Debtor of Bank's security interest in such Account and/or (ii) conduct a credit check of any Account Debtor to approve any such Account Debtor's credit. In addition, Bank may notify Account Debtors to make payments in respect of Accounts directly to Bank.

(g) **No Liability.** Bank shall not be responsible or liable for any shortage or discrepancy in, damage to, or loss or destruction of, any goods, the sale or other disposition of which gives rise to an Account, or for any error, act, omission, or delay of any kind occurring in the settlement, failure to settle, collection or failure to collect any Account, or for settling any Account in good faith for less than the full amount thereof, nor shall Bank be deemed to be responsible for any of Borrower's obligations under any contract or agreement giving rise to an Account. Nothing herein shall, however, relieve Bank from liability for its own gross negligence or willful misconduct.

6.4 Remittance of Proceeds. Except as otherwise provided in Section 6.3(c), deliver, in kind, all proceeds arising from the disposition of any Collateral to Bank in the original form in which received by Borrower not later than the following Business Day after receipt by Borrower, to be applied to the Obligations (a) prior to an Event of Default, pursuant to the terms of Section 6.3(c) hereof, and (b) after the occurrence and during the continuance of an Event of Default, pursuant to the terms of Section 9.4 hereof; provided that, if no Event of Default has occurred and is continuing, Borrower shall not be obligated to remit to Bank the proceeds of the sale of worn out or obsolete Equipment disposed of by Borrower in good faith in an arm's length transaction for an aggregate purchase price of Twenty Five Thousand Dollars (\$25,000.00) or less (for all such transactions in any fiscal year). Borrower agrees that it will not commingle proceeds of Collateral with any of Borrower's other funds or property, but will hold such proceeds separate and apart from such other funds and property and in an express trust for Bank. Nothing in this Section 6.4 limits the restrictions on disposition of Collateral set forth elsewhere in this Agreement.

6.5 Taxes; Pensions. Timely file, and require each of its Subsidiaries to timely file, all required tax returns and reports and timely pay, and require each of its Subsidiaries to timely pay, all foreign, federal, state and local taxes, assessments, deposits and contributions owed by Borrower and each of its Subsidiaries, except for deferred payment of any taxes contested pursuant to the terms of Section 5.9 hereof, and shall deliver to Bank, on demand, appropriate certificates attesting to such payments, and pay all amounts necessary to fund all present pension, profit sharing and deferred compensation plans in accordance with their terms.

6.6 Access to Collateral; Books and Records. At reasonable times, on one (1) Business Day's notice (provided no notice is required if an Event of Default has occurred and is continuing), Bank, or its agents, shall have the right, up to one (1) time per year (unless an Event of Default has occurred and is continuing in which case such inspections and audits shall occur as often as Bank shall determine is necessary), to inspect the Collateral and the right to audit and copy Borrower's Books. The foregoing inspections and audits shall be conducted at Borrower's expense and the charge therefor shall be One Thousand Dollars (\$1,000.00) per person per day (or such higher amount as shall represent Bank's then-current standard charge for the same), plus reasonable out-of-pocket expenses. In the event Borrower and Bank schedule an audit more than eight (8) days in advance, and Borrower cancels or seeks to or reschedules the audit with less than eight (8) days written notice to Bank, then (without limiting any of Bank's rights or remedies) Borrower shall pay Bank a fee of Two Thousand Dollars (\$2,000.00) plus any out-of-pocket expenses incurred by Bank to compensate Bank for the anticipated costs and expenses of the cancellation or rescheduling.

6.7 Insurance.

(a) Keep its business and the Collateral insured for risks and in amounts standard for companies in Borrower's industry and location and as Bank may reasonably request. Insurance policies shall be in a form, with financially sound and reputable insurance companies that are not Affiliates of Borrower, and in amounts that are satisfactory to Bank. All property policies shall have a lender's loss payable endorsement showing Bank as a lender loss payee. All liability policies shall show, or have endorsements showing, Bank as an additional insured. Bank shall be named as lender loss payee and/or additional insured with respect to any such insurance providing coverage in respect of any Collateral.

(b) Ensure that proceeds payable under any property policy are, at Bank's option, payable to Bank on account of the Obligations.

(c) At Bank's request, Borrower shall deliver certified copies of insurance policies and evidence of all premium payments. Each provider of any such insurance required under this Section 6.7 shall agree, by endorsement upon the policy or policies issued by it or by independent instruments furnished to Bank, that it will give Bank thirty (30) days prior written notice before any such policy or policies shall be materially altered or canceled. If Borrower fails to obtain insurance as required under this Section 6.7 or to pay any amount or furnish any required proof of payment to third persons and Bank, Bank may make all or part of such payment or obtain such insurance policies required in this Section 6.7, and take any action under the policies Bank deems prudent.

6.8 Accounts.

(a) Maintain its and all of its Subsidiaries', if any, primary depository, operating accounts and securities accounts with Bank and Bank's Affiliates with all excess funds maintained at or invested through Bank or an affiliate of Bank, which accounts shall represent at least (i) 95% of the dollar value or (ii) all but \$1,000,000 of Borrower's and its Subsidiaries' accounts at all financial institutions. Notwithstanding the foregoing, until December 31, 2019, Borrower's Subsidiaries may maintain deposits of up to Two Million Dollars (\$2,000,000.00) in the aggregate with financial institutions other than Bank and Bank's Affiliates. In addition, Borrower and its Subsidiaries Borrower shall conduct all cash management, foreign exchange, letter of credit banking, and business credit cards with Bank.

(b) For each Collateral Account that Borrower at any time maintains, Borrower shall cause the applicable bank or financial institution (other than Bank) at or with which any Collateral Account is maintained to execute and deliver a Control Agreement or other appropriate instrument with respect to such Collateral Account to perfect Bank's Lien in such Collateral Account in accordance with the terms hereunder which Control Agreement may not be terminated without the prior written consent of Bank. The provisions of the previous sentence shall not apply to deposit accounts exclusively used for payroll, payroll taxes and other employee wage and benefit payments to or for the benefit of Borrower's employees and identified to Bank by Borrower as such.

6.9 Financial Covenants - Liquidity Coverage Ratio. Borrower shall maintain at all times, to be certified as of the last day of each month, a Liquidity Coverage Ratio equal to or greater than 2.0 to 1.00.

6.10 Protection and Registration of Intellectual Property Rights.

(a) (i) Protect, defend and maintain the validity and enforceability of its Intellectual Property; (ii) promptly advise Bank in writing of material infringements of its Intellectual Property; and (iii) not allow any Intellectual Property material to Borrower's business to be abandoned, forfeited or dedicated to the public without Bank's written consent.

(b) If Borrower (i) obtains any Patent, registered Trademark, registered Copyright, registered mask work, or any pending application for any of the foregoing, whether as owner, licensee or otherwise, or (ii) applies for any Patent or the registration of any Trademark, then Borrower shall immediately provide written notice thereof to Bank and shall execute such intellectual property security agreements and other documents and take such other actions as Bank shall request in its good faith business judgment to perfect and maintain a first priority perfected security interest in favor of Bank in such property. If Borrower decides to register any Copyrights or mask works in the United States Copyright Office, Borrower shall: (x) provide Bank with at least fifteen (15) days prior written notice of Borrower's intent to register such Copyrights or mask works together with a copy of the application it intends to file with the United States Copyright Office (excluding exhibits thereto); (y) execute an intellectual property security agreement and such other documents and take such other actions as Bank may request in its good faith business judgment to perfect and maintain a first priority perfected security interest in favor of Bank in the Copyrights or mask works intended to be registered with the United States Copyright Office; and (z) record such intellectual property security agreement with the United States Copyright Office contemporaneously with filing the Copyright or mask work application(s) with the United States Copyright Office. Borrower shall promptly provide to Bank copies of all applications that it files for Patents or for the registration of Trademarks, Copyrights or mask works, together with evidence of the recording of the intellectual property security agreement required for Bank to perfect and maintain a first priority perfected security interest in such property.

(c) Provide written notice to Bank within ten (10) days of entering or becoming bound by any Restricted License (other than over-the-counter software that is commercially available to the public). Borrower shall take such steps as Bank requests to obtain the consent of, or waiver by, any person whose consent or waiver is necessary for (i) any Restricted License to be deemed "Collateral" and for Bank to have a security interest in it that might otherwise be restricted or prohibited by law or by the terms of any such Restricted License, whether now existing or entered into in the future, and (ii) Bank to have the ability in the event of a liquidation of any Collateral to dispose of such Collateral in accordance with Bank's rights and remedies under this Agreement and the other Loan Documents

6.11 Litigation Cooperation. From the date hereof and continuing through the termination of this Agreement, make available to Bank without expense to Bank, Borrower and its officers, employees and agents and Borrower's books and records, to the extent that Bank may deem them reasonably necessary to prosecute or defend any third-party suit or proceeding instituted by or against Bank with respect to any Collateral or relating to Borrower.

6.12 Online Banking.

(a) Utilize Bank's online banking platform for all matters requested by Bank which shall include, without limitation (and without request by Bank for the following matters), uploading information pertaining to Accounts and Account Debtors, requesting approval for exceptions, requesting Credit Extensions, and uploading financial statements and other reports required to be delivered by this Agreement (including, without limitation, those described in Section 6.2 of this Agreement).

(b) Comply with the terms of Bank's Online Banking Agreement as in effect from time to time and ensure that all persons utilizing Bank's online banking platform are duly authorized to do so by an Administrator. Bank shall be entitled to assume the authenticity, accuracy and completeness on any information, instruction or request for a Credit Extension submitted via Bank's online banking platform and to further assume that any submissions or requests made via Bank's online banking platform have been duly authorized by an Administrator..

6.13 Further Assurances. Execute any further instruments and take further action as Bank reasonably requests to perfect or continue Bank's Lien in the Collateral or to effect the purposes of this Agreement. Deliver to Bank, within five (5) days after the same are sent or received, copies of all correspondence, reports, documents and other filings with any Governmental Authority regarding compliance with or maintenance of Governmental Approvals or Requirements of Law or that could reasonably be expected to have a material effect on any of the Governmental Approvals or otherwise on the operations of Borrower or any of its Subsidiaries.

6.14 Creation/Acquisition of Subsidiaries. Notwithstanding and without limiting the negative covenants contained in Sections 7.3 and 7.7 hereof, in the event Borrower or any Subsidiary creates or acquires any Subsidiary (including without limitation, pursuant to a Division), Borrower and such Subsidiary shall promptly notify Bank of the creation or acquisition of such new Subsidiary and, at Bank's request, in its sole discretion, shall (a) with respect to Subsidiaries organized within the United States only, cause such new Subsidiary to provide to Bank a joinder to the Loan Documents to cause such Subsidiary to become a co-borrower hereunder, and grant a continuing pledge and security interest in and to the assets of such Subsidiary (substantially as described on Exhibit A hereto), (b) provide to Bank appropriate certificates and powers and financing statements, pledging all of the direct or beneficial ownership interest in such new Subsidiary, in form and substance satisfactory to Bank, and (c) provide to Bank all other documentation in form and substance reasonably satisfactory to Bank, which in its opinion is appropriate with respect to the execution and delivery of the applicable documentation referred to above. Any document, agreement, or instrument executed or issued pursuant to this Section 6.14 shall be a Loan Document.

7 NEGATIVE COVENANTS

Borrower shall not do any of the following without Bank's prior written consent:

7.1 Dispositions. Convey, sell, lease, transfer, assign, or otherwise dispose of (including, without limitation, pursuant to a Division) (collectively, "**Transfer**"), or permit any of its Subsidiaries to Transfer, all or any material part of its business or property, except for Transfers (a) of Inventory in the ordinary course of business; (b) of worn out or obsolete Equipment; (c) in connection with Permitted Liens and Permitted Investments; (d) of non-exclusive licenses for the use of the Intellectual Property of Borrower in the ordinary course of business that could not

result in a legal transfer of title of the licensed property but that may be exclusive in respects other than territory and that may be exclusive as to territory only as to discrete geographical areas outside of the United States, or (e) of exclusive licenses of Intellectual Property in the ordinary course of Borrower's business and consistent with Borrower's past practices.

7.2 Changes in Business, Management, Control, or Business Locations. (a) Engage in or permit any of its Subsidiaries, if any, to engage in any business other than the businesses currently engaged in by Borrower and such Subsidiary, as applicable, or reasonably related thereto; (b) liquidate or dissolve, other than Subsidiaries that own assets with an aggregate value of less than One Hundred Thousand Dollars (\$100,000.00); (c) fail to provide notice to Bank of any Key Person departing from or ceasing to be employed by Borrower within five (5) days after his or her departure from Borrower, or (d) permit or suffer any Change in Control.

Borrower shall not, without at least thirty (30) days prior written notice to Bank: (1) add any new offices or business locations, including warehouses (unless such new offices or business locations contain less than Fifty Thousand Dollars (\$50,000.00) in Borrower's assets or property) or deliver any portion of the Collateral valued, individually or in the aggregate, in excess of Fifty Thousand Dollars (\$50,000.00) to a bailee at a location other than to a bailee and at a location already disclosed in the Perfection Certificate, (2) change its jurisdiction of organization, (3) change its organizational structure or type, (4) change its legal name, or (5) change any organizational number (if any) assigned by its jurisdiction of organization. If Borrower intends to add any new offices or business locations, including warehouses, containing in excess of Fifty Thousand Dollars (\$50,000.00) of Borrower's assets or property, then Borrower will first receive the written consent of Bank, and the landlord of any such new offices or business locations, including warehouses, shall execute and deliver a landlord consent in form and substance satisfactory to Bank. If Borrower intends to deliver any portion of the Collateral valued, individually or in the aggregate, in excess of Fifty Thousand Dollars (\$50,000.00) to a bailee, and Bank and such bailee are not already parties to a bailee agreement governing both the Collateral and the location to which Borrower intends to deliver the Collateral, then Borrower will first receive the written consent of Bank, and such bailee shall execute and deliver a bailee agreement in form and substance satisfactory to Bank in its sole discretion.

7.3 Mergers or Acquisitions. Merge or consolidate, or permit any of its Subsidiaries to merge or consolidate, with any other Person, or acquire, or permit any of its Subsidiaries to acquire, all or substantially all of the capital stock or property of another Person (including, without limitation, by the formation of any Subsidiary or pursuant to a Division). A Subsidiary may merge or consolidate into another Subsidiary or into Borrower.

7.4 Indebtedness. Create, incur, assume, or be liable for any Indebtedness, or permit any Subsidiary to do so, other than Permitted Indebtedness.

7.5 Encumbrance. Create, incur, allow, or suffer any Lien on any of its property, or assign or convey any right to receive income, including the sale of any Accounts, or permit any of its Subsidiaries to do so, except for Permitted Liens, permit any Collateral not to be subject to the first priority security interest granted herein, or enter into any agreement, document, instrument or other arrangement (except with or in favor of Bank) with any Person which directly or indirectly prohibits or has the effect of prohibiting Borrower or any Subsidiary from assigning, mortgaging, pledging, granting a security interest in or upon, or encumbering any of Borrower's or any Subsidiary's Intellectual Property, except as is otherwise permitted in Section 7.1 hereof and the definition of "Permitted Liens" herein.

7.6 Maintenance of Collateral Accounts. Maintain any Collateral Account except pursuant to the terms of Section 6.8(b) hereof.

7.7 Distributions; Investments. (a) Pay any cash dividends or make any distribution or payment or redeem, retire or purchase any capital stock, provided that Borrower may repurchase the stock of employees so long as an Event of Default does not exist at the time of any such repurchase and would not exist after giving effect to any such repurchase, provided that the aggregate amount of all such repurchases does not exceed Five Hundred Thousand Dollars (\$500,000.00); or (b) directly or indirectly make any Investment (including, without limitation, any additional Investment in any Subsidiary) other than Permitted Investments, or permit any of its Subsidiaries to do so.

7.8 Transactions with Affiliates. Directly or indirectly enter into or permit to exist any material transaction with any Affiliate of Borrower, except for transactions that are in the ordinary course of Borrower's business, upon fair and reasonable terms that are no less favorable to Borrower than would be obtained in an arm's length transaction with a non-affiliated Person.

7.9 Subordinated Debt. (a) Make or permit any payment on any Subordinated Debt, except under the terms of any subordination, intercreditor, or other similar agreement to which such Subordinated Debt is subject, or (b) amend any provision in any document relating to the Subordinated Debt which would increase the amount thereof or adversely affect the subordination thereof to Obligations owed to Bank.

7.10 Compliance. Become an "investment company" or a company controlled by an "investment company", under the Investment Company Act of 1940, as amended, or undertake as one of its important activities extending credit to purchase or carry margin stock (as defined in Regulation U of the Board of Governors of the Federal Reserve System), or use the proceeds of any Credit Extension for that purpose; fail to meet the minimum funding requirements of ERISA, permit a Reportable Event or Prohibited Transaction, as defined in ERISA, to occur; fail to comply with the Federal Fair Labor Standards Act or violate any other law or regulation, if the violation could reasonably be expected to have a material adverse effect on Borrower's business, or permit any of its Subsidiaries to do so; withdraw or permit any Subsidiary to withdraw from participation in, permit partial or complete termination of, or permit the occurrence of any other event with respect to, any present pension, profit sharing and deferred compensation plan which could reasonably be expected to result in any liability of Borrower, including any liability to the Pension Benefit Guaranty Corporation or its successors or any other governmental agency.

7.11 Subsidiary Limitations. Permit any Subsidiary or Subsidiaries that are not a Borrower to maintain assets in an aggregate amount for all such Subsidiaries in excess of One Hundred Thousand Dollars (\$100,000) at any time.

