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

FORM 10-K

(MARK ONE)

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

FOR THE FISCAL YEAR ENDED DECEMBER 31, 2018

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	**54-1560050**
(State or Other Jurisdiction of Incorporation or Organization)	***(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:

Title of Each Class	Name of Each Exchange on which Registered
Common Stock, par value $0.001 per share	**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 x

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 x

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 x 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 x No ☐

Indicate by check mark if disclosure of delinquent filers pursuant to Item 405 of Regulation S-K is not contained herein, and will not be contained, to the best of registrant's knowledge, in definitive proxy or information statements incorporated by reference in Part III of this Form 10-K or any amendment to this Form 10-K. x

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 x	Smaller reporting company x

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. o

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

The aggregate market value of the voting and non-voting common equity held by non-affiliates of the registrant on June 29, 2018 based upon the closing price of Common Stock on such date as reported by the Nasdaq Capital Market, was approximately $71.9 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 12, 2019 there were 28,125,598 shares of the registrant's common stock outstanding.

DOCUMENTS INCORPORATED BY REFERENCE

Specified portions of the registrant's Proxy Statement with respect to its 2019 Annual Meeting of stockholders, anticipated to be filed within 120 days after the end of its fiscal year ended December 31, 2018, 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, 2018

TABLE OF CONTENTS

PART I		
Item 1.	Business	1
Item 1A.	Risk Factors	9
Item 1B.	Unresolved Staff Comments	24
Item 2.	Properties	24
Item 3.	Legal Proceedings	24
Item 4.	Mine Safety Disclosure	25
PART II		
Item 5.	Market for Registrant’s Common Equity, Related Stockholder Matters and Issuer Purchases of Equity Securities	26
Item 6.	Selected Financial Data	28
Item 7.	Management’s Discussion and Analysis of Financial Condition and Results of Operations	29
Item 7A.	Quantitative and Qualitative Disclosures About Market Risk	40
Item 8.	Financial Statements and Supplementary Data	41
Item 9.	Changes in and Disagreements with Accountants on Accounting and Financial Disclosure	76
Item 9A.	Controls and Procedures	77
Item 9B.	Other Information	78
PART III		
Item 10.	Directors, Executive Officers and Corporate Governance	79
Item 11.	Executive Compensation	79
Item 12.	Security Ownership of Certain Beneficial Owners and Management and Related Stockholder Matters	79
Item 13.	Certain Relationships and Related Transactions, and Director Independence	79
Item 14.	Principal Accounting Fees and Services	79
PART IV		
Item 15.	Exhibits, Financial Statement Schedules	80
Item 16.	Form 10-K Summary	86
SIGNATURES		86

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 products for the telecommunications industry 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 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 advanced materials, sensing, and healthcare applications. 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 main business 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, as well as communications test products. We are continuing 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 51% and 44% of our total revenues for the years ended December 31, 2018 and 2017, respectively.

Our Technology Development segment performs applied research principally in the areas of sensing & instrumentation, advanced materials, optical technologies, and health sciences. Our Technology Development segment comprised approximately 49% and 56% of our total revenues for the years ended December 31, 2018 and 2017, 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, 2018, approximately 44% of our total revenues were generated under the SBIR program, compared to 37% for the year ended December 31, 2017.

For the years ended December 31, 2018 and 2017, 53% and 48%, 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. 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 can 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 months following the closing.

Acquisition of Micron Optics, Inc.

On October 15, 2018, we acquired the assets 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 for total cash consideration of $5 million, including $4.0 million paid at closing and $1.0 million placed in escrow until the later of October 1, 2019, or the date that specified matters are resolved as agreed by us and MOI. The purchase price was subject to adjustment after closing based upon an analysis of final working capital compared to a target amount specified in the purchase agreement. In 2019, we expect to pay an additional $0.5 million to MOI in connection with the working capital adjustment. With the acquisition of MOI, we 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 instruments. We provide fiber optic test & measurement products which provide solutions primarily for the telecommunications industry marketed under the Luna Technologies brand. We also market our 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 and the ability to operate 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 and measurement 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 & Measurement, Sensing, and Instrumentation Products

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

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

Historically, our optical test & measurement products have primarily served the telecommunications industry, as well as valuable applications in other fields. Our test & 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 and allow 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 replace 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 and deliver 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 the technology can provide exceptional value to the aerospace and automotive industries as they adopt electrification and lighter weight systems and transition from steel and aluminum to 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 an 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. In addition, we manufacture and sell fiber optic coils for use in gyroscopes.