8 EVENTS OF DEFAULT

Any one of the following shall constitute an event of default (an "**Event of Default**") under this Agreement:

8.1 Payment Default. Borrower fails to (a) make any payment of principal or interest on any Credit Extension when due, or (b) pay any other Obligations within three (3) Business Days after such Obligations are due and payable (which three (3) Business Day cure period shall not apply to payments due on the Revolving Line Maturity Date). During the cure period, the failure to make or pay any payment specified under clause (b) hereunder is not an Event of Default (but no Credit Extension will be made during the cure period);

8.2 Covenant Default.

(a) Borrower fails or neglects to perform any obligation in Sections 6.2, 6.3, 6.4, 6.5, 6.6, 6.7, 6.8, 6.9, 6.10, 6.12, or 6.14, or violates any covenant in Section 7; or

(b) Borrower fails or neglects to perform, keep, or observe any other term, provision, condition, covenant or agreement contained in this Agreement or any Loan Documents, and as to any default (other than those specified in this Section 8) under such other term, provision, condition, covenant or agreement that can be cured, has failed to cure the default within ten (10) days after the occurrence thereof; provided, however, that if the default cannot by its nature be cured within the ten (10) day period or cannot after diligent attempts by Borrower be cured within such ten (10) day period, and such default is likely to be cured within a reasonable time, then Borrower shall have an additional period (which shall not in any case exceed thirty (30) days) to attempt to cure such default, and within such reasonable time period the failure to cure the default shall not be deemed an Event of Default (but no Credit Extensions shall be made during such cure period). Cure periods provided under this section shall not apply, among other things, to financial covenants or any other covenants set forth in clause (a) above;

8.3 Material Adverse Change. A Material Adverse Change occurs;

8.4 Attachment; Levy; Restraint on Business.

(a) (i) The service of process seeking to attach, by trustee or similar process, any funds of Borrower or of any entity under the control of Borrower (including a Subsidiary) on deposit or otherwise maintained with Bank or any Bank Affiliate, or (ii) a notice of lien or levy is filed against any of Borrower's assets by any Governmental Authority, and the same under subclauses (i) and (ii) hereof are not, within ten (10) days after the occurrence thereof, discharged or stayed (whether through the posting of a bond or otherwise); provided, however, no Credit Extensions shall be made during any ten (10) day cure period; or

(b) (i) any material portion of Borrower's assets is attached, seized, levied on, or comes into possession of a trustee or receiver, or (ii) any court order enjoins, restrains, or prevents Borrower from conducting all or any material part of its business;

8.5 Insolvency. (a) Borrower or any of its Subsidiaries is unable to pay its debts (including trade debts) as they become due or otherwise becomes insolvent; (b) Borrower or any of its Subsidiaries begins an Insolvency Proceeding; or (c) an Insolvency Proceeding is begun against Borrower or any of its Subsidiaries and is not dismissed or stayed within thirty (30) days (but no Credit Extensions shall be made while any of the conditions described in clause (a) exist and/or until any Insolvency Proceeding is dismissed);

8.6 Other Agreements. There is, under any agreement to which Borrower or any Guarantor is a party with a third party or parties, (a) any default resulting in a right by such third party or parties, whether or not exercised, to accelerate the maturity of any Indebtedness in an amount individually or in the aggregate in excess of Two Hundred Fifty Thousand Dollars (\$250,000); or (b) any default by Borrower, the result of which could have a material adverse effect on Borrower's business;

8.7 Judgments; Penalties. One or more fines, penalties or final judgments, orders or decrees for the payment of money in an amount, individually or in the aggregate, of at least Two Hundred Fifty Thousand Dollars (\$250,000.00) (not covered by independent third-party insurance as to which liability has been accepted by such insurance carrier) shall be rendered against Borrower by any Governmental Authority, and the same are not, within ten (10) days after the entry, assessment or issuance thereof, discharged, satisfied, or paid, or after execution thereof, stayed or bonded pending appeal, or such judgments are not discharged prior to the expiration of any such stay (provided that no Credit Extensions will be made prior to the satisfaction, payment, discharge, stay, or bonding of such fine, penalty, judgment, order or decree);

8.8 Misrepresentations. Borrower or any Person acting for Borrower makes any representation, warranty, or other statement now or later in this Agreement, any Loan Document or in any writing delivered to Bank or to induce Bank to enter this Agreement or any Loan Document, and such representation, warranty, or other statement is incorrect in any material respect when made;

8.9 Subordinated Debt. Any document, instrument, or agreement evidencing any Subordinated Debt shall for any reason be revoked or invalidated or otherwise cease to be in full force and effect, any Person shall be in breach thereof or contest in any manner the validity or enforceability thereof or deny that it has any further liability or obligation thereunder, or the Obligations shall for any reason be subordinated or shall not have the priority contemplated by this Agreement or any applicable subordination or intercreditor agreement; or

8.10 Governmental Approvals. Any Governmental Approval shall have been (a) revoked, rescinded, suspended, modified in an adverse manner or not renewed in the ordinary course for a full term or (b) subject to any decision by a Governmental Authority that designates a hearing with respect to any applications for renewal of any of such Governmental Approval or that could result in the Governmental Authority taking any of the actions described in clause (a) above, and such decision or such revocation, rescission, suspension, modification or non-renewal (i) causes, or could reasonably be expected to cause, a Material Adverse Change, or (ii) adversely affects the legal qualifications of Borrower or any of its Subsidiaries to hold such Governmental Approval in any applicable jurisdiction and such revocation, rescission, suspension, modification or non-renewal could reasonably be expected to affect the status of or legal qualifications of Borrower or any of its Subsidiaries to hold any Governmental Approval in any other jurisdiction; or

8.11 Regulatory Event. The commencement of or an any development in (a) any inquiry, investigation, or regulatory action by any applicable Governmental Authority against Borrower, any of its Subsidiaries and/or any other Person engaged in the industry in which Borrower conducts its business or (b) any legal action or proceeding to

which Borrower, any of its Subsidiaries and/or any other Person engaged in the industry in which Borrower conducts its business is a party that, in the case of either (a) or (b), Bank in its sole discretion determines could impact Borrower's or any of its Subsidiaries' ability to continue its business as then currently conducted or could have a negative impact on the industry in which Borrower conducts its business as a whole.

9 BANK'S RIGHTS AND REMEDIES

9.1 Rights and Remedies. Upon the occurrence and during the continuance of an Event of Default, Bank may, without notice or demand, do any or all of the following:

(a) declare all Obligations immediately due and payable (but if an Event of Default described in Section 8.5 occurs all Obligations are immediately due and payable without any action by Bank);

(b) stop advancing money or extending credit for Borrower's benefit under this Agreement or under any other agreement between Borrower and Bank;

(c) demand that Borrower (i) deposit cash with Bank in an amount equal to at least (A) one hundred five percent (105.0%) of the Dollar Equivalent of the aggregate face amount of all Letters of Credit denominated in Dollars remaining undrawn, and (B) one hundred ten percent (110.0%) of the Dollar Equivalent of the aggregate face amount of all Letters of Credit denominated in a Foreign Currency remaining undrawn (plus, in each case, all interest, fees, and costs due or to become due in connection therewith (as estimated by Bank in its good faith business judgment)), to secure all of the Obligations relating to such Letters of Credit, as collateral security for the repayment of any future drawings under such Letters of Credit, and Borrower shall forthwith deposit and pay such amounts, and (ii) pay in advance all letter of credit fees scheduled to be paid or payable over the remaining term of any Letters of Credit;

(d) terminate any FX Contracts;

(e) verify the amount of, demand payment of and performance under, and collect any Accounts and General Intangibles, settle or adjust disputes and claims directly with Account Debtors for amounts on terms and in any order that Bank considers advisable, and notify any Person owing Borrower money of Bank's security interest in such funds. Borrower shall collect all payments in trust for Bank and, if requested by Bank, immediately deliver the payments to Bank in the form received from the Account Debtor, with proper endorsements for deposit;

(f) make any payments and do any acts it considers necessary or reasonable to protect the Collateral and/or its security interest in the Collateral. Borrower shall assemble the Collateral if Bank requests and make it available as Bank designates. Bank may enter premises where the Collateral is located, take and maintain possession of any part of the Collateral, and pay, purchase, contest, or compromise any Lien which appears to be prior or superior to its security interest and pay all expenses incurred. Borrower grants Bank a license to enter and occupy any of its premises, without charge, to exercise any of Bank's rights or remedies;

(g) apply to the Obligations any (i) balances and deposits of Borrower it holds, or (ii) amount held by Bank owing to or for the credit or the account of Borrower;

(h) ship, reclaim, recover, store, finish, maintain, repair, prepare for sale, advertise for sale, and sell the Collateral. Bank is hereby granted a non-exclusive, royalty-free license or other right to use, without charge, Borrower's labels, Patents, Copyrights, mask works, rights of use of any name, trade secrets, trade names, Trademarks, and advertising matter, or any similar property as it pertains to the Collateral, in completing production of, advertising for sale, and selling any Collateral and, in connection with Bank's exercise of its rights under this Section 9.1, Borrower's rights under all licenses and all franchise agreements inure to Bank's benefit;

(i) place a "hold" on any account maintained with Bank and/or deliver a notice of exclusive control, any entitlement order, or other directions or instructions pursuant to any Control Agreement or similar agreements providing control of any Collateral;

(j) demand and receive possession of Borrower's Books; and

(k) exercise all rights and remedies available to Bank under the Loan Documents or at law or equity, including all remedies provided under the Code (including disposal of the Collateral pursuant to the terms thereof).

9.2 Power of Attorney. Borrower hereby irrevocably appoints Bank as its lawful attorney-in-fact, exercisable following the occurrence and during the continuance of an Event of Default, to: (a) endorse Borrower's name on any checks, payment instruments, or other forms of payment or security; (b) sign Borrower's name on any invoice or bill of lading for any Account or drafts against Account Debtors; (c) demand, collect, sue, and give releases to any Account Debtor for monies due, settle and adjust disputes and claims about the Accounts directly with Account Debtors, and compromise, prosecute, or defend any action, claim, case, or proceeding about any Collateral (including filing a claim or voting a claim in any bankruptcy case in Bank's or Borrower's name, as Bank chooses); (d) make, settle, and adjust all claims under Borrower's insurance policies; (e) pay, contest or settle any Lien, charge, encumbrance, security interest, or other claim in or to the Collateral, or any judgment based thereon, or otherwise take any action to terminate or discharge the same; and (f) transfer the Collateral into the name of Bank or a third party as the Code permits. Borrower hereby appoints Bank as its lawful attorney-in-fact to sign Borrower's name on any documents necessary to perfect or continue the perfection of Bank's security interest in the Collateral regardless of whether an Event of Default has occurred until all Obligations have been satisfied in full and the Loan Documents have been terminated. Bank's foregoing appointment as Borrower's attorney in fact, and all of Bank's rights and powers, coupled with an interest, are irrevocable until all Obligations have been fully repaid and performed and the Loan Documents have been terminated.

9.3 Protective Payments. If Borrower fails to obtain the insurance called for by Section 6.7 or fails to pay any premium thereon or fails to pay any other amount which Borrower is obligated to pay under this Agreement or any other Loan Document or which may be required to preserve the Collateral, Bank may obtain such insurance or make such payment, and all amounts so paid by Bank are Bank Expenses and immediately due and payable, bearing interest at the then highest rate applicable to the Obligations, and secured by the Collateral. Bank will make reasonable efforts to provide Borrower with notice of Bank obtaining such insurance at the time it is obtained or within a reasonable time thereafter. No payments by Bank are deemed an agreement to make similar payments in the future or Bank's waiver of any Event of Default.

9.4 Application of Payments and Proceeds. Bank shall have the right to apply in any order any funds in its possession, whether from Borrower account balances, payments, proceeds realized as the result of any collection of Accounts or other disposition of the Collateral, or otherwise, to the Obligations. Bank shall pay any surplus to Borrower by credit to the Designated Deposit Account or to other Persons legally entitled thereto; Borrower shall remain liable to Bank for any deficiency. If Bank, directly or indirectly, enters into a deferred payment or other credit transaction with any purchaser at any sale of Collateral, Bank shall have the option, exercisable at any time, of either reducing the Obligations by the principal amount of the purchase price or deferring the reduction of the Obligations until the actual receipt by Bank of cash therefor.

9.5 Bank's Liability for Collateral. So long as Bank complies with reasonable banking practices regarding the safekeeping of the Collateral in the possession or under the control of Bank, Bank shall not be liable or responsible for: (a) the safekeeping of the Collateral; (b) any loss or damage to the Collateral; (c) any diminution in the value of the Collateral; or (d) any act or default of any carrier, warehouseman, bailee, or other Person. Borrower bears all risk of loss, damage or destruction of the Collateral.

9.6 No Waiver; Remedies Cumulative. Bank's failure, at any time or times, to require strict performance by Borrower of any provision of this Agreement or any other Loan Document shall not waive, affect, or diminish any right of Bank thereafter to demand strict performance and compliance herewith or therewith. No waiver hereunder shall be effective unless signed by the party granting the waiver and then is only effective for the specific instance and purpose for which it is given. Bank's rights and remedies under this Agreement and the other Loan Documents are cumulative. Bank has all rights and remedies provided under the Code, by law, or in equity. Bank's exercise of one right or remedy is not an election and shall not preclude Bank from exercising any other remedy under this Agreement or other remedy available at law or in equity, and Bank's waiver of any Event of Default is not a continuing waiver. Bank's delay in exercising any remedy is not a waiver, election, or acquiescence.

9.7 Demand Waiver. Borrower waives demand, notice of default or dishonor, notice of payment and nonpayment, notice of any default, nonpayment at maturity, release, compromise, settlement, extension, or renewal of accounts, documents, instruments, chattel paper, and guarantees held by Bank on which Borrower is liable.

9.8 Borrower Liability. Any Borrower may, acting singly, request Credit Extensions hereunder. Each Borrower hereby appoints each other as agent for the other for all purposes hereunder, including with respect to requesting Credit Extensions hereunder. Each Borrower hereunder shall be jointly and severally obligated to repay all Credit Extensions made hereunder, regardless of which Borrower actually receives said Credit Extension, as if each Borrower hereunder directly received all Credit Extensions. Each Borrower waives (a) any suretyship defenses available to it under the Code or any other applicable law, and (b) any right to require Bank to: (i) proceed against any Borrower or any other person; (ii) proceed against or exhaust any security; or (iii) pursue any other remedy. Bank may exercise or not exercise any right or remedy it has against any Borrower or any security it holds (including the right to foreclose by judicial or non-judicial sale) without affecting any Borrower's liability. Notwithstanding any other provision of this Agreement or other related document, each Borrower irrevocably waives all rights that it may have at law or in equity (including, without limitation, any law subrogating Borrower to the rights of Bank under this Agreement) to seek contribution, indemnification or any other form of reimbursement from any other Borrower, or any other Person now or hereafter primarily or secondarily liable for any of the Obligations, for any payment made by Borrower with respect to the Obligations in connection with this Agreement or otherwise and all rights that it might have to benefit from, or to participate in, any security for the Obligations as a result of any payment made by Borrower with respect to the Obligations in connection with this Agreement or otherwise. Any agreement providing for indemnification, reimbursement or any other arrangement prohibited under this Section 9.8 shall be null and void. If any payment is made to a Borrower in contravention of this Section 9.8, such Borrower shall hold such payment in trust for Bank and such payment shall be promptly delivered to Bank for application to the Obligations, whether matured or unmatured.

10 NOTICES

All notices, consents, requests, approvals, demands, or other communication by any party to this Agreement or any other Loan Document must be in writing and shall be deemed to have been validly served, given, or delivered: (a) upon the earlier of actual receipt and three (3) Business Days after deposit in the U.S. mail, first class, registered or certified mail return receipt requested, with proper postage prepaid; (b) upon transmission, when sent by electronic mail or facsimile transmission; (c) one (1) Business Day after deposit with a reputable overnight courier with all charges prepaid; or (d) when delivered, if hand-delivered by messenger, all of which shall be addressed to the party to be notified and sent to the address, facsimile number, or email address indicated below. Bank or Borrower may change its mailing or electronic mail address or facsimile number by giving the other party written notice thereof in accordance with the terms of this Section 10.

If to Borrower: Luna Innovations Incorporated
Luna Technologies, Inc.
c/o Luna Innovations Incorporated
1 Riverside Circle, Suite 400
Roanoke, Virginia 24016
Attn: Scott Graeff
Fax: (540) 769-8401
Email: graeffs@lunainnovations.com

With a copy to: Woods Rogers PLC
10 South Jefferson Street
Suite 1400
Roanoke, Va. 24011
Attn: Talfourd H. Kemper, Jr.
Email: fkemper@woodsrogers.com

If to Bank: Silicon Valley Bank
8020 Towers Crescent Drive Suite 475
Vienna, Virginia 22182
Attn: Ms. Alicia Fuller
Fax: (703) 356-7643
Email: afuller@svb.com

with a copy to: Morrison & Foerster LLP
20 Clarendon Street, 20th Floor
Boston, Massachusetts 02116
Attn: Charles W. Stavros, Esquire
Email: cstavros@mof.com

11 CHOICE OF LAW, VENUE, JURY TRIAL WAIVER AND JUDICIAL REFERENCE

Massachusetts law governs the Loan Documents without regard to principles of conflicts of law. Borrower and Bank each submit to the exclusive jurisdiction of the State and Federal courts in Massachusetts; provided, however, that nothing in this Agreement shall be deemed to operate to preclude Bank from bringing suit or taking other legal action in any other jurisdiction to realize on the Collateral or any other security for the Obligations, or to enforce a judgment or other court order in favor of Bank. Borrower expressly submits and consents in advance to such jurisdiction in any action or suit commenced in any such court, and Borrower hereby waives any objection that it may have based upon lack of personal jurisdiction, improper venue, or forum non conveniens and hereby consents to the granting of such legal or equitable relief as is deemed appropriate by such court. Borrower hereby waives personal service of the summons, complaints, and other process issued in such action or suit and agrees that service of such summons, complaints, and other process may be made by registered or certified mail addressed to Borrower at the address set forth in Section 10 of this Agreement and that service so made shall be deemed completed upon the earlier to occur of Borrower's actual receipt thereof or three (3) days after deposit in the U.S. mails, proper postage prepaid. NOTWITHSTANDING ANYTHING TO THE CONTRARY SET FORTH HEREINABOVE, BANK SHALL SPECIFICALLY HAVE THE RIGHT TO BRING ANY ACTION OR PROCEEDING AGAINST BORROWER OR ITS PROPERTY IN THE COURTS OF ANY OTHER JURISDICTION WHICH BANK DEEMS NECESSARY OR APPROPRIATE IN ORDER TO REALIZE ON THE COLLATERAL OR TO OTHERWISE ENFORCE BANK'S RIGHTS AGAINST BORROWER OR ITS PROPERTY.

TO THE FULLEST EXTENT PERMITTED BY APPLICABLE LAW, BORROWER AND BANK EACH WAIVE THEIR RIGHT TO A JURY TRIAL OF ANY CLAIM OR CAUSE OF ACTION ARISING OUT OF OR BASED UPON THIS AGREEMENT, THE LOAN DOCUMENTS OR ANY CONTEMPLATED TRANSACTION, INCLUDING CONTRACT, TORT, BREACH OF DUTY AND ALL OTHER CLAIMS. THIS WAIVER IS A MATERIAL INDUCEMENT FOR BOTH PARTIES TO ENTER INTO THIS AGREEMENT. EACH PARTY HAS REVIEWED THIS WAIVER WITH ITS COUNSEL.

This Section 11 shall survive the termination of this Agreement.

12 GENERAL PROVISIONS

12.1 Termination Prior to Maturity Date; Survival. All covenants, representations and warranties made in this Agreement shall continue in full force until this Agreement has terminated pursuant to its terms and all Obligations (other than inchoate indemnity obligations, and any Obligations under Bank Services Agreements that are cash collateralized in accordance with Section 4.1 of this Agreement) have been satisfied. So long as Borrower has satisfied the Obligations (other than inchoate indemnity obligations, and any other obligations which, by their terms, are to survive the termination of this Agreement, and any Obligations under Bank Services Agreements that are cash collateralized in accordance with Section 4.1 of this Agreement), this Agreement may be terminated prior to the Revolving Line Maturity Date by Borrower, effective three (3) Business Days after written notice of termination is given to Bank. Those obligations that are expressly specified in this Agreement as surviving this Agreement's termination shall continue to survive notwithstanding this Agreement's termination.

12.2 Successors and Assigns. This Agreement binds and is for the benefit of the successors and permitted assigns of each party. Borrower may not assign this Agreement or any rights or obligations under it without Bank's prior written consent (which may be granted or withheld in Bank's discretion). Bank has the right, without the consent of or notice to Borrower, to sell, transfer, assign, negotiate, or grant participation in all or any part of, or any interest in, Bank's obligations, rights, and benefits under this Agreement and the other Loan Documents (other than the Warrant, as to which assignment, transfer and other such actions are governed by the terms thereof).

12.3 Indemnification. Borrower agrees to indemnify, defend and hold Bank and its directors, officers, employees, agents, attorneys, or any other Person affiliated with or representing Bank (each, an "**Indemnified Person**") harmless against: (i) all obligations, demands, claims, and liabilities (collectively, "**Claims**") claimed or asserted by any other party in connection with the transactions contemplated by the Loan Documents; and (ii) all losses or expenses (including Bank Expenses) in any way suffered, incurred, or paid by such Indemnified Person as a result of, following from, consequential to, or arising from transactions between Bank and Borrower contemplated by the Loan Documents (including reasonable attorneys' fees and expenses), except for Claims and/or losses directly caused by such Indemnified Person's gross negligence or willful misconduct.

This Section 12.3 shall survive until all statutes of limitation with respect to the Claims, losses, and expenses for which indemnity is given shall have run.

12.4 Time of Essence. Time is of the essence for the performance of all Obligations in this Agreement.

12.5 Severability of Provisions. Each provision of this Agreement is severable from every other provision in determining the enforceability of any provision.

12.6 Correction of Loan Documents. Bank may correct patent errors and fill in any blanks in the Loan Documents consistent with the agreement of the parties.

12.7 Amendments in Writing; Waiver; Integration. No purported amendment or modification of any Loan Document, or waiver, discharge or termination of any obligation under any Loan Document, shall be enforceable or admissible unless, and only to the extent, expressly set forth in a writing signed by the party against which enforcement or admission is sought. Without limiting the generality of the foregoing, no oral promise or statement, nor any action, inaction, delay, failure to require performance or course of conduct shall operate as, or evidence, an amendment, supplement or waiver or have any other effect on any Loan Document. Any waiver granted shall be limited to the specific circumstance expressly described in it, and shall not apply to any subsequent or other circumstance, whether similar or dissimilar, or give rise to, or evidence, any obligation or commitment to grant any further waiver. The Loan Documents represent the entire agreement about this subject matter and supersede prior negotiations or agreements. All prior agreements, understandings, representations, warranties, and negotiations between the parties about the subject matter of the Loan Documents merge into the Loan Documents.

12.8 Counterparts. This Agreement may be executed in any number of counterparts and by different parties on separate counterparts, each of which, when executed and delivered, is an original, and all taken together, constitute one Agreement.

12.9 Confidentiality. In handling any confidential information, Bank shall exercise the same degree of care that it exercises for its own proprietary information, but disclosure of information may be made: (a) to Bank's Subsidiaries or Affiliates (such Subsidiaries and Affiliates, together with Bank, collectively, "**Bank Entities**"); (b) to prospective transferees or purchasers of any interest in the Credit Extensions (provided, however, Bank shall use its best efforts to obtain any prospective transferee's or purchaser's agreement to the terms of this provision); (c) as required by law, regulation, subpoena, or other order; (d) to Bank's regulators or as otherwise required in connection with Bank's examination or audit; (e) as Bank considers appropriate in exercising remedies under the Loan Documents; and (f) to third-party service providers of Bank so long as such service providers have executed a confidentiality agreement with Bank with terms no less restrictive than those contained herein. Confidential information does not include information that is either: (i) in the public domain or in Bank's possession when disclosed to Bank, or becomes part of the public domain (other than as a result of its disclosure by Bank in violation of this Agreement) after disclosure to Bank; or (ii) disclosed to Bank by a third party, if Bank does not know that the third party is prohibited from disclosing the information.

Bank Entities may use anonymous forms of confidential information for aggregate datasets, for analyses or reporting, and for any other uses not expressly prohibited in writing by Borrower. The provisions of the immediately preceding sentence shall survive the termination of this Agreement.

12.10 Attorneys' Fees, Costs and Expenses. In any action or proceeding between Borrower and Bank arising out of or relating to the Loan Documents, the prevailing party shall be entitled to recover its reasonable attorneys' fees and other costs and expenses incurred, in addition to any other relief to which it may be entitled.

12.11 Electronic Execution of Documents. The words "execution," "signed," "signature" and words of like import in any Loan Document shall be deemed to include electronic signatures or the keeping of records in electronic form, each of which shall be of the same legal effect, validity and enforceability as a manually executed signature or the use of a paper-based recordkeeping systems, as the case may be, to the extent and as provided for in any applicable law, including, without limitation, any state law based on the Uniform Electronic Transactions Act.

12.12 Right of Setoff. Borrower hereby grants to Bank a Lien and a right of setoff as security for all Obligations to Bank, whether now existing or hereafter arising upon and against all deposits, credits, collateral and property, now or hereafter in the possession, custody, safekeeping or control of Bank or any entity under the control of Bank (including a subsidiary of Bank) or in transit to any of them. At any time after the occurrence and during the continuance of an Event of Default, without demand or notice, Bank may setoff the same or any part thereof and apply the same to any liability or Obligation of Borrower even though unmatured and regardless of the adequacy of any other collateral securing the Obligations. ANY AND ALL RIGHTS TO REQUIRE BANK TO EXERCISE ITS RIGHTS OR REMEDIES WITH RESPECT TO ANY OTHER COLLATERAL WHICH SECURES THE OBLIGATIONS, PRIOR TO EXERCISING ITS RIGHT OF SETOFF WITH RESPECT TO SUCH DEPOSITS, CREDITS OR OTHER PROPERTY OF BORROWER, ARE HEREBY KNOWINGLY, VOLUNTARILY AND IRREVOCABLY WAIVED.

12.13 Captions. The headings used in this Agreement are for convenience only and shall not affect the interpretation of this Agreement.

12.14 Construction of Agreement. The parties mutually acknowledge that they and their attorneys have participated in the preparation and negotiation of this Agreement. In cases of uncertainty this Agreement shall be construed without regard to which of the parties caused the uncertainty to exist.

12.15 Relationship. The relationship of the parties to this Agreement is determined solely by the provisions of this Agreement. The parties do not intend to create any agency, partnership, joint venture, trust, fiduciary or other relationship with duties or incidents different from those of parties to an arm's-length contract.

12.16 Third Parties. Nothing in this Agreement, whether express or implied, is intended to: (a) confer any benefits, rights or remedies under or by reason of this Agreement on any persons other than the express parties to it and their respective permitted successors and assigns; (b) relieve or discharge the obligation or liability of any person not an express party to this Agreement; or (c) give any person not an express party to this Agreement any right of subrogation or action against any party to this Agreement.

12.17 No Novation. Borrower and Bank hereby agree that, effective upon the execution and delivery of this Agreement by each such party, the terms and provisions of the Prior Loan Agreement shall be and hereby are amended, restated and superseded in their entirety by the terms and provisions of this Agreement, and the Prior Loan Agreement shall be automatically terminated on the Effective Date of this Agreement. Nothing herein contained shall be construed as a substitution or novation of the obligations of Borrower outstanding under the Prior Loan Agreement, any instruments securing the same, which obligations shall remain in full force and effect, except to the extent that the terms thereof are modified hereby or by instruments or other Loan Documents executed concurrently herewith. Nothing expressed or implied in this Agreement shall be construed as a release or other discharge of any Borrower from any of the Obligations or any liabilities under the Prior Loan Agreement or any of the security agreements, pledge agreements, mortgages, guaranties or other Loan Documents (as such term is defined in the Prior Loan Agreement), executed in connection therewith. Borrower hereby (i) confirms and agrees that each Loan Document to which it is a party is, and shall continue to be, in full force and effect and is hereby ratified and confirmed in all respects except that on and after the Effective Date all references in any such Loan Document to the "Loan and Security

Agreement”, the “Loan Agreement” the “Agreement”, “thereto”, “thereof”, “thereunder” or words of like import referring to the Prior Loan Agreement shall mean the Prior Loan Agreement as amended and restated by this Agreement; and (ii) confirms and agrees that to the extent that the Prior Loan Agreement or any Loan Document executed in connection therewith purports to assign or pledge to the Bank, or to grant to the Bank a security interest in or lien on, any collateral as security for the Obligations of Borrower or any guarantor from time to time existing in respect of the Prior Loan Agreement, such pledge, assignment or grant of the security interest or lien is hereby ratified and confirmed in all respects and shall remain effective as of the first date it became effective, as amended and restated by this Agreement.

12.18 Waiver of Claims; Release.

(a) Borrower hereby acknowledges and agrees that it has no offsets, defenses, causes of action, suits, damages, claims, or counterclaims against Bank, or Bank’s officers, directors, employees, attorneys, representatives, predecessors, successors, and assigns (collectively, the “**Bank Released Parties**”) with respect to the Obligations, the Loan Documents, the Collateral, any contracts, promises, commitments or other agreements to provide, to arrange for, or to obtain loans or other financial accommodations to or for the Borrowers, and all actions taken or contemplated to be taken in connection with, arising from, or in any manner whatsoever relating to the foregoing, or otherwise, and that if any Borrower now has, or ever did have, any offsets, defenses, causes of action, suits, damages, claims, or counterclaims against one or more of the Bank Released Parties, whether known or unknown, at law or in equity, from the beginning of the world through this date and through the time of execution of this Agreement (collectively, the “**Released Claims**”), all of them are hereby expressly **WAIVED**, and Borrower hereby **RELEASES** the Bank Released Parties from any liability therefor. Borrower hereby irrevocably agrees to refrain from directly or indirectly asserting any claim or demand or commencing (or causing to be commenced) any suit, action, arbitration or proceeding of any kind, in any court or before any tribunal or arbiter or arbitration panel, against any Bank Released Party as to any Released Claim. Nothing contained in this Section 12.18 is intended to be, and shall not be construed as, a waiver of Bank’s obligations under this Agreement or any other Loan Document from and after the Effective Date.

(b) In furtherance of this release, Borrower expressly acknowledges and waives any and all rights under Section 1542 of the California Civil Code, which provides as follows:

“A general release does not extend to claims that the creditor or releasing party does not know or suspect to exist in his or her favor at the time of executing the release and that, if known by him or her, would have materially affected his or her settlement with the debtor or released party.”

(c) This release may be pleaded as a full and complete defense and/or as a cross-complaint or counterclaim against any action, suit, or other proceeding that may be instituted, prosecuted or attempted in breach of this release. Borrower acknowledges that the release contained herein constitutes a material inducement to Bank to enter into this Agreement, and that Bank would not have done so but for Bank’s expectation that such release is valid and enforceable in all events.

(d) By entering into this release, Borrower recognizes that no facts or representations are ever absolutely certain and it may hereafter discover facts in addition to or different from those which it presently knows or believes to be true, but that it is the intention of Borrower hereby to fully, finally and forever settle and release all matters, disputes and differences, known or unknown, suspected or unsuspected; accordingly, if any Borrower should subsequently discover that any fact that it relied upon in entering into this release was untrue, or that any understanding of the facts was incorrect, such Borrower shall not be entitled to set aside this release by reason thereof, regardless of any claim of mistake of fact or law or any other circumstances whatsoever. Borrower acknowledges that it is not relying upon and has not relied upon any representation or statement made by Bank with respect to the facts underlying this release or with regard to any of such party’s rights or asserted rights.

(e) Borrower hereby represents and warrants to Bank, and Bank is relying thereon, as follows: (i) except as expressly stated in this Agreement, neither Bank nor any agent, employee or representative of Bank has made any statement or representation to any Borrower regarding any fact relied upon by such Borrower in entering into this Agreement; (ii) Borrower has made such investigation of the facts pertaining to this Agreement and all of the

matters appertaining thereto, as it deems necessary; (iii) the terms of this Agreement are contractual and not a mere recital; (iv) this Agreement has been carefully read by Borrower, the contents hereof are known and understood by Borrower, and this Agreement is signed freely, and without duress, by such Borrower; and (v) Borrower represents and warrants that it is the sole and lawful owner of all right, title and interest in and to every claim and every other matter which it releases herein, and that it has not heretofore assigned or transferred, or purported to assign or transfer, to any person, firm or entity any claims or other matters herein released. Borrower shall indemnify Bank, defend and hold it harmless from and against all claims based upon or arising in connection with prior assignments or purported assignments or transfers of any claims or matters released herein.

13 **DEFINITIONS**

13.1 **Definitions.** As used in the Loan Documents, the word “shall” is mandatory, the word “may” is permissive, the word “or” is not exclusive, the words “includes” and “including” are not limiting, the singular includes the plural, and numbers denoting amounts that are set off in brackets are negative. As used in this Agreement, the following capitalized terms have the following meanings:

“**Account**” is, as to any Person, any “**account**” of such Person as “**account**” is defined in the Code with such additions to such term as may hereafter be made, and includes, without limitation, all accounts receivable and other sums owing to such Person.

“**Account Debtor**” is any “**account debtor**” as defined in the Code with such additions to such term as may hereafter be made.

“**Administrator**” is an individual that is named:

(a) as an “**Administrator**” in the “**SVB Online Services**” form completed by Borrower with the authority to determine who will be authorized to use SVB Online Services (as defined in Bank’s Online Banking Agreement as in effect from time to time) on behalf of Borrower; and

(b) as an Authorized Signer of Borrower in an approval by the Board.

“**Advance**” or “**Advances**” means a revolving credit loan (or revolving credit loans) under the Revolving Line.

“**Affiliate**” is, with respect to any Person, each other Person that owns or controls directly or indirectly the Person, any Person that controls or is controlled by or is under common control with the Person, and each of that Person’s senior executive officers, directors, partners and, for any Person that is a limited liability company, that Person’s managers and members.

“**Agreement**” is defined in the preamble hereof.

“**API Canada**” means Advanced Photonix Canada, Inc., a Canadian corporation and wholly-owned Subsidiary of API.

“**Authorized Signer**” is any individual listed in Borrower’s Borrowing Resolution who is authorized to execute the Loan Documents, including making (and executing if applicable) any Credit Extension request, on behalf of Borrower.

“**Availability Amount**” is (a) the Revolving Line, minus (b) the aggregate Dollar Equivalent amount of all outstanding Letters of Credit (including drawn but unreimbursed Letters of Credit) plus an amount equal to the Letter of Credit Reserve, minus (c) the FX Reduction Amount, minus (d) any amounts used for Cash Management Services, and minus (e) the outstanding principal balance of any Advances.

“**Bank**” is defined in the preamble hereof.

“**Bank Entities**” is defined in Section 12.9.

“**Bank Expenses**” are all audit fees and expenses, costs, and expenses (including reasonable attorneys’ fees and expenses) for preparing, amending, negotiating, administering, defending and enforcing the Loan Documents (including, without limitation, those incurred in connection with appeals or Insolvency Proceedings) or otherwise incurred with respect to Borrower or any Guarantor.

“**Bank Services**” are any products, credit services, and/or financial accommodations previously, now, or hereafter provided to Borrower or any of its Subsidiaries by Bank or any Bank Affiliate, including, without limitation, any letters of credit, cash management services (including, without limitation, merchant services, direct deposit of payroll, business credit cards, and check cashing services), interest rate swap arrangements, and foreign exchange services as any such products or services may be identified in Bank’s various agreements related thereto (each, a “**Bank Services Agreement**”).

“**Bank Services Agreement**” is defined in the definition of Bank Services.

“**Board**” is Borrower’s board of directors.

“**Borrower**” is defined in the preamble hereof.

“**Borrower’s Books**” are all Borrower’s books and records including ledgers, federal and state tax returns, records regarding Borrower’s assets or liabilities, the Collateral, business operations or financial condition, and all computer programs or storage or any equipment containing such information.

“**Borrowing Resolutions**” are, with respect to any Person, those resolutions adopted by such Person’s board of directors (and, if required under the terms of such Person’s Operating Documents, stockholders) and delivered by such Person to Bank approving the Loan Documents to which such Person is a party and the transactions contemplated thereby, together with a certificate executed by its secretary on behalf of such Person certifying (a) such Person has the authority to execute, deliver, and perform its obligations under each of the Loan Documents to which it is a party, (b) that set forth as a part of or attached as an exhibit to such certificate is a true, correct, and complete copy of the resolutions then in full force and effect authorizing and ratifying the execution, delivery, and performance by such Person of the Loan Documents to which it is a party, (c) the name(s) of the Person(s) authorized to execute the Loan Documents, including making (and executing if applicable) any Credit Extension request, on behalf of such Person, together with a sample of the true signature(s) of such Person(s), and (d) that Bank may conclusively rely on such certificate unless and until such Person shall have delivered to Bank a further certificate canceling or amending such prior certificate.

“**Business Day**” is any day that is not a Saturday, Sunday or a day on which Bank is closed.

“**Cash Collateral Account**” is defined in Section 6.3(c).