Tunable Lasers

We have acquired the rights to manufacture a line of swept tunable lasers to allow us to compete more effectively in our existing fiber optic test & measurement as well as sensing markets. This technology is being integrated into current and new products to help us provide our customers with faster, more flexible and cost-effective test & measurement products. The 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 to conduct 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 for decades, THz waves are in the early stages of being explored and commercialized due to the fact that 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 can be 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.

Sales and Marketing

We primarily market our fiber optic test & measurement 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 other sales around the world. 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 in print 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 we derive from our contract research business, including revenue generation and identification of promising technologies for further development. We focus primarily on opportunities in which we develop intellectual property rights in areas that we believe have commercialization potential. We take a disciplined approach to contract research to try to ensure that the costs of any contract we undertake will be fully reimbursed. We believe that this model is cost-efficient and significantly reduces our development risk in that it enables us to defray the costs of higher risk technology development with third-party funding.

Although 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 developed under those contracts and to continuously enlarge and strengthen our intellectual property portfolio. New technology that we develop may complement existing technologies and enable us to develop applications and products that were not previously possible. In addition, the technologies we develop may also be applicable to 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 $21.0 million and $18.6 million for the years ended December 31, 2018 and 2017, respectively.

Each year, U.S. government federal agencies and departments are required to set aside 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 will 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, as well as to successfully defend these 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 262 U.S. and international patents and approximately 255 U.S. and international patent applications, and we intend to file, or request that our licensors file, additional patent applications for patents covering our products. Our issued patents generally have terms that are scheduled to expire between 2019 and 2037. The patents scheduled to expire in 2019 are not expected to have a significant impact on our revenues or results of operations. However, 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. 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 patents and patent applications 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 September 2020.

Coherent Patents

We have licensed, on a non-exclusive basis, several U.S. patents and other intellectual property rights owned or controlled by Coherent, Inc., related to the manufacturing, using, importing, selling and offering for sale of Coherent’s “Iolon” brand of swept tunable lasers, which we market under our “Phoenix” brand. These patents expire between 2020 and 2025.

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 have a license back from Intuitive for a patent application that covers certain refinements to the measurements covered in the first two patents, which are necessary in order to achieve the necessary accuracies for medical and other applications. This patent application was filed in the United States, the European Patent Office, China, India, Russia, Brazil, Japan and Indonesia. These patents and patent applications can support other nonmedical applications of our fiber optic shape sensing technology.

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. The optoelectronic business was a component of the operations of Advanced Photonix, Inc.

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 2025. 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 and Intuitive has certain rights to require us to transfer and assign this Coherent license to Intuitive, in which case Intuitive would be similarly required to supply us with lasers.

NASA

We have licensed, on a non-exclusive basis, certain patents from NASA under two license agreements. These patents concern the measurement of strain in optical fiber using Bragg gratings and Rayleigh scatter, and also the measurement of the properties of fiber-optic communications devices. 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, which is September 2020. These license agreements may be terminated by us on 90 days' notice. Either party may terminate the license agreements for cause upon certain conditions.

Competition

We 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.

We also compete, or will 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.

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, 2018, we, including all of our divisions, had 196 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, 2018, we had approximately 196 total employees, including approximately 141 in research, development and engineering positions, approximately 20 in operations, approximately 12 in sales and marketing, and approximately 23 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

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 $26.0 million and $23.5 million at December 31, 2018 and 2017, 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 $4.5 million and $5.5 million as of December 31, 2018 and 2017, 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.

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 $5.8 million and $6.9 million at December 31, 2018 and 2017, respectively.

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 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. We have agreed on final billing rates with the U.S. government through December 31, 2017.

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, 2018, 44% of our total revenues were generated under the SBIR program, compared to 37% in for the year ended December 31, 2017.

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, 2018, we had approximately 196 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 49% and 56% of our total revenues for the years ended December 31, 2018 and 2017, 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 rough 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.

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 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 or 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.

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 a history of losses, 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 a history of net losses from operations and only recently generated positive net income from continuing operations of $1.2 million for the year ended December 31, 2018. 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 to become 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 & 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 October 2018 we acquired the assets of Micron Optics, Inc., a leading provider of provider of innovative optical components and laser-based equipment that advance the quality of optical measurements. In March 2019 we acquired General Photonics Corporation, 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. 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;
- performance shortfalls as a result of the diversion 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.

Recent developments relating to the United Kingdom's referendum vote in favor of withdrawal from the European Union could adversely affect us.