“**Cash Equivalents**” means (a) marketable direct obligations issued or unconditionally guaranteed by the United States or any agency or any State thereof having maturities of not more than one (1) year from the date of acquisition; (b) commercial paper maturing no more than one (1) year after its creation and having the highest rating from either Standard & Poor’s Ratings Group or Moody’s Investors Service, Inc.; (c) Bank’s certificates of deposit issued maturing no more than one (1) year after issue; and (d) money market funds at least ninety-five percent (95%) of the assets of which constitute Cash Equivalents of the kinds described in clauses (a) through (c) of this definition.

“**Change in Control**” means (a) at any time, any “person” or “group” (as such terms are used in Sections 13(d) and 14(d) of the Exchange Act), shall become, or obtain rights (whether by means of warrants, options or otherwise) to become, the “beneficial owner” (as defined in Rules 13(d)-3 and 13(d)-5 under the Exchange Act), directly or indirectly, of forty percent (40.0%) or more of the ordinary voting power for the election of directors of Borrower (determined on a fully diluted basis) other than by the sale of Borrower’s equity securities in a public offering or to venture capital or private equity investors so long as Borrower identifies to Bank the venture capital or private equity investors at least seven (7) Business Days prior to the closing of the transaction and provides to Bank a

description of the material terms of the transaction; (b) during any period of twelve (12) consecutive months, a majority of the members of the board of directors or other equivalent governing body of Borrower cease to be composed of individuals (i) who were members of that board or equivalent governing body on the first day of such period, (ii) whose election or nomination to that board or equivalent governing body was approved by individuals referred to in clause (i) above constituting at the time of such election or nomination at least a majority of that board or equivalent governing body or (iii) whose election or nomination to that board or other equivalent governing body was approved by individuals referred to in clauses (i) and (ii) above constituting at the time of such election or nomination at least a majority of that board or equivalent governing body; or (c) at any time, Borrower shall cease to own and control, of record and beneficially, directly or indirectly, one hundred percent (100.0%) of each class of outstanding capital stock of each subsidiary of Borrower free and clear of all Liens (except Liens created by this Agreement).

“**Claims**” is defined in Section 12.3.

“**Code**” is the Uniform Commercial Code, as the same may, from time to time, be enacted and in effect in the Commonwealth of Massachusetts; provided, that, to the extent that the Code is used to define any term herein or in any Loan Document and such term is defined differently in different Articles or Divisions of the Code, the definition of such term contained in Article or Division 9 shall govern; provided further, that in the event that, by reason of mandatory provisions of law, any or all of the attachment, perfection, or priority of, or remedies with respect to, Bank’s Lien on any Collateral is governed by the Uniform Commercial Code in effect in a jurisdiction other than the Commonwealth of Massachusetts, the term “**Code**” shall mean the Uniform Commercial Code as enacted and in effect in such other jurisdiction solely for purposes of the provisions thereof relating to such attachment, perfection, priority, or remedies and for purposes of definitions relating to such provisions.

“**Collateral**” is any and all properties, rights and assets of Borrower described on Exhibit A.

“**Collateral Account**” is any Deposit Account, Securities Account, or Commodity Account.

“**Commodity Account**” is any “commodity account” as defined in the Code with such additions to such term as may hereafter be made.

“**Compliance Certificate**” is that certain certificate in the form attached hereto as Exhibit B.

“**Contingent Obligation**” is, for any Person, any direct or indirect liability, contingent or not, of that Person for (a) any indebtedness, lease, dividend, letter of credit or other obligation of another such as an obligation, in each case, directly or indirectly guaranteed, endorsed, co made, discounted or sold with recourse by that Person, or for which that Person is directly or indirectly liable; (b) any obligations for undrawn letters of credit for the account of that Person; and (c) all obligations from any interest rate, currency or commodity swap agreement, interest rate cap or collar agreement, or other agreement or arrangement designated to protect a Person against fluctuation in interest rates, currency exchange rates or commodity prices; but “Contingent Obligation” does not include endorsements in the ordinary course of business. The amount of a Contingent Obligation is the stated or determined amount of the primary obligation for which the Contingent Obligation is made or, if not determinable, the maximum reasonably anticipated liability for it determined by the Person in good faith; but the amount may not exceed the maximum of the obligations under any guarantee or other support arrangement.

“**Control Agreement**” is any control agreement entered into among the depository institution at which Borrower maintains a Deposit Account or the securities intermediary or commodity intermediary at which Borrower maintains a Securities Account or a Commodity Account, Borrower, and Bank pursuant to which Bank obtains control (within the meaning of the Code) over such Deposit Account, Securities Account, or Commodity Account.

“**Copyrights**” are any and all copyright rights, copyright applications, copyright registrations and like protections in each work of authorship and derivative work thereof, whether published or unpublished and whether or not the same also constitutes a trade secret.

“**Credit Extension**” is any Advance, any Overadvance, Letter of Credit, FX Contract, amount utilized for Cash Management Services, or any other extension of credit by Bank for Borrower’s benefit.

“**Currency**” is coined money and such other banknotes or other paper money as are authorized by law and circulate as a medium of exchange.

“**Default Rate**” is defined in Section 2.7(b).

“**Deferred Revenue**” is all amounts received or invoiced in advance of performance under contracts and not yet recognized as revenue.

“**Deposit Account**” is any “**deposit account**” as defined in the Code with such additions to such term as may hereafter be made.

“**Designated Deposit Account**” is Borrower’s deposit account, account number xxxxxxx246, maintained with Bank.

“**Division**” means, in reference to any Person which is an entity, the division of such Person into two (2) or more separate Persons, with the dividing Person either continuing or terminating its existence as part of such division, including, without limitation, as contemplated under Section 18-217 of the Delaware Limited Liability Company Act for limited liability companies formed under Delaware law, or any analogous action taken pursuant to any other applicable law with respect to any corporation, limited liability company, partnership or other entity.

“**Dollars,**” “**dollars**” or use of the sign “\$” means only lawful money of the United States and not any other currency, regardless of whether that currency uses the “\$” sign to denote its currency or may be readily converted into lawful money of the United States.

“**Dollar Equivalent**” is, at any time, (a) with respect to any amount denominated in Dollars, such amount, and (b) with respect to any amount denominated in a Foreign Currency, the equivalent amount therefor in Dollars as determined by Bank at such time on the basis of the then-prevailing rate of exchange in San Francisco, California, for sales of the Foreign Currency for transfer to the country issuing such Foreign Currency.

“**Effective Date**” is defined in the preamble hereof.

“**Equipment**” is all “**equipment**” as defined in the Code with such additions to such term as may hereafter be made, and includes without limitation all machinery, fixtures, goods, vehicles (including motor vehicles and trailers), and any interest in any of the foregoing.

“**ERISA**” is the Employee Retirement Income Security Act of 1974, and its regulations.

“**Event of Default**” is defined in Section 8.

“**Exchange Act**” is the Securities Exchange Act of 1934, as amended.

“**Foreign Currency**” means lawful money of a country other than the United States.

“**Funding Date**” is any date on which a Credit Extension is made to or for the account of Borrower which shall be a Business Day.

“**FX Business Day**” is any day when (a) Bank’s Foreign Exchange Department is conducting its normal business and (b) the Foreign Currency being purchased or sold by Borrower is available to Bank from the entity from which Bank shall buy or sell such Foreign Currency.

“**FX Contract**” is defined in Section 2.4.

“**FX Reduction Amount**” is defined in Section 2.4.

“**GAAP**” is generally accepted accounting principles set forth in the opinions and pronouncements of the Accounting Principles Board of the American Institute of Certified Public Accountants and statements and pronouncements of the Financial Accounting Standards Board or in such other statements by such other Person as may be approved by a significant segment of the accounting profession, which are applicable to the circumstances as of the date of determination.

“**General Intangibles**” is all “general intangibles” as defined in the Code in effect on the date hereof with such additions to such term as may hereafter be made, and includes without limitation, all Intellectual Property, claims, income and other tax refunds, security and other deposits, payment intangibles, contract rights, options to purchase or sell real or personal property, rights in all litigation presently or hereafter pending (whether in contract, tort or otherwise), insurance policies (including without limitation key man, property damage, and business interruption insurance), payments of insurance and rights to payment of any kind.

“**Governmental Approval**” is any consent, authorization, approval, order, license, franchise, permit, certificate, accreditation, registration, filing or notice, of, issued by, from or to, or other act by or in respect of, any Governmental Authority.

“**Governmental Authority**” is any nation or government, any state or other political subdivision thereof, any agency, authority, instrumentality, regulatory body, court, central bank or other entity exercising executive, legislative, judicial, taxing, regulatory or administrative functions of or pertaining to government, any securities exchange and any self-regulatory organization.

“**Guarantor**” is any Person providing a Guaranty in favor of Bank.

“**Guaranty**” is any guarantee of all or any part of the Obligations, as the same may from time to time be amended, restated, modified or otherwise supplemented.

“**Indebtedness**” is (a) indebtedness for borrowed money or the deferred price of property or services, such as reimbursement and other obligations for surety bonds and letters of credit, (b) obligations evidenced by notes, bonds, debentures or similar instruments, (c) capital lease obligations, and (d) Contingent Obligations.

“**Indemnified Person**” is defined in Section 12.3.

“**Insolvency Proceeding**” is any proceeding by or against any Person under the United States Bankruptcy Code, or any other bankruptcy or insolvency law, including assignments for the benefit of creditors, compositions, extensions generally with its creditors, or proceedings seeking reorganization, arrangement, or other relief.

“**Intellectual Property**” means, with respect to any Person, all of such Person’s right, title, and interest in and to the following:

- (a) its Copyrights, Trademarks and Patents;
- (b) any and all trade secrets and trade secret rights, including, without limitation, any rights to unpatented inventions, know-how and operating manuals;
- (c) any and all source code;
- (d) any and all design rights which may be available to such Person;
- (e) any and all claims for damages by way of past, present and future infringement of any of the foregoing, with the right, but not the obligation, to sue for and collect such damages for said use or infringement of the Intellectual Property rights identified above; and
- (f) all amendments, renewals and extensions of any of the Copyrights, Trademarks or Patents.

“**Inventory**” is all “**inventory**” as defined in the Code in effect on the date hereof with such additions to such term as may hereafter be made, and includes without limitation all merchandise, raw materials, parts, supplies, packing and shipping materials, work in process and finished products, including without limitation such inventory as is temporarily out of Borrower’s custody or possession or in transit and including any returned goods and any documents of title representing any of the above.

“**Investment**” is any beneficial ownership interest in any Person (including stock, partnership interest or other securities), and any loan, advance or capital contribution to any Person.

“**Key Person**” is each of Borrower’s (a) Chief Executive Officer, who is Scott A. Graeff as of the Effective Date.

“**Letter of Credit**” is a standby or commercial letter of credit issued by Bank upon request of Borrower based upon an application, guarantee, indemnity, or similar agreement.

“**Letter of Credit Application**” is defined in Section 2.3(b).

“**Letter of Credit Reserve**” has the meaning set forth in Section 2.3(e).

“**Lien**” is a claim, mortgage, deed of trust, levy, charge, pledge, security interest or other encumbrance of any kind, whether voluntarily incurred or arising by operation of law or otherwise against any property.

“**Liquidity Coverage Ratio**” means the ratio of (A) (i) unrestricted cash of Borrower at Bank plus (ii) the Availability Amount, divided by (B) all Obligations of Borrower to Bank, including, without limitation, all Indebtedness under Letters of Credit.

“**Loan Documents**” are, collectively, this Agreement and any schedules, exhibits, certificates, notices, and any other documents related to this Agreement, any Bank Services Agreement, the Perfection Certificate, any Control Agreement, any subordination agreement, any note, or notes or guaranties executed by Borrower or any Guarantor, and any other present or future agreement by Borrower and/or any Guarantor with or for the benefit of Bank in connection with this Agreement or Bank Services, all as amended, restated, or otherwise modified.

“**Material Adverse Change**” is (a) a material impairment in the perfection or priority of Bank’s Lien in the Collateral or in the value of such Collateral; (b) a material adverse change in the business, operations, or condition (financial or otherwise) of Borrower; (c) a material impairment of the prospect of repayment of any portion of the Obligations; (d) Bank determines, based upon information available to it and in its reasonable judgment, that there is a reasonable likelihood that Borrower shall fail to comply with one or more of the financial covenants in Section 6 during the next succeeding financial reporting period, or (e) any Key Person departs from or ceases to be employed by Borrower.

“**Monthly Financial Statements**” is defined in Section 6.2(b).

“**Obligations**” are Borrower’s obligations to pay when due any debts, principal, interest, fees, Bank Expenses, and other amounts Borrower owes Bank now or later, whether under this Agreement, the other Loan Documents, or otherwise, including, without limitation, all obligations relating to Bank Services and interest accruing after Insolvency Proceedings begin and debts, liabilities, or obligations of Borrower assigned to Bank, and to perform Borrower’s duties under the Loan Documents.

“**Operating Documents**” are, for any Person, such Person’s formation documents, as certified by the Secretary of State (or equivalent agency) of such Person’s jurisdiction of organization on a date that is no earlier than thirty (30) days prior to the Effective Date, and, (a) if such Person is a corporation, its bylaws in current form, (b) if such Person is a limited liability company, its limited liability company agreement (or similar agreement), and (c) if such Person is a partnership, its partnership agreement (or similar agreement), each of the foregoing with all current amendments or modifications thereto.

“**Patents**” means all patents, patent applications and like protections including without limitation improvements, divisions, continuations, renewals, reissues, extensions and continuations-in-part of the same.

“**Payment Date**” is the last calendar day of each month.

“**Perfection Certificate**” is defined in Section 5.1.

“**Permitted Indebtedness**” is:

- (a) Borrower’s Indebtedness to Bank under this Agreement and the other Loan Documents;
- (b) Indebtedness existing on the Effective Date and shown on the Perfection Certificate;
- (c) Subordinated Debt;
- (d) unsecured Indebtedness to trade creditors incurred in the ordinary course of business; and
- (e) extensions, refinancings, modifications, amendments and restatements of any items of Permitted Indebtedness (a) through (d) above, provided that the principal amount thereof is not increased or the terms thereof are not modified to impose more burdensome terms upon Borrower or its Subsidiary, as the case may be.

“**Permitted Investments**” are:

- (a) Investments shown on the Perfection Certificate and existing on the Effective Date;
- (b) Cash Equivalents;
- (c) Investments consisting of the endorsement of negotiable instruments for deposit or collection or similar transactions in the ordinary course of Borrower’s business;
- (d) Investments consisting of (i) travel advances and employee relocation loans and other employee loans and advances in the ordinary course of business, and (ii) loans to employees, officers or directors relating to the purchase of equity securities of Borrower or its Subsidiaries pursuant to employee stock purchase plans or agreements approved by the Board;
- (e) Investments (including debt obligations) received in connection with the bankruptcy or reorganization of customers or suppliers and in settlement of delinquent obligations of, and other disputes with, customers or suppliers arising in the ordinary course of business;
- (f) Investments consisting of notes receivable of, or prepaid royalties and other credit extensions, to customers and suppliers who are not Affiliates, in the ordinary course of business; provided that this paragraph (f) shall not apply to Investments of Borrower in any Subsidiary;
- (g) Investments consisting of the creation of a Subsidiary for the purpose of consummating a merger transaction permitted by Section 7.3 of this Agreement, which is otherwise a Permitted Investment; and
- (h) Investments by Borrower in API Canada in an amount not to exceed Two Hundred Fifty Thousand Dollars (\$250,000) in the aggregate in any consecutive three (3) month period.

“**Permitted Liens**” are:

- (a) Liens existing on the Effective Date and shown on the Perfection Certificate or arising under this Agreement and the other Loan Documents;
- (b) Liens for taxes, fees, assessments or other government charges or levies, either (i) not due and payable or (ii) being contested in good faith and for which Borrower maintains adequate reserves on its Books, that no notice of any such Lien has been filed or recorded under the Internal Revenue Code of 1986, as amended, and the Treasury Regulations adopted thereunder;

(c) purchase money Liens (i) on Equipment acquired or held by Borrower incurred for financing the acquisition of the Equipment securing no more than Two Hundred Fifty Thousand Dollars (\$250,000) in the aggregate amount outstanding, or (ii) existing on Equipment when acquired, if the Lien is confined to the property and improvements and the proceeds of the Equipment;

(d) Liens of carriers, warehousemen, suppliers, or other Persons that are possessory in nature arising in the ordinary course of business so long as such Liens attach only to Inventory, securing liabilities in the aggregate amount not to exceed Two Hundred Fifty Thousand Dollars (\$250,000) and which are not delinquent or remain payable without penalty or which are being contested in good faith and by appropriate proceedings which proceedings have the effect of preventing the forfeiture or sale of the property subject thereto;

(e) Liens to secure payment of workers' compensation, employment insurance, old-age pensions, social security and other like obligations incurred in the ordinary course of business (other than Liens imposed by ERISA);

(f) Liens incurred in the extension, renewal or refinancing of the Indebtedness secured by Liens described in (a) through (c), but any extension, renewal or replacement Lien must be limited to the property encumbered by the existing Lien and the principal amount of the indebtedness may not increase;

(g) leases or subleases of real property granted in the ordinary course of Borrower's business, and leases, subleases, non-exclusive licenses or sublicenses of property (other than real property or Intellectual Property) granted in the ordinary course of Borrower's business, if the leases, subleases, licenses and sublicenses do not prohibit granting Bank a security interest;

(h) non-exclusive licenses of Intellectual Property granted to third parties in the ordinary course of business;

(i) exclusive licenses of Intellectual Property in the ordinary course of Borrower's business and consistent with Borrower's past practices;

(j) Liens arising from judgments, orders, decrees or attachments in circumstances not constituting an Event of Default under Sections 8.4 or 8.7; and

(a) Liens in favor of other financial institutions arising in connection with Borrower's deposit and/or securities accounts held at such institutions, provided that Bank has a perfected security interest in the amounts held in such deposit and/or securities accounts.

"Person" is any individual, sole proprietorship, partnership, limited liability company, joint venture, company, trust, unincorporated organization, association, corporation, institution, public benefit corporation, firm, joint stock company, estate, entity or government agency.

"Prime Rate" is the rate of interest per annum from time to time published in the money rates section of The Wall Street Journal or any successor publication thereto as the "prime rate" then in effect; provided that, in the event such rate of interest is less than zero, such rate shall be deemed to be zero for purposes of this Agreement; and provided further that if such rate of interest, as set forth from time to time in the money rates section of The Wall Street Journal, becomes unavailable for any reason as determined by Bank, the "Prime Rate" shall mean the rate of interest per annum announced by Bank as its prime rate in effect at its principal office in the State of California (such Bank announced Prime Rate not being intended to be the lowest rate of interest charged by Bank in connection with extensions of credit to debtors); provided that, in the event such rate of interest is less than zero, such rate shall be deemed to be zero for purposes of this Agreement.

"Registered Organization" is any "registered organization" as defined in the Code with such additions to such term as may hereafter be made.

"Requirement of Law" is as to any Person, the organizational or governing documents of such Person, and any law (statutory or common), treaty, rule or regulation or determination of an arbitrator or a court or other Governmental Authority, in each case applicable to or binding upon such Person or any of its property or to which such Person or any of its property is subject.

“Reserves” means, as of any date of determination, such amounts as Bank may from time to time establish and revise in its good faith business judgment, reducing the amount of Advances and other financial accommodations which would otherwise be available to Borrower (a) to reflect events, conditions, contingencies or risks which, as determined by Bank in its good faith business judgment, do or may adversely affect (i) the Collateral or any other property which is security for the Obligations or its value (including without limitation any increase in delinquencies of Accounts), (ii) the assets, business or prospects of Borrower or any Guarantor, or (iii) the security interests and other rights of Bank in the Collateral (including the enforceability, perfection and priority thereof); or (b) to reflect Bank's reasonable belief that any collateral report or financial information furnished by or on behalf of Borrower or any Guarantor to Bank is or may have been incomplete, inaccurate or misleading in any material respect; or (c) in respect of any state of facts which Bank determines constitutes an Event of Default or that may, with notice or passage of time or both, constitute an Event of Default.

“Responsible Officer” is any of the Chief Executive Officer, President, Chief Financial Officer and Controller of Borrower.

“Restricted License” is any material license or other agreement with respect to which Borrower is the licensee (a) that prohibits or otherwise restricts Borrower from granting a security interest in Borrower's interest in such license or agreement or any other property, or (b) for which a default under or termination of could interfere with Bank's right to sell any Collateral.

“Revolving Line” is an aggregate principal amount equal to Ten Million Dollars (\$10,000,000.00).

“Revolving Line Maturity Date” is October 10, 2020.

“SEC” shall mean the Securities and Exchange Commission, any successor thereto, and any analogous Governmental Authority.

“Securities Account” is any **“securities account”** as defined in the Code with such additions to such term as may hereafter be made.

“Subordinated Debt” is indebtedness incurred by Borrower subordinated to all of Borrower's now or hereafter indebtedness to Bank (pursuant to a subordination, intercreditor, or other similar agreement in form and substance satisfactory to Bank entered into between Bank and the other creditor), on terms acceptable to Bank.

“Subsidiary” is, as to any Person, a corporation, partnership, limited liability company or other entity of which shares of stock or other ownership interests having ordinary voting power (other than stock or such other ownership interests having such power only by reason of the happening of a contingency) to elect a majority of the board of directors or other managers of such corporation, partnership or other entity are at the time owned, or the management of which is otherwise controlled, directly or indirectly through one or more intermediaries, or both, by such Person. Unless the context otherwise requires, each reference to a Subsidiary herein shall be a reference to a Subsidiary of Borrower or Guarantor.

“Trademarks” means any trademark and servicemark rights, whether registered or not, applications to register and registrations of the same and like protections, and the entire goodwill of the business of Borrower connected with and symbolized by such trademarks.


“Transfer” is defined in Section 7.1.

[Signature page follows.]


IN WITNESS WHEREOF, the parties hereto have caused this Agreement to be executed as a sealed instrument under the laws of the Commonwealth of Massachusetts as of the Effective Date.

BORROWER:

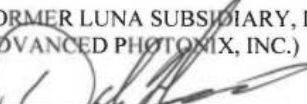
LUNA INNOVATIONS INCORPORATED

By 
Name: Dale E. Messick
Title: Chief Financial Officer

LUNA TECHNOLOGIES, INC.

By 
Name: Dale E. Messick
Title: Chief Financial Officer


FORMER LUNA SUBSIDIARY, INC. (f/k/a
ADVANCED PHOTONIX, INC.)

By 
Name: Dale E. Messick
Title: Chief Executive Officer

TERAMETRIX LLC

By 
Name: Dale E. Messick
Title: Chief Executive Officer

GENERAL PHOTONICS CORP.

By 
Name: Dale E. Messick
Title: Chief Financial Officer

BANK:

SILICON VALLEY BANK

By _____

Name: _____

Title: _____

IN WITNESS WHEREOF, the parties hereto have caused this Agreement to be executed as a sealed instrument under the laws of the Commonwealth of Massachusetts as of the Effective Date.

BORROWER:

LUNA INNOVATIONS INCORPORATED

By _____
Name: _____
Title: _____

LUNA TECHNOLOGIES, INC.

By _____
Name: _____
Title: _____

FORMER LUNA SUBSIDIARY, INC. (f/k/a
ADVANCED PHOTONIX, INC.)

By _____
Name: _____
Title: _____

TEREMETRIX, LLC

By _____
Name: _____
Title: _____

GENERAL PHOTONICS CORP.

By _____
Name: _____
Title: _____

BANK:

SILICON VALLEY BANK

By Michael Copley
Name: Michael Copley
Title: Director

EXHIBIT A - COLLATERAL DESCRIPTION

The Collateral consists of all of Borrower's right, title and interest in and to the following personal property:

All goods, Accounts (including health-care receivables), Equipment, Inventory, contract rights or rights to payment of money, leases, license agreements, franchise agreements, General Intangibles (except as provided below), domain names, commercial tort claims, documents, instruments (including any promissory notes), chattel paper (whether tangible or electronic), cash, deposit accounts, certificates of deposit, fixtures, letters of credit rights (whether or not the letter of credit is evidenced by a writing), securities, and all other investment property, supporting obligations, and financial assets, whether now owned or hereafter acquired, wherever located; and

all Borrower's Books relating to the foregoing, and any and all claims, rights and interests in any of the above and all substitutions for, additions, attachments, accessories, accessions and improvements to and replacements, products, proceeds and insurance proceeds of any or all of the foregoing.

Notwithstanding the foregoing, the Collateral does not include any Intellectual Property; provided, however, the Collateral shall include all Accounts and all proceeds of Intellectual Property. If a judicial authority (including a U.S. Bankruptcy Court) would hold that a security interest in the underlying Intellectual Property is necessary to have a security interest in such Accounts and such property that are proceeds of Intellectual Property, then the Collateral shall automatically, and effective as of the Effective Date, include the Intellectual Property to the extent necessary to permit perfection of Bank's security interest in such Accounts and such other property of Borrower that are proceeds of the Intellectual Property.

Pursuant to the terms of a certain negative pledge arrangement with Bank, Borrower has agreed not to encumber any of its Intellectual Property without Bank's prior written consent.

EXHIBIT B
COMPLIANCE CERTIFICATE

TO: SILICON VALLEY BANK
FROM: LUNA INNOVATIONS INCORPORATED, et al

Date: _____

The undersigned authorized officer of Luna Innovations Incorporated, Luna Technologies, Inc., Former Luna Subsidiary, Inc., TeraMetrix, LLC, and General Photonics Corp. (individually and collectively, jointly and severally, the “**Borrower**”) certifies that under the terms and conditions of the Loan and Security Agreement between Borrower and Bank (the “**Agreement**”), (1) Borrower is in complete compliance for the period ending _____ with all required covenants except as noted below, (2) there are no Events of Default, (3) all representations and warranties in the Agreement are true and correct in all material respects on this date except as noted below; provided, however, that such materiality qualifier shall not be applicable to any representations and warranties that already are qualified or modified by materiality in the text thereof; and provided, further that those representations and warranties expressly referring to a specific date shall be true, accurate and complete in all material respects as of such date, (4) Borrower, and each of its Subsidiaries, has timely filed all required tax returns and reports, and Borrower has timely paid all foreign, federal, state and local taxes, assessments, deposits and contributions owed by Borrower except as otherwise permitted pursuant to the terms of Section 5.9 of the Agreement, and (5) no Liens have been levied or claims made against Borrower or any of its Subsidiaries, if any, relating to unpaid employee payroll or benefits of which Borrower has not previously provided written notification to Bank. Attached are the required documents supporting the certification. The undersigned certifies that these are prepared in accordance with GAAP consistently applied from one period to the next except as explained in an accompanying letter or footnotes. The undersigned acknowledges that no borrowings may be requested at any time or date of determination that Borrower is not in compliance with any of the terms of the Agreement, and that compliance is determined not just at the date this certificate is delivered. Capitalized terms used but not otherwise defined herein shall have the meanings given them in the Agreement.

Please indicate compliance status by circling Yes/No under “Complies” column.

<u>Reporting Covenants</u>	<u>Required</u>	<u>Complies</u>
Monthly financial statements with Compliance Certificate	Monthly within 30 days	Yes No
Annual financial statements (CPA Audited)	FYE within 180 days	Yes No
10-Q, 10-K and 8-K	Within 5 days after filing with SEC	Yes No
Board approved projections	FYE within 30 days, and as amended	Yes No

<u>Financial Covenant</u>	<u>Required</u>	<u>Actual</u>	<u>Complies</u>
Maintain as indicated:			
Liquidity Coverage Ratio	≥ 2.0:1.0		Yes No

The following financial covenant analyses and information set forth in Schedule 1 attached hereto are true and accurate as of the date of this Certificate.

The following are the exceptions with respect to the certification above: (If no exceptions exist, state “No exceptions to note.”)

LUNA INNOVATIONS INCORPORATED
LUNA TECHNOLOGIES, INC.
FORMER LUNA SUBSIDIARY, INC.
TERAMETRIX, LLC
GENERAL PHOTONICS CORP.

By: _____
Name: _____
Title: _____

BANK USE ONLY

Received by: _____
AUTHORIZED SIGNER

Date: _____

Verified: _____
AUTHORIZED SIGNER

Date: _____

Compliance Status: Yes No

Schedule 1 to Compliance Certificate

Financial Covenants of Borrower

In the event of a conflict between this Schedule and the Loan Agreement, the terms of the Loan Agreement shall govern.

Dated: _____

Liquidity Coverage Ratio (Section 6.9)

Required: Borrower shall maintain at all times, to be certified as of the last day of each month, a Liquidity Coverage Ratio of equal to or greater than 2.0 to 1.00.

Actual:

- | | | |
|----|---|---------|
| A. | Aggregate value of Borrower's unrestricted cash at Bank | \$_____ |
| B. | Availability Amount | \$_____ |
| C. | Line A. plus Line B | \$_____ |
| D. | Aggregate of all Obligations owing to Bank, including, without limitation, all issued and outstanding letters of credit | \$_____ |
| E. | Line C divided by Line D | \$_____ |

Is Line E greater than 2.0?

_____ No, not in compliance

_____ Yes, in compliance



301 1st Street, SW, Suite
200
Roanoke, VA 24011
P: 540-769-8400
F: 540-769-8401
www.lunainc.com

November 25, 2019

Dale E. Messick
154 Forest Drive
Salem, VA 24153

Re: Separation Agreement

Dear Dale:

This letter sets forth the substance of the separation agreement (the "**Agreement**") which Luna Innovations Incorporated (the "**Company**") is offering to you to aid in your employment transition.

1. **Separation.** Your last day of work with the Company and your employment termination date will be November 30, 2019 (the "**Separation Date**").

2. **Accrued Salary and Vacation.** On the next regular payroll date following the Separation Date, the Company will pay you all accrued salary and vacation earned through the Separation Date, subject to standard payroll deductions and withholdings. You will receive these payments regardless of whether you sign this Agreement.

3. **Severance Benefits.** If you timely execute no earlier than the Separation Date, return and do not revoke this Agreement, and comply with your obligations hereunder and remain in compliance with your obligations under the Confidentiality Agreement that you previously signed, then pursuant to Section 6.1(a) of the Amended and Restated Employment Agreement between you and the Company dated August 1, 2018 (the "**Employment Agreement**"), Company will provide you with the following "**Severance Benefits**":

a. The Company will make severance payments to you in the form of continuation of your base salary in effect on the Separation Date for nine (9) months following the Separation Date (the "**Salary Continuation**"). The Salary Continuation will be subject to standard payroll deductions and withholdings. The first payment of the Salary Continuation will be made on the day that is sixty (60) days following the Separation Date (the "**Severance Pay Commencement Date**"), provided the Company has received the executed Agreement from you on or before that date and that the Agreement is no longer subject to revocation. On the Severance Pay Commencement Date, the Company will pay in a lump sum the aggregate amount of the Salary Continuation under this Section 3(a) that the Company would have paid you through such date had the payments commenced on the Separation Date through the Severance Pay Commencement

Date, with the balance paid thereafter on the applicable schedule described below. The remaining installments will occur on the Company's regularly scheduled payroll dates thereafter.

b. The Company will pay you the amount equal to your 2019 Target Bonus, as that term is defined in the Employment Agreement (the "**Bonus Severance Payment**"). The Bonus Severance Payment shall be subject to standard payroll deductions and withholdings and will be paid in a lump sum when annual bonuses are otherwise paid on or before March 15, 2020.

c. If you timely elect continued coverage under COBRA for yourself and your covered dependents under the Company's group health plans following the Separation Date, and provided you timely execute and return this fully signed and dated Agreement to the Company, allow it to become effective, and comply fully with your obligations hereunder, then the Company will pay, as and when due to the insurance carrier or COBRA administrator (as applicable), the portion of your COBRA premiums that it was paying immediately prior to the Separation Date until the earliest of (A) twelve (12) months after the Separation Date (B) the expiration of your eligibility for the continuation coverage under COBRA, or (C) the date when you become eligible for substantially equivalent health insurance coverage in connection with new employment or self-employment (such period from the termination date through the earliest of (A) through (C), the "**COBRA Payment Period**"). Notwithstanding the foregoing, if at any time the Company determines, in its sole discretion, that the payment of the COBRA premiums would result in a violation of the nondiscrimination rules of Section 105(h)(2) of the Code or any statute or regulation of similar effect (including but not limited to the 2010 Patient Protection and Affordable Care Act, as amended by the 2010 Health Care and Education Reconciliation Act), then provided you remain eligible for reimbursement in accordance with this Section 3(b), in lieu of providing the COBRA premiums, the Company will instead pay you on the last day of each remaining month of the COBRA Payment Period, a fully taxable cash payment equal to the Company's portion of the COBRA premiums for that month, subject to applicable tax withholdings for the remainder of the COBRA Payment Period. Nothing in this Agreement shall deprive you of your rights under COBRA or ERISA for benefits under plans and policies arising under your employment by the Company.

d. You shall also receive a cash payment equal to the value of any unvested 401(k) Company match amount. This payment will be made in one lump sum on the Severance Pay Commencement Date, provided the Company has received the executed Agreement from you on or before that date and that the Agreement is no longer subject to revocation.

4. Benefit Plans.

If you are currently participating in the Company's group health insurance plans, your participation as an employee will end on the Separation Date. Thereafter, to the extent provided by the federal COBRA law or, if applicable, state insurance laws, and by the Company's current group health insurance policies, you will be eligible to continue your group health insurance benefits, and the terms of Section 3(c) will apply if you elect continued coverage under COBRA.

Your participation in Employer-Sponsored Group Life Insurance and Short and Long Term Disability Insurance will cease as of the Separation Date; however, you may elect to convert your Insurance by contacting The Hartford on or before December 31, 2019.

Deductions for the 401(k) Plan will end with your last regular paycheck. You will receive information by mail concerning 401(k) plan rollover procedures should you be a participant in this program.

You have the right to continue your current Health Care Spending Account if you are participating in this program. Enclosed is the information concerning how to continue this benefit. Dependent Care Spending Accounts cannot be continued. Your last full Spending Account payroll deductions was processed in the November 16 to November 30, 2019 pay period.

5. Equity. You were previously granted certain shares of restricted Company common stock ("**Restricted Shares**") and restricted stock units with respect to shares of the Company's common stock ("**Restricted Stock Units**") pursuant to the Company's 2016 Equity Incentive Plan (the "**Plan**") and the restricted stock grant notices and agreements and restricted stock unit grant notices and agreements governing the Restricted Shares and Restricted Stock Units (the "**Equity Award Documents**"). Vesting of the Restricted Stock Units will cease as of the date that you are no longer in Continuous Service (as defined in the Plan).

6. Other Compensation or Benefits. You acknowledge that, except as expressly provided in this Agreement, you will not receive any additional compensation, severance or benefits after the Separation Date.

7. Expense Reimbursements. You agree that, within ten (10) days of the Separation Date, you will submit your final documented expense reimbursement statement reflecting all business expenses you incurred through the Separation Date, if any, for which you seek reimbursement. The Company will reimburse you for reasonable business expenses pursuant to its regular business practice.

8. Return of Company Property. By the Separation Date, you agree to return to the Company all Company documents (and all copies thereof) and other Company property that you have had in your possession at any time, including, but not limited to, Company files, notes, drawings, records, business plans and forecasts, financial information, specifications, computer-recorded information, tangible property (including, but not limited to, computers), credit cards, entry cards, identification badges and keys; and, any materials of any kind that contain or embody any proprietary or confidential information of the Company (and all reproductions thereof). Please coordinate return of Company property with Scott Graeff. **Receipt of the Severance Benefits described in Section 3 of this Agreement is expressly conditioned upon return of all Company Property.**

9. Confidential Information and Post-Termination Obligations. Both during and after your employment you acknowledge your continuing obligations under your Confidentiality Agreement not to use or disclose any confidential or proprietary information of the Company and to refrain from certain solicitation and competitive activities. For the avoidance of doubt, you and

the Company agree that the restrictions in Section 5(a)(1) of the Confidentiality Agreement shall remain in effect for one (1) year following the Separation Date. A copy of your Confidentiality Agreement is attached hereto as Exhibit A. If you have any doubts as to the scope of the restrictions in your agreement, you should contact Scott Graeff immediately to assess your compliance. As you know, the Company will enforce its contract rights. Please familiarize yourself with the enclosed agreement which you signed. Confidential information that is also a "trade secret," as defined by law, may be disclosed (A) if it is made (i) in confidence to a federal, state, or local government official, either directly or indirectly, or to an attorney and (ii) solely for the purpose of reporting or investigating a suspected violation of law; or (B) is made in a complaint or other document filed in a lawsuit or other proceeding, if such filing is made under seal. In addition, in the event that you file a lawsuit for retaliation by the Company for reporting a suspected violation of law, you may disclose the trade secret to your attorney and use the trade secret information in the court proceeding, if you: (A) file any document containing the trade secret under seal; and (B) do not disclose the trade secret, except pursuant to court order.

10. Confidentiality. The provisions of this Agreement will be held in strictest confidence by you and will not be publicized or disclosed in any manner whatsoever; *provided, however,* that: (a) you may disclose this Agreement to your immediate family; (b) you may disclose this Agreement in confidence to your attorney, accountant, auditor, tax preparer, and financial advisor; (c) you may disclose your post-termination obligations to a prospective employer; and (d) you may disclose this Agreement insofar as such disclosure may be required by law. Notwithstanding the foregoing, nothing in this Agreement shall limit your right to voluntarily communicate with the Equal Employment Opportunity Commission, United States Department of Labor, the National Labor Relations Board, the Securities and Exchange Commission, other federal government agency or similar state or local agency or to discuss the terms and conditions of your employment with others to the extent expressly permitted by Section 7 of the National Labor Relations Act.

11. Non-Disparagement. You agree not to disparage the Company, and the Company's attorneys, directors, managers, partners, employees, agents and affiliates, in any manner likely to be harmful to them or their business, business reputation or personal reputation; provided that you may respond accurately and fully to any question, inquiry or request for information when required by legal process. Notwithstanding the foregoing, nothing in this Agreement shall limit your right to voluntarily communicate with the Equal Employment Opportunity Commission, United States Department of Labor, the National Labor Relations Board, the Securities and Exchange Commission, other federal government agency or similar state or local agency or to discuss the terms and conditions of your employment with others to the extent expressly permitted by Section 7 of the National Labor Relations Act.

12. Cooperation after Termination. Pursuant to Section 6.5 of the Employment Agreement, you agree to reasonably cooperate with the Company in all matters relating to the winding up of your pending work including, but not limited to, any litigation in which the Company is involved, and the orderly transfer of any such pending work to such other employees as may be designated by the Company; provided, however, that your obligations hereunder shall not interfere with your efforts to obtain subsequent employment and/or your obligations to and

responsibilities for a subsequent employer and the obligations hereunder shall end six (6) months following the Separation Date (the "**Cooperation Period**"). You will be paid for your efforts under this Section at an hourly rate of \$141.67 and shall be reimbursed for your reasonable expenses.

13. Release. In exchange for the payments and other consideration under this Agreement, to which you would not otherwise be entitled, and except as otherwise set forth in this Agreement, you, on behalf of yourself and, to the extent permitted by law, on behalf of your spouse, heirs, executors, administrators, assigns, insurers, attorneys and other persons or entities, acting or purporting to act on your behalf (collectively, the "**Employee Parties**"), hereby generally and completely release, acquit and forever discharge the Company, its parents and subsidiaries, and its and their officers, directors, managers, partners, agents, representatives, employees, attorneys, shareholders, predecessors, successors, assigns, insurers and affiliates (the "**Company Parties**") of and from any and all claims, liabilities, demands, contentions, actions, causes of action, suits, costs, expenses, attorneys' fees, damages, indemnities, debts, judgments, levies, executions and obligations of every kind and nature, in law, equity, or otherwise, both known and unknown, suspected and unsuspected, disclosed and undisclosed, arising out of or in any way related to agreements, events, acts or conduct at any time prior to and including the execution date of this Agreement, including but not limited to: all such claims and demands directly or indirectly arising out of or in any way connected with your employment with the Company or the termination of that employment; claims or demands related to salary, bonuses, commissions, stock, stock options, or any other ownership interests in the Company, vacation pay, fringe benefits, expense reimbursements, severance pay, or any other form of compensation; claims pursuant to any federal, state or local law, statute, or cause of action; tort law; or contract law (individually a "**Claim**" and collectively "**Claims**"). The Claims you are releasing and waiving in this Agreement include, but are not limited to, any and all Claims that any of the Company Parties:

- has violated its personnel policies, handbooks, contracts of employment, or covenants of good faith and fair dealing;
- has discriminated against you on the basis of age, race, color, sex (including sexual harassment), national origin, ancestry, disability, religion, sexual orientation, marital status, parental status, source of income, entitlement to benefits, any union activities or other protected category in violation of any local, state or federal law, constitution, ordinance, or regulation, including but not limited to: Age Discrimination in Employment Act, as amended ("**ADEA**"); Title VII of the Civil Rights Act of 1964, as amended; the Civil Rights Act of 1991; 42 U.S.C. § 1981, as amended; the Equal Pay Act; the Americans With Disabilities Act; the Genetic Information Nondiscrimination Act; the Family and Medical Leave Act; the Virginians with Disabilities Act; the Virginia Human Rights Act; the Employee Retirement Income Security Act; the Employee Polygraph Protection Act; the Worker Adjustment and Retraining Notification Act; the Older Workers Benefit Protection Act; the anti-retaliation provisions of the Sarbanes-Oxley Act, or any other federal or state law regarding whistleblower retaliation; the Lilly Ledbetter Fair Pay Act; the Uniformed Services Employment and Reemployment Rights Act; the Fair Credit Reporting Act; and the National Labor Relations Act; or

- has violated any statute, public policy or common law (including but not limited to Claims for retaliatory discharge; negligent hiring, retention or supervision; defamation; intentional or negligent infliction of emotional distress and/or mental anguish; intentional interference with contract; negligence; detrimental reliance; loss of consortium to you or any member of your family and/or promissory estoppel).

Notwithstanding the foregoing, other than events expressly contemplated by this Agreement you do not waive or release rights or Claims that may arise from events that occur after the date this waiver is executed and you are not releasing any right of indemnification you may have for any liabilities arising from your actions within the course and scope of your employment with the Company or within the course and scope of your role as an officer of the Company. Also excluded from this Agreement are any Claims which cannot be waived by law, including, without limitation, any rights you may have under applicable workers' compensation laws and your right, if applicable, to file or participate in an investigative proceeding of any federal, state or local governmental agency. Nothing in this Agreement shall prevent you from filing, cooperating with, or participating in any proceeding or investigation before the Equal Employment Opportunity Commission, United States Department of Labor, the National Labor Relations Board, the Occupational Safety and Health Administration, the Securities and Exchange Commission or any other federal government agency, or similar state or local agency ("**Government Agencies**"), or exercising any rights pursuant to Section 7 of the National Labor Relations Act. You further understand this Agreement does not limit your ability to voluntarily communicate with any Government Agencies or otherwise participate in any investigation or proceeding that may be conducted by any Government Agency, including providing documents or other information, without notice to the Company. While this Agreement does not limit your right to receive an award for information provided to the Securities and Exchange Commission, you understand and agree that you are otherwise waiving, to the fullest extent permitted by law, any and all rights you may have to individual relief based on any Claims that you have released and any rights you have waived by signing this Agreement. If any Claim is not subject to release, to the extent permitted by law, you waive any right or ability to be a class or collective action representative or to otherwise participate in any putative or certified class, collective or multi-party action or proceeding based on such a Claim in which any of the Company Parties is a party. This Agreement does not abrogate your existing rights under any Company benefit plan or any plan or agreement related to equity ownership in the Company; however, it does waive, release and forever discharge Claims existing as of the date you execute this Agreement pursuant to any such plan or agreement.

14. Your Acknowledgments and Affirmations/ Effective Date of Agreement. You acknowledge that you are knowingly and voluntarily waiving and releasing any and all rights you may have under the ADEA, as amended. You also acknowledge and agree that (i) the consideration given to you in exchange for the waiver and release in this Agreement is in addition to anything of value to which you were already entitled, and (ii) that you have been paid for all time worked, have received all the leave, leaves of absence and leave benefits and protections for which you are eligible, and have not suffered any on-the-job injury for which you have not already filed a Claim. You affirm that all of the decisions of the Company Parties regarding your pay and benefits through the date of your execution of this Agreement were not discriminatory based on

age, disability, race, color, sex, religion, national origin or any other classification protected by law. You affirm that you have not filed or caused to be filed, and are not presently a party to, a Claim against any of the Company Parties. You further affirm that you have no known workplace injuries or occupational diseases. You acknowledge and affirm that you have not been retaliated against for reporting any allegation of corporate fraud or other wrongdoing by any of the Company Parties, or for exercising any rights protected by law, including any rights protected by the Fair Labor Standards Act, the Family Medical Leave Act or any related statute or local leave or disability accommodation laws, or any applicable state workers' compensation law. You further acknowledge and affirm that you have been advised by this writing that: (a) your waiver and release do not apply to any rights or Claims that may arise after the execution date of this Agreement; (b) you have been advised hereby that you have the right to consult with an attorney prior to executing this Agreement; (c) you have been given twenty-one (21) days to consider this Agreement (although you may choose to voluntarily execute this Agreement earlier, but no earlier than the Separation Date, and if you do you will sign the Consideration Period waiver below); (d) you have seven (7) days following your execution of this Agreement to revoke this Agreement; and (e) this Agreement shall not be effective until the date upon which the revocation period has expired unexercised (the "*Effective Date*"), which shall be the eighth day after this Agreement is executed by you.

15. No Admission. This Agreement does not constitute an admission by the Company of any wrongful action or violation of any federal, state, or local statute, or common law rights, including those relating to the provisions of any law or statute concerning employment actions, or of any other possible or claimed violation of law or rights.

16. Breach. You agree that upon any breach of this Agreement you will forfeit all amounts paid or owing to you under this Agreement. Further, you acknowledge that it may be impossible to assess the damages caused by your violation of the terms of Sections 8, 9, 10 and 11 of this Agreement and further agree that any threatened or actual violation or breach of those Sections of this Agreement will constitute immediate and irreparable injury to the Company. You therefore agree that any such breach of this Agreement is a material breach of this Agreement, and, in addition to any and all other damages and remedies available to the Company upon your breach of this Agreement, the Company shall be entitled to an injunction to prevent you from violating or breaching this Agreement. You agree that if the Company is successful in whole or part in any legal or equitable action against you under this Agreement, you agree to pay all of the costs, including reasonable attorneys' fees, incurred by the Company in enforcing the terms of this Agreement.

17. Miscellaneous. This Agreement, including Exhibit A, constitutes the complete, final and exclusive embodiment of the entire agreement between you and the Company with regard to this subject matter. It is entered into without reliance on any promise or representation, written or oral, other than those expressly contained herein, and it supersedes any other such promises, warranties or representations. This Agreement may not be modified or amended except in a writing signed by both you and a duly authorized officer of the Company. This Agreement will bind the heirs, personal representatives, successors and assigns of both you and the Company, and inure to the benefit of both you and the Company, their heirs, successors and assigns. If any

Dale E. Messick
November 25, 2019
Page 8 of 9

provision of this Agreement is determined to be invalid or unenforceable, in whole or in part, this determination will not affect any other provision of this Agreement and the provision in question will be modified by the court so as to be rendered enforceable. This Agreement will be deemed to have been entered into and will be construed and enforced in accordance with the laws of the Commonwealth of Virginia as applied to contracts made and to be performed entirely within Virginia.

If this Agreement is acceptable to you, please sign below and return the original to me on or before the date that is twenty-one (21) days after you receive this Agreement, but no earlier than the Separation Date. This offer will expire if we have not received your executed copy by that date.

I wish you good luck in your future endeavors.


[signatures to follow on next page]

Dale E. Messick
November 25, 2019
Page 9 of 9

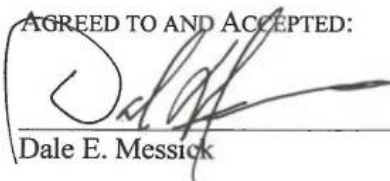
Sincerely,

LUNA INNOVATIONS INCORPORATED

By: _____


Name: Scott A. Graeff
Title: Chief Executive Officer

AGREED TO AND ACCEPTED:




Dale E. Messick

Exhibit A – Confidentiality Agreement

CONSIDERATION PERIOD

I, Dale E. Messick, understand that I have the right to take at least 21 days to consider whether to sign this Agreement, which I received on November 25, 2019. If I elect to sign this Agreement before 21 days have passed, I understand I am to sign and date below this paragraph to confirm that I knowingly and voluntarily agree to waive the 21-day consideration period. I understand that I am not permitted to sign prior to the Separation Date.

AGREED:



Signature

12/4/19

Date

EXHIBIT A
Confidentiality Agreement

EMPLOYMENT AGREEMENT

This EMPLOYMENT AGREEMENT (the "*Agreement*") is entered into effective as of December 2, 2019 (the "*Effective Date*"), by and between Gene Nestro (the "*Employee*") and Luna Innovations Incorporated (the "*Company*").

The Company desires to employ the Employee and, in connection therewith, to compensate the Employee for Employee's personal services to the Company; and

The Employee wishes to be employed by the Company and provide personal services to the Company in return for certain compensation.

Accordingly, in consideration of the mutual promises and covenants contained herein, the parties agree to the following:

1. EMPLOYMENT BY THE COMPANY.

1.1 At-Will Employment. Employee shall be employed by the Company on an "at-will" basis, meaning either the Company or Employee may terminate Employee's employment at any time, with or without cause or advanced notice. Any contrary representations that may have been made to Employee shall be superseded by this Agreement. This Agreement shall constitute the full and complete agreement between Employee and the Company on the "at-will" nature of Employee's employment with the Company, which may be changed only in an express written agreement signed by Employee and a duly authorized officer of the Company. Employee's rights to any compensation following a termination shall be only as set forth in Section 6.

1.2 Position. Subject to the terms set forth herein, the Company agrees to employ Employee, in the position of Chief Financial Officer, and Employee hereby accepts such employment. During the term of Employee's employment with the Company, and excluding periods of vacation and sick leave to which Employee is entitled, Employee shall devote all business time and attention to the affairs of the Company necessary to discharge the responsibilities assigned hereunder, and shall use commercially reasonable efforts to perform faithfully and efficiently such responsibilities.

1.3 Duties. Employee will report to the President and Chief Executive Officer ("*CEO*") and will render such business and professional services in the performance of his duties, consistent with Employee's position as Chief Financial Officer, as shall reasonably be assigned to him by the CEO and the Company's Board of Directors (the "*Board*"), subject to the oversight and direction of the CEO and Board. Employee shall perform his duties under this Agreement principally out of the Company's corporate headquarters, or such other location as assigned. In addition, the Employee shall make such business trips to such places as may be reasonably necessary or advisable for the efficient operations of the Company.

1.4 Company Policies and Benefits. The employment relationship between the parties shall also be subject to the Company's personnel policies and procedures as they may be adopted, revised or deleted from time to time in the Company's sole discretion. The Employee will be eligible to participate on the same basis as similarly situated employees in the Company's benefit plans in effect from time to time during his employment. All matters of eligibility for coverage or benefits under any benefit plan shall be determined in accordance with the provisions of such plan.

The Company reserves the right to change, alter, or terminate any benefit plan in its sole discretion. Notwithstanding the foregoing, in the event that the terms of this Agreement differ from or are in conflict with the Company's general employment policies or practices, this Agreement shall control.

2. COMPENSATION.

2.1 **Salary.** Employee shall receive for Employee's services to be rendered hereunder an initial annualized base salary of \$275,000, subject to review and adjustment from time to time by the Company in its sole discretion, payable subject to standard federal and state payroll withholding requirements in accordance with Company's standard payroll practices ("**Base Salary**").

2.2 **Bonus.**

(a) **During Employment.** Employee shall be eligible to earn an annual performance bonus with a target of 40%, with a maximum potential of 80% of the actual salary received in the year in which the bonus is being measured (an "**Annual Bonus**" and the target amount of an Annual Bonus, the "**Target Bonus**" and the maximum amount of an Annual Bonus, the "**Maximum Target Bonus**"). The Annual Bonus will be based upon the CEO's and the Board's assessment of the Employee's performance and the Company's attainment of targeted goals as set by the Board in its reasonable good faith discretion. The Annual Bonus, if any, will be subject to applicable payroll deductions and withholdings. Following the close of each calendar year, the CEO and Board will determine whether the Employee has earned the Annual Bonus, and the amount of any Annual Bonus, based on the set criteria. No amount of the Annual Bonus is guaranteed, and the Employee must be an employee in good standing through December 31 of the year in which the Annual Bonus is being measured to be eligible to receive an Annual Bonus. No partial or prorated bonuses will be provided. For the avoidance of doubt, Employee will not be eligible for an Annual Bonus for 2019. The Annual Bonus, if earned, will be paid no later than March 15 of the calendar year immediately following the applicable calendar year for which the Annual Bonus is being measured. The Employee's eligibility for an Annual Bonus is subject to change in the discretion of the Board (or any authorized committee thereof). Employee acknowledges that if the Company adopts an incentive compensation plan the terms of any such plan may supersede and replace the provisions of this Section 2.2, as determined by the Company in its sole discretion.

(b) **Upon Termination.** Subject to the provisions of Section 6.1(a)(iii), in the event Employee leaves the employ of the Company for any reason prior to December 31 of the year in which the Annual Bonus is being measured, he is not eligible for such Annual Bonus, prorated or otherwise.

2.3 **Equity Incentive Awards.**

(a) As a sign-on bonus, and subject to the approval of the Board, the Company will award (such award, the "**Restricted Stock Award**") Employee 50,000 shares (the "**Restricted Shares**") of the Company's Common Stock. The Restricted Stock Award will be subject to the terms of the Company's 2016 Equity Incentive Plan (the "**Plan**"). The Restricted Stock Award will vest over a three year period as follows: (i) one-third (33.333%) of the Restricted Shares shall vest, and the Restricted Shares will be released from the Company's repurchase option, on the 12-

month anniversary of the Effective Date, (ii) one-third (33.333%) of the Restricted Shares shall vest, and the Restricted Shares will be released from the Company's repurchase option, on the 24-month anniversary of the Effective Date; and (iii) the remaining one-third (33.333%) of the Restricted Shares shall vest, and the Restricted Shares will be released from the Company's repurchase option, on the 36-month anniversary of the Effective Date, subject to Employee remaining in Continuous Service (as defined in the Plan) on each such vesting date. No right to any Restricted Shares is earned or accrued until such time that vesting occurs.

(b) Additionally, Employee will be eligible to participate in the Executive Long-term Incentive Plan.

2.4 Expense Reimbursement. The Company will reimburse Employee for reasonable business expenses in accordance with the Company's standard expense reimbursement policy. For the avoidance of doubt, to the extent that any reimbursements payable to Employee are subject to the provisions of Section 409A of the Internal Revenue Code of 1986, as amended (the "*Code*"): (a) any such reimbursements will be paid no later than December 31 of the year following the year in which the expense was incurred, (b) the amount of expenses reimbursed in one year will not affect the amount eligible for reimbursement in any subsequent year, and (c) the right to reimbursement under this Agreement will not be subject to liquidation or exchange for another benefit.

3. CONFIDENTIAL INFORMATION, INVENTIONS, NON-SOLICITATION AND NON-COMPETITION OBLIGATIONS. As a condition of employment, Employee agrees to execute and abide by an Employee Confidential Information, Inventions, Non-Solicitation and Non-Competition Agreement attached as **Exhibit A** ("*Confidential Information Agreement*"), which may be amended in writing signed by the parties from time to time without regard to this Agreement. The Confidential Information Agreement contains provisions that are intended by the parties to survive and do survive termination of this Agreement.

4. OUTSIDE ACTIVITIES. Except with the prior written consent of the CEO, Employee will not, while employed by the Company, undertake or engage in any other employment, occupation or business enterprise that would interfere with Employee's responsibilities and the performance of Employee's duties hereunder except for (i) reasonable time devoted to volunteer services for or on behalf of such religious, educational, non-profit and/or other charitable organization as Employee may wish to serve, (ii) reasonable time devoted to activities in the non-profit and business communities consistent with Employee position with the Company; or (iii) reasonable time serving as trustee, director or advisor to any family companies or trusts. This restriction shall not, however, preclude the Employee (x) from owning (A) less than one percent (1%) of the total outstanding shares of a publicly traded company or (B) equity in real estate holding or management companies, or (y) from employment or service in any capacity with Affiliates of the Company. As used in this Agreement, "*Affiliates*" means an entity under common management or control with the Company.

5. NO CONFLICT WITH EXISTING OBLIGATIONS. Employee represents that Employee's performance of all the terms of this Agreement and as an employee of the Company do not and will not breach any agreement or obligation of any kind made prior to Employee's employment by the Company, including agreements or obligations Employee may have with prior employers or entities

for which Employee has provided services. Employee has not entered into, and Employee agrees that Employee will not enter into, any agreement or obligation, either written or oral, in conflict herewith.

6. **TERMINATION OF EMPLOYMENT.** The parties acknowledge that Employee's employment relationship with the Company is at-will. Either Employee or the Company may terminate the employment relationship at any time, with or without cause. The provisions in this Section govern the amount of compensation, if any, to be provided to Employee upon termination of employment and do not alter this at-will status.

6.1 **Termination by the Company or Resignation by Employee.**

(a) The Company shall have the right to terminate Employee's employment with the Company pursuant to this Section 6.1 at any time with or without Cause (as defined below), by giving notice as described in Section 7.1 of this Agreement. Likewise, Employee can resign from employment with the Company with or without Good Reason (as defined below), by giving notice as described in Section 7.1 of this Agreement. If Employee is terminated by the Company (with or without Cause) or resigns from employment with the Company (with or without Good Reason), then Employee shall be entitled to the Accrued Obligations (as defined below), and in addition, if Employee is terminated without Cause or resigns for Good Reason, and provided that such termination constitutes a "separation from service" (as defined under Treasury Regulation Section 1.409A-1(h), without regard to any alternative definition thereunder, a "*Separation from Service*"), and further provided that the Employee executes and allows to become effective a separation agreement that includes, among other terms, a general release of claims in favor of the Company and its affiliates and representatives, in a reasonable form presented by the Company (the "*Release*"), and subject to Section 6.1(b) (the date that the Release becomes effective and may no longer be revoked by the Employee is referred to as the "*Release Date*"), then the Employee shall be eligible to receive the following severance benefits (collectively the "*Severance Benefits*"):

(i) An amount equal to nine (9) months of Employee's then current Base Salary, less standard payroll deductions and withholdings, paid in installments on the Company's regular payroll dates;

(ii) provided Employee timely elects continued coverage under COBRA under the Company's group health plans following such termination, the portion of the COBRA premiums that the Company was previously paying, to continue Employee's health insurance coverage in effect on the termination date until the earliest of: (1) twelve (12) months following the termination date (the "*COBRA Severance Period*"); (2) the date when Employee becomes eligible for substantially equivalent health insurance coverage in connection with new employment or self-employment; or (3) the date Employee ceases to be eligible for COBRA continuation coverage for any reason, including plan termination (such period from the termination date through the earlier of (1)-(3), (the "*COBRA Payment Period*"). Notwithstanding the foregoing, if at any time the Company determines that its payment of COBRA premiums on Employee's behalf would result in a violation of applicable law (including, but not limited to, the 2010 Patient Protection and Affordable Care Act, as amended by the 2010 Health Care and Education Reconciliation Act), then in lieu of paying COBRA premiums pursuant to this Section, the Company shall pay Employee on the last day

of each remaining month of the COBRA Payment Period, a fully taxable cash payment equal to the COBRA premium for such month, subject to applicable tax withholding (such amount, the "*Special Severance Payment*"), for the remainder of the COBRA Payment Period. Nothing in this Agreement shall deprive Employee of his rights under COBRA or ERISA for benefits under plans and policies arising under his employment by the Company;

(iii) A lump sum cash payment in an amount equal to the Target Bonus for the year in which the termination occurs (the "*Bonus Severance Payment*"), subject to standard payroll deductions and withholdings, which will be paid when annual bonuses are otherwise paid, which in no event will be later than March 15 of the year following the year in which the termination date occurs; and

(iv) A lump cash payment equal to the value of any unvested 401(k) Company match amount.

(b) Employee shall not receive the Severance Benefits pursuant to Section 6.1(a) unless he executes the Release within the consideration period specified therein, which shall in no event be more than 45 days, and until the Release becomes effective and can no longer be revoked by Employee under its terms. Employee's ability to receive benefits pursuant to Section 6.1(a) is further conditioned upon his: returning all Company property; complying with his post-termination obligations under this Agreement and the Confidential Information Agreement (or subsequently signed agreement relating to that subject matter); complying with the Release including without limitation any non-disparagement and confidentiality provisions contained therein; and resignation from any other positions he holds with the Company, effective no later than Employee's date of termination (or such other date as requested by the CEO).

(c) The Company will not make any payments to Employee with respect to any of the benefits pursuant to Section 6.1(a) prior to the 60th day following Employee's date of termination. On the 60th day following Employee's date of termination, and provided that Employee has delivered an effective Release, the Company will make the first payments to Employee under Section 6.1(a)(i) in a lump sum equal to the aggregate amount of payments that the Company would have paid Employee through such date had the payments commenced on the Employee's date of termination through such 60th day, with the balance of the payments paid thereafter on the schedule described above, subject to any delay in payment required by Section 6.7.

(d) For purposes of this Agreement, "*Accrued Obligations*" are (i) Employee's accrued but unpaid salary and accrued but unused vacation through the date of termination (which, for purpose of clarity, shall be paid in cash), (ii) any unreimbursed business expenses incurred by Employee payable in accordance with the Company's standard expense reimbursement policies, (iii) benefits owed to Employee under any qualified retirement plan or health and welfare benefit plan in which Employee was a participant in accordance with applicable law and the provisions of such plan; and (iv) any Annual Bonus earned but unpaid for the prior fiscal year.

(e) For purposes of this Agreement, "*Good Reason*" means any of the following actions taken by the Company without Employee's consent: (i) a reduction of Employee's Base Salary (unless such reduction is made in connection with an across-the-board reduction in base

salaries of the Company's senior executives); (ii) material reduction in Employee's authority, duties or responsibilities in the position stated above, *provided, however*, that the acquisition of the Company and subsequent conversion of the Company to a division or unit of the acquiring company will not by itself result in a diminution of Employee's position; (iii) a material change in the geographic location of Employee's primary work facility or location; provided, that a relocation of fifty (50) or more miles from downtown Roanoke, Virginia, will be considered a material change in geographic location; (iv) any material breach by the Company of any of its obligations hereunder; or (v) a change so that Employee is no longer eligible to receive an Annual Bonus as described in the first two sentences of Section 2.2(a). In order to resign for Good Reason, Employee must provide written notice of the event giving rise to Good Reason to the CEO within thirty (30) days after the condition first arises, allow the Company thirty (30) days to cure such condition, and if the Company fails to cure the condition within such period, Employee's resignation from all positions Employee then holds with the Company must be effective not later than sixty (60) days after the end of the Company's cure period.

(f) For purposes of this Agreement, "*Cause*" means first, the Employee's conviction of any felony or any crime involving fraud, dishonesty or moral turpitude under the laws of the United States or any state thereof (which, for purpose of clarity, would exclude traffic offenses). Second, "*Cause*" means, as reasonably determined in good faith by the CEO, Employee's willful and material acts or omissions that constitute the following conduct: (i) commission or attempted commission of, or participation in, a fraud or act of dishonesty against the Company; (ii) material violation of any contract or agreement between the Employee and the Company or of any statutory duty owed to the Company after Employee is provided with a reasonable opportunity of not less than thirty (30) days to cure from the date written notice (in reasonable detail) thereof is given to Employee by the Company; (iii) unauthorized use or disclosure of the Company's confidential information or trade secrets; (iv) gross misconduct or gross negligence causing material injury to the Company; (v) breach of fiduciary duty, including without limitation concealing information relevant to the Company from the CEO or the Board of a nature that senior executives should disclose to a chief executive officer or boards of directors in fulfilling such duty; or (vii) refusal to comply with a lawful directive of the CEO or the Board after Employee is provided with a reasonable opportunity of not less than ten (10) days to cure from the date notice thereof is given to Employee by the Company.

(g) The benefits provided to Employee pursuant to this Section 6.1 are in lieu of, and not in addition to, any benefits to which Employee may otherwise be entitled under any Company severance plan, policy or program.

(h) Any damages caused by the termination of Employee's employment without Cause or for Good Reason would be difficult to ascertain; therefore, the Severance Benefits for which Employee is eligible pursuant to Section 6.1(a) above in exchange for the Release is agreed to by the parties as liquidated damages, to serve as full compensation, and not a penalty.

(i) If the Company terminates the Employee's employment for Cause or Employee resigns from employment with the Company without Good Reason, regardless of whether or not such termination is in connection with a Change in Control (as defined below), then Employee

shall be entitled to the Accrued Obligations, but Employee will not receive the Severance Benefits or any other severance compensation or benefit.

6.2 Resignation by the Employee for Good Reason or Termination by the Company without Cause (in connection with a Change in Control).

(a) In the event that the Company terminates Employee's employment without Cause or Employee resigns for Good Reason within three months prior to or twelve (12) months following the effective date of a Change in Control ("***Change in Control Termination Date***"), then Employee shall be entitled to the Accrued Obligations and, subject to Employee's compliance with Section 6.1(b) above, including but not limited to the Release requirement and Employee's continued compliance with his obligations to the Company under the Confidential Information Agreement (or subsequently signed agreement relating to that subject matter), then:

(i) Employee shall be eligible to receive the Severance Benefits under the terms and conditions described in Section 6.1; provided that (A) the amounts set forth in clauses (i) and (iv) of Section 6.1(a) shall be paid in lump sums in accordance with the timing set forth in Section 6.1(a) and not deferred per such clauses (i) and (iv) and (B) the Bonus Severance Payment shall be equal to the Maximum Target Bonus as opposed to the Target Bonus; and

(ii) Effective as of the later of Employee's Change in Control Termination Date or the effective date of the Change in Control, the vesting and exercisability of all outstanding stock options and other stock awards covering the Company's Common Stock that are held by Employee as of immediately prior to the Change in Control Termination Date shall be accelerated (and lapse, in the case of reacquisition or repurchase rights) in full. Employee's stock options and stock awards shall remain outstanding following Employee's Change in Control Termination Date if and to the extent necessary to give effect to this Section 6.2(a)(ii) subject to earlier termination under the terms of the equity plan under which such awards were granted and the original maximum term of the award (without regard to Employee's termination).

(b) As used in this Agreement, "***Change in Control***" means "Change in Control" as defined in the Company's 2016 Equity Incentive Plan.

6.3 Termination by Virtue of Death or Disability of the Employee.

(a) In the event of Employee's death while employed pursuant to this Agreement, all obligations of the parties hereunder and Employee's employment shall terminate immediately, and the Company shall, pursuant to the Company's standard payroll policies, pay to the Employee's legal representatives the Accrued Obligations due to Employee, but the Company will not provide the Severance Benefits, or any other severance compensation or benefit.

(b) Subject to applicable state and federal law, the Company shall at all times have the right, upon written notice to the Employee, to terminate this Agreement based on the Employee's Disability (as defined below). Termination by the Company of the Employee's

employment based on "**Disability**" shall mean termination because the Employee is unable due to a physical or mental condition to perform the essential functions of his position with or without reasonable accommodation for six (6) months in the aggregate during any twelve (12) month period or based on the written certification by two licensed physicians of the likely continuation of such condition for such period. This definition shall be interpreted and applied consistent with the Americans with Disabilities Act, the Family and Medical Leave Act, and other applicable law. In the event Employee's employment is terminated based on the Employee's Disability, Employee will be entitled to the Accrued Obligations, but will not receive the Severance Benefits, or any other severance compensation or benefit.

6.4 Termination Due to Discontinuance of Business. Anything in this Agreement to the contrary notwithstanding, in the event the Company's business is discontinued because rendered impracticable by substantial financial losses, lack of funding, legal decisions, administrative rulings, declaration of war, dissolution, national or local economic depression or crisis or any reasons beyond the control of the Company, then this Agreement shall terminate as of the day the Company determines to cease operation with the same force and effect as if such day of the month were originally set as the termination date hereof. In the event this Agreement is terminated pursuant to this Section 6.4, Employee will be entitled to the Accrued Obligations, but will not receive the Severance Benefits, or any other severance compensation or benefit.

6.5 Cooperation With Company After Termination of Employment. Following termination of Employee's employment for any reason, Employee shall reasonably cooperate with the Company in all matters relating to the winding up of Employee's pending work including, but not limited to, any litigation in which the Company is involved, and the orderly transfer of any such pending work to such other Employees as may be designated by the Company; provided, however, that the obligations hereunder shall not interfere with Employee's efforts to obtain subsequent employment and/or his obligations to and responsibilities for a subsequent employer and the obligations hereunder shall end six months after the termination of the Employee's employment; and provided further that the Employee will be paid for his efforts hereunder at an hourly rate determined by dividing his last Annual Salary by 1,800 hours and that Employee shall be reimbursed his reasonable expenses.

6.6 Effect of Termination. Employee agrees that should his employment be terminated for any reason, he shall be deemed to have resigned from any and all positions with the Company, including, but not limited, all positions with any and all subsidiaries and Affiliates of the Company.

6.7 Application of Section 409A. It is intended that all of the severance payments payable under this Agreement satisfy, to the greatest extent possible, the exemptions from the application of Section 409A of the Code and the regulations and other guidance thereunder and any state law of similar effect (collectively, "**Section 409A**") provided under Treasury Regulations Sections 1.409A-1(b)(4) and 1.409A-1(b)(9), and this Agreement will be construed in a manner that complies with Section 409A. If not so exempt, this Agreement (and any definitions hereunder) will be construed in a manner that complies with Section 409A, and incorporates by reference all required definitions and payment terms. No severance payments will be made under this Agreement unless Employee's termination of employment constitutes a Separation from Service. For purposes of

Section 409A (including, without limitation, for purposes of Treasury Regulations Section 1.409A-2(b)(2)(iii)), Employee's right to receive any installment payments under this Agreement (whether severance payments or otherwise) shall be treated as a right to receive a series of separate payments and, accordingly, each installment payment hereunder shall at all times be considered a separate and distinct payment. To the extent that any severance payments are deferred compensation under Section 409A, and are not otherwise exempt from the application of Section 409A, then, if the period during which Employee may consider and sign the Release spans two calendar years, the severance payments will not begin until the second calendar year. If the Company determines that the severance benefits provided under this Agreement constitutes "deferred compensation" under Section 409A and if Employee is a "specified employee" of the Company, as such term is defined in Section 409A(a)(2)(B)(i) of the Code at the time of Employee's Separation from Service, then, solely to the extent necessary to avoid the incurrence of the adverse personal tax consequences under Section 409A, the timing of the Severance will be delayed as follows: on the earlier to occur of (a) the date that is six months and one day after Employee's Separation from Service, and (b) the date of Employee's death (such earlier date, the "*Delayed Initial Payment Date*"), the Company will pay to Employee a lump sum amount equal to the sum of the severance benefits that Employee would otherwise have received through the Delayed Initial Payment Date if the commencement of the payment of the severance benefits had not been delayed pursuant to this Section 6.7 and (ii) commence paying the balance of the severance benefits in accordance with the applicable payment schedule set forth in Section 6.1. No interest shall be due on any amounts deferred pursuant to this Section 6.7.

6.8 Excise Tax Adjustment. Notwithstanding any of the foregoing to the contrary in the event that the severance and other benefits provided for in this Agreement or otherwise payable to Employee (i) constitute "parachute payments" within the meaning of Section 280G of the Internal Revenue Code of 1986, as amended (the "*Code*") and (ii) but for this Section, would be subject to the excise tax imposed by Section 4999 of the Code ("*Excise Tax*"), then Employee's severance benefits under this Agreement shall be payable either (A) in full, or (B) as to such lesser amount which would result in no portion of such severance benefits being subject to excise tax under Section 4999 of the Code, whichever of the foregoing amounts, taking into account the applicable federal, state and local income taxes and the excise tax imposed by Section 4999, results in the receipt by Employee on an after-tax basis, of the greatest amount of severance benefits under this Agreement, notwithstanding that all or some portion of such severance benefits may be taxable under Section 4999 of the Code. Unless the Company and Employee otherwise agree in writing, any determination required under this Section shall be made in writing by the Company's independent public accountants (the "*Accountants*"), whose determination shall be conclusive and binding upon Employee and the Company for all purposes. For purposes of making the calculations required by this Section, the Accountants may make reasonable assumptions and approximations concerning applicable taxes and may rely on reasonable, good faith interpretations concerning the application of Sections 280G and 4999 of the Code. The Company and Employee shall furnish to the Accountants such information and documents as the Accountants may reasonably request in order to make a determination under this Section. The Company shall bear all costs the Accountants may reasonably incur in connection with any calculations contemplated by this Section. Any reduction in payments and/or benefits required by this Section shall occur in the following order: (1) reduction of cash payments; (2) reduction in vesting acceleration of equity awards; and (3) reduction of other benefits paid or

provided to Employee. In the event that acceleration of vesting of equity awards is to be reduced, such acceleration of vesting shall be cancelled in the reverse order of the date of grant for Employee's equity awards. If two or more equity awards are granted on the same date, each award will be reduced on a pro-rata basis.

7. GENERAL PROVISIONS.

7.1 Notices. Any notices required hereunder to be in writing shall be deemed effectively given: (a) upon personal delivery to the party to be notified, (b) when sent by electronic mail or confirmed facsimile if sent during normal business hours of the recipient, and if not, then on the next business day, (c) five (5) days after having been sent by registered or certified mail, return receipt requested, postage prepaid, or (d) one (1) day after deposit with a nationally recognized overnight courier, specifying next day delivery, with written verification of receipt. All communications shall be sent to the Company at its primary office location and to Employee at Employee's address as listed on the Company payroll or to Employee's Company-issued email address, or at such other address as the Company or Employee may designate by ten (10) days advance written notice to the other.

7.2 Severability. Whenever possible, each provision of this Agreement will be interpreted in such manner as to be effective and valid under applicable law, but if any provision of this Agreement is held to be invalid, illegal or unenforceable in any respect under any applicable law or rule in any jurisdiction, such invalidity, illegality or unenforceability will not affect any other provision or any other jurisdiction, but this Agreement will be reformed, construed and enforced in such jurisdiction as if such invalid, illegal or unenforceable provisions had never been contained herein.

7.3 Waiver. If either party should waive any breach of any provisions of this Agreement, Employee or it shall not thereby be deemed to have waived any preceding or succeeding breach of the same or any other provision of this Agreement.

7.4 Complete Agreement. This Agreement, including the Exhibit thereto, constitutes the entire agreement between Employee and the Company with regard to the subject matter hereof. This Agreement is the complete, final, and exclusive embodiment of their agreement with regard to this subject matter and supersedes any prior oral discussions or written communications and agreements. This Agreement is entered into without reliance on any promise or representation other than those expressly contained herein, and it cannot be modified or amended except in writing signed by Employee and an authorized officer of the Company. The parties have entered into a separate Confidential Information Agreement and have or may enter into separate agreement related to stock awards. These separate agreements govern other aspects of the relationship between the parties, have or may have provisions that survive termination of the Employee's employment under this Agreement, may be amended or superseded by the parties without regard to this Agreement and are enforceable according to their terms without regard to the enforcement provision of this Agreement.

7.5 **Counterparts.** This Agreement may be executed by electronic transmission and in separate counterparts, any one of which need not contain signatures of more than one party, but all of which taken together will constitute one and the same Agreement.

7.6 **Headings.** The headings of the sections hereof are inserted for convenience only and shall not be deemed to constitute a part hereof nor to affect the meaning thereof.

7.7 **Successors and Assigns.** The Company shall assign this Agreement and its rights and obligations hereunder in whole, but not in part, to any company or other entity with or into which the Company may hereafter merge or consolidate or to which the Company may transfer all or substantially all of its assets, if in any such case said company or other entity shall by operation of law or expressly in writing assume all obligations of the Company hereunder as fully as if it had been originally made a party hereto, but may not otherwise assign this Agreement or its rights and obligations hereunder. The Employee may not assign or transfer this Agreement or any rights or obligations hereunder, other than to his estate upon his death.

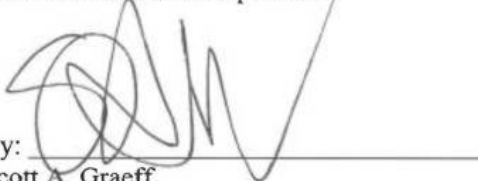
7.8 **Choice of Law.** All questions concerning the construction, validity and interpretation of this Agreement will be governed by the law of the Commonwealth of Virginia.

7.9 **Resolution of Disputes.** The parties recognize that litigation in federal or state courts or before federal or state administrative agencies of disputes arising out of the Employee's employment with the Company or out of this Agreement, or the Employee's termination of employment or termination of this Agreement, may not be in the best interests of either the Employee or the Company, and may result in unnecessary costs, delays, complexities, and uncertainty. The parties agree that any dispute between the parties arising out of or relating to the negotiation, execution, performance or termination of this Agreement or the Employee's employment, including, but not limited to, any claim arising out of this Agreement, claims under Title VII of the Civil Rights Act of 1964, as amended, the Civil Rights Act of 1991, the Age Discrimination in Employment Act of 1967, the Americans with Disabilities Act of 1990, Section 1981 of the Civil Rights Act of 1966, as amended, the Family Medical Leave Act, the Employee Retirement Income Security Act, and any similar federal, state or local law, statute, regulation, or any common law doctrine, whether that dispute arises during or after employment, shall be settled by binding arbitration in accordance with the National Rules for the Resolution of Employment Disputes of the American Arbitration Association; *provided however*, that this dispute resolution provision shall not apply to any separate agreements between the parties that do not themselves specify arbitration as an exclusive remedy. The location for the arbitration shall be the Roanoke, Virginia area. Any award made by such panel shall be final, binding and conclusive on the parties for all purposes and shall be kept confidential, and judgment upon the award rendered by the arbitrators may be entered in any court having jurisdiction thereof. The arbitrators' fees and expenses and all administrative fees and expenses associated with the filing of the arbitration shall be borne by the Company; *provided however*, that at the Employee's option, Employee may voluntarily pay up to one-half the costs and fees. The parties acknowledge and agree that their obligations to arbitrate under this Section survive the termination of this Agreement and continue after the termination of the employment relationship between Employee and the Company. The parties each further agree that the arbitration provisions of this Agreement shall provide each party with its exclusive remedy, and each party expressly waives any right it might have to seek redress in any other forum, except as otherwise expressly provided in this

Agreement. By election arbitration as the means for final settlement of all claims, **the parties hereby waive their respective rights to, and agree not to, sue each other in any action in a Federal, State or local court with respect to such claims, but may seek to enforce in court an arbitration award rendered pursuant to this Agreement. The parties specifically agree to waive their respective rights to a trial by jury, and further agree that no demand, request or motion will be made for trial by jury.**

IN WITNESS WHEREOF, the parties have executed this Employment Agreement on the day and year first written above.

Luna Innovations Incorporated



By:
Scott A. Graeff
President & CEO

Employee:



Gene Nastro

EXHIBIT A

EMPLOYEE CONFIDENTIAL INFORMATION, INVENTIONS, NON-SOLICITATION AND NON-COMPETITION AGREEMENT

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{2312556-2, 110610-00000-01}

FIRST AMENDMENT TO LEASE AGREEMENT

This First Amendment to Lease Agreement ("**Amendment**"), dated as of the 21st day of February, 2020 (for purposes of this Amendment, the "**Effective Date**"), is entered into between SBA TENANT, LLC, a Virginia limited liability company ("**Landlord**") and LUNA INNOVATIONS INCORPORATED, a Virginia corporation ("**Tenant**" and, together with Landlord, collectively referred to herein as the "**Parties**").

WHEREAS, Landlord and Tenant entered into that certain Lease Agreement dated as of November 25, 2014, with the term commencing on April 1, 2015 and ending on March 31, 2020, relating to certain premises within the first floor office space located at 301 1st Street, SW, Suite 200, Roanoke, Virginia 24011, containing approximately 4,423 square feet of office space as more particularly described therein (collectively, the "**Lease**");

WHEREAS, Landlord and Tenant have agreed to amend the Lease, upon the terms and conditions hereinafter described; and

WHEREAS, unless specified otherwise herein, all capitalized terms used but not defined in this Amendment shall have the meanings given to them in the Lease.

NOW, THEREFORE, for good and valuable consideration paid by Tenant to Landlord and the mutual covenants, terms, and conditions, set forth herein, the receipt and sufficiency of which are hereby acknowledged, the Parties hereby amend the Lease on the terms hereof as of the Effective Date as follows:

1. Lease Term. The following sentence in Section (1)(A) of the Lease is hereby deleted: "Subject to the terms and condition in this Section, the term of this Lease shall commence on April 1, 2015 (the "**Commencement Date**") and end on March 31, 2020." The deleted sentence in Section (1)(A) is replaced with the following language: "Subject to the terms and conditions in this Section, the term of this Lease shall commence on April 1, 2015 (the "**Commencement Date**") and end on March 31, 2021."

2. No Default. Landlord and Tenant hereby affirm that as of the Effective Date, no breach, default, or other act, error, or omission which, with the giving of notice or passage of time or both, would constitute a breach or default by either party, has occurred and is continuing under the Lease.

3. Affirmation of Lease Terms. Except as modified by this Amendment, Landlord and Tenant hereby ratify the Lease and agree that the Lease shall remain unchanged and shall continue in full force and effect. In the event there is any conflict between the terms of the Lease and the terms set forth in this Amendment, the terms specifically set out in this Amendment shall control. From and after the Effective Date, any and all references to "the Lease" or "this Lease" in the Lease shall mean the Lease as modified by this Amendment.

4. Mutual Authorization Representation. Each of Landlord and Tenant hereby represent and warrant to each other that: (a) this Amendment (and each term and provision hereof) has been duly and appropriately authorized by such party through proper written corporate action and approval; and (b) no additional consent, agreement, or approval is required with respect hereto.

5. Miscellaneous.

(a) Entire Agreement. This Amendment contains the entire understanding between the Parties with respect to the matters being amended as contained herein.

(b) Amendment and Modification. This Amendment may not be changed or modified orally, but only by an agreement in writing signed by the party against whom enforcement of any waiver, change, or modification is sought.

(c) Further Assurances. Each of the Parties shall deliver to the other any further instruments or documents which may be reasonably required to establish to the satisfaction of the other party that it has agreed to be bound by and become liable under the terms and conditions of the Lease and this Amendment.

(d) Counterparts. This Agreement may be executed in counterparts, each of which shall be deemed an original.

[SIGNATURE PAGE FOLLOWS]

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

LANDLORD:
SBA TENANT, LLC,
a Virginia limited liability company

By: 
Name: William H. Chapman, Jr.
Title: Managing Partner

TENANT:
LUNA INNOVATIONS INCORPORATED,
a Virginia corporation

By: 
Name: SCOTT A. GRAEFF
Title: CEO

[Signature Page to First Amendment to Lease Agreement]

SUBSIDIARIES

Luna Technologies, Inc.
Former Luna Subsidiary, Inc. (previously Advanced Photonix, Inc.)
TeraMetrix, LLC
Advanced Photonix Inc. Canada
General Photonics Corporation

CONSENT OF INDEPENDENT REGISTERED PUBLIC ACCOUNTING FIRM

We have issued our reports dated March 13, 2020, with respect to the consolidated financial statements and internal control over financial reporting in the Annual Report of Luna Innovations Incorporated on Form 10-K for the year ended December 31, 2019. We consent to the incorporation by reference of said reports in the Registration Statements of Luna Innovations Incorporated on Form S-3 (File No. 333-191809), on Form S-4 (File No. 333-201956) and on Forms S-8 (File No. 333-211802, File No. 333-204435 and File No. 333-138745).

/s/ GRANT THORNTON LLP

Arlington, Virginia
March 13, 2020

**CERTIFICATION OF PRINCIPAL EXECUTIVE OFFICER PURSUANT TO
SECTION 302 OF THE SARBANES-OXLEY ACT OF 2002**

I, Scott A. Graeff, certify that:

1. I have reviewed this annual report on Form 10-K of Luna Innovations Incorporated;
2. Based on my knowledge, this report does not contain any untrue statement of a material fact or omit to state a material fact necessary to make the statements made, in light of the circumstances under which such statements were made, not misleading with respect to the period covered by this report;
3. Based on my knowledge, the financial statements, and other financial information included in this report, fairly present in all material respects the financial condition, results of operations and cash flows of the registrant as of, and for, the periods presented in this report;
4. The registrant's other certifying officer and I are responsible for establishing and maintaining disclosure controls and procedures (as defined in Exchange Act Rules 13a-15(e) and 15d-15(e)) and internal control over financial reporting (as defined in Exchange Act Rules 13a-15(f) and 15d-15(f)) for the registrant and have:
 - a. designed such disclosure controls and procedures, or caused such disclosure controls and procedures to be designed under our supervision, to ensure that material information relating to the registrant, including its consolidated subsidiaries, is made known to us by others within those entities, particularly during the period in which this report is being prepared;
 - b. designed such internal control over financial reporting, or caused such internal control over financial reporting to be designed under our supervision, to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles;
 - c. evaluated the effectiveness of the registrant's disclosure controls and procedures and presented in this report our conclusions about the effectiveness of the disclosure controls and procedures, as of the end of the period covered by this report based on such evaluation; and
 - d. disclosed in this report any change in the registrant's internal control over financial reporting that occurred during the registrant's most recent fiscal quarter (the registrant's fourth fiscal quarter in the case of an annual report) that has materially affected, or is reasonably likely to materially affect, the registrant's internal control over financial reporting; and
5. The registrant's other certifying officer and I have disclosed, based on our most recent evaluation of internal control over financial reporting, to the registrant's auditors and the audit committee of the registrant's board of directors (or persons performing the equivalent functions):
 - a. all significant deficiencies and material weaknesses in the design or operation of internal control over financial reporting which are reasonably likely to adversely affect the registrant's ability to record, process, summarize and report financial information; and
 - b. any fraud, whether or not material, that involves management or other employees who have a significant role in the registrant's internal control over financial reporting.

Date: March 13, 2020

/s/ Scott A. Graeff

Scott A. Graeff

**President and Chief Executive Officer
(principal executive officer)**

**CERTIFICATION OF PRINCIPAL FINANCIAL OFFICER PURSUANT TO
SECTION 302 OF THE SARBANES-OXLEY ACT OF 2002**

I, Eugene J. Nestro, certify that:

1. I have reviewed this annual report on Form 10-K of Luna Innovations Incorporated;
2. Based on my knowledge, this report does not contain any untrue statement of a material fact or omit to state a material fact necessary to make the statements made, in light of the circumstances under which such statements were made, not misleading with respect to the period covered by this report;
3. Based on my knowledge, the financial statements, and other financial information included in this report, fairly present in all material respects the financial condition, results of operations and cash flows of the registrant as of, and for, the periods presented in this report;
4. The registrant's other certifying officer and I are responsible for establishing and maintaining disclosure controls and procedures (as defined in Exchange Act Rules 13a-15(e) and 15d-15(e)) and internal control over financial reporting (as defined in Exchange Act Rules 13a-15(f) and 15d-15(f)) for the registrant and have:
 - a. designed such disclosure controls and procedures, or caused such disclosure controls and procedures to be designed under our supervision, to ensure that material information relating to the registrant, including its consolidated subsidiaries, is made known to us by others within those entities, particularly during the period in which this report is being prepared;
 - b. designed such internal control over financial reporting, or caused such internal control over financial reporting to be designed under our supervision, to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with generally accepted accounting principles;
 - c. evaluated the effectiveness of the registrant's disclosure controls and procedures and presented in this report our conclusions about the effectiveness of the disclosure controls and procedures, as of the end of the period covered by this report based on such evaluation; and
 - d. disclosed in this report any change in the registrant's internal control over financial reporting that occurred during the registrant's most recent fiscal quarter (the registrant's fourth fiscal quarter in the case of an annual report) that has materially affected, or is reasonably likely to materially affect, the registrant's internal control over financial reporting; and
5. The registrant's other certifying officer and I have disclosed, based on our most recent evaluation of internal control over financial reporting, to the registrant's auditors and the audit committee of the registrant's board of directors (or persons performing the equivalent functions):
 - a. all significant deficiencies and material weaknesses in the design or operation of internal control over financial reporting which are reasonably likely to adversely affect the registrant's ability to record, process, summarize and report financial information; and
 - b. any fraud, whether or not material, that involves management or other employees who have a significant role in the registrant's internal control over financial reporting.

Date: March 13, 2020

/s/ Eugene J. Nestro

Eugene J. Nestro
Chief Financial Officer
(principal financial officer)

**CERTIFICATION OF PRINCIPAL EXECUTIVE OFFICER PURSUANT TO
SECTION 906 OF THE SARBANES-OXLEY ACT OF 2002**

In connection with the annual report of Luna Innovations Incorporated (the "Company") on Form 10-K for the year ended December 31, 2019 as filed with the Securities and Exchange Commission on the date hereof (the "Report"), I, Scott A. Graeff, President and Chief Executive Officer of the Company, certify, pursuant to 18 U.S.C. § 1350, as adopted pursuant to § 906 of the Sarbanes-Oxley Act of 2002, that to my knowledge:

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

This certification accompanies this Report to which it relates, shall not be deemed "filed" with the Securities and Exchange Commission and is not to be incorporated by reference into any filing of the Company under the Securities Act of 1933, as amended, or the Securities Exchange Act of 1934, as amended (whether made before or after the date of the Report), irrespective of any general incorporation language contained in such filing.

/s/ Scott A. Graeff

Scott A. Graeff

**President and Chief Executive Officer
(principal executive officer)**

March 13, 2020

**CERTIFICATION OF PRINCIPAL FINANCIAL OFFICER PURSUANT TO
SECTION 906 OF THE SARBANES-OXLEY ACT OF 2002**

In connection with to the annual report of Luna Innovations Incorporated (the "Company") on Form 10-K for the year ended December 31, 2019 as filed with the Securities and Exchange Commission on the date hereof (the "Report"), I, Eugene J. Nestro, Chief Financial Officer of the Company, certify, pursuant to 18 U.S.C. § 1350, as adopted pursuant to § 906 of the Sarbanes-Oxley Act of 2002, that to my knowledge:

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

This certification accompanies this Report to which it relates, shall not be deemed "filed" with the Securities and Exchange Commission and is not to be incorporated by reference into any filing of the Company under the Securities Act of 1933, as amended, or the Securities Exchange Act of 1934, as amended (whether made before or after the date of the Report), irrespective of any general incorporation language contained in such filing.

/s/ Eugene J. Nestro

Eugene J. Nestro
Chief Financial Officer
(principal financial officer)

March 13, 2020