The UK held a referendum on June 23, 2016, in which a majority voted for the UK's withdrawal from the EU, commonly known as 'Brexit'. As a result of this vote, on March 29, 2017, the UK officially started the separation process and commenced negotiations to determine the terms of the UK's withdrawal from the EU. The UK is currently scheduled to leave the EU at 11:00p.m. GMT on March 29, 2019. If the UK and the EU are unable to negotiate acceptable withdrawal terms, barrier-free access between the UK and other European Member States or among the EEA overall could be diminished or eliminated. The effects of Brexit are expected to be far-reaching and will depend on any agreements (or lack thereof) between the UK and the EU and, in particular, any arrangements for the UK to retain access to EU markets either during a transitional period or more permanently. Given the level of uncertainty, Brexit, and the perceptions as to its impact, may adversely affect business activity and economic conditions in the UK, Europe and globally and could continue to contribute to instability in global financial and foreign exchange markets, asset valuations and credit ratings. Brexit could also have the effect of disrupting and potentially ending the free movement of goods, services and people between the UK and the EU, which may negatively affect our operations together with those of our customers and suppliers.

For example, it is unclear at this time what Brexit's impact will have on our intellectual property rights and the process for obtaining, maintaining, defending and enforcing such rights. For example, while current guidance provided by the UK's government suggests that trademarks granted by the EU, known as EU registered trademarks or EUTMs, will be continue to be protected in the UK after Brexit, it is unclear whether we will be required to refile our trademarks and other intellectual property applications domestically in the UK and whether any other steps will be required for us to protect our trade marks in the UK in the future. As a result of Brexit, other European countries may seek to conduct referenda with respect to their continuing membership in the EU. Given these possibilities and others we may not anticipate, as well as the lack of comparable precedent, we cannot be certain of the full extent to which Brexit could adversely affect our business, results of operations and financial condition.

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, products 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, 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, 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.

As a technology company, and particularly as a government contractor, we may face a heightened risk of a security breach or disruption from threats to gain unauthorized access to our proprietary, confidential or classified information on our IT networks and related systems. 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 the operations of certain of our customers. 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. To date, we have not experienced a significant cyber-intrusion or cyber-attack. 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.

A security breach 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. Any of these developments in the future could have a negative impact on our results of operations, financial condition and cash flows.

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.

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

The United States Tax Cuts and Jobs Act of 2017 could adversely affect our business and financial condition.

The U.S. Tax Cuts and Jobs Act (the "TCJA") significantly reforms the US Internal Revenue Code. The TCJA, among other things, contains significant changes to U.S. federal corporate income taxation, including reduction of the U.S. federal corporate income tax rate from a top marginal rate of 35% to a flat rate of 21%, limitation of the tax deduction for interest expense to 30% of adjusted earnings (except for certain small businesses), limitation of the deduction for net operating losses to 80% of current year taxable income and elimination of net operating loss carrybacks, immediate deductions for certain new investments instead of deductions for depreciation expense over time, and modifying or repealing many business deductions and credits. Federal net operating losses arising in taxable year ending after December 31, 2017, will be carried forward indefinitely pursuant to the TCJA. We continue to examine the impact this tax reform legislation may have on our business. Notwithstanding the reduction in the corporate income tax rate, the overall impact of the TCJA is uncertain and our business and financial condition could be adversely affected. The impact of this tax reform on holders of our common stock is also uncertain and could be adverse. We urge our stockholders to consult with their legal and tax advisors with respect to such legislation and the potential tax consequences of investing in 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.

Carilion Clinic holds approximately 4.1 million shares of our common stock (including approximately 1.3 million shares issuable to Carilion upon conversion of shares of Series A Convertible Preferred Stock that Carilion holds). All of these shares have been registered for sale on a Form S-3 registration statement and, accordingly, may generally be freely sold by Carilion at any time. Any sales of these shares, or the perception that future sales of shares may occur by Carilion or any of our other significant stockholders, may have a material adverse effect on the market price of our stock. Any such continuing material adverse effect on the market price of our stock could impair our ability to comply with Nasdaq's continuing listing standards in respect of our minimum stock price, as further described below.

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 $5.00 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.

If our internal control over financial reporting is found not to be effective or if we make disclosure of existing or potential material weaknesses in those controls, investors could lose confidence in our financial reports, and our stock price may be adversely affected.

Section 404 of the Sarbanes-Oxley Act of 2002 requires us to include an internal control report with our Annual Report on Form 10-K. That report must include management's assessment of the effectiveness of our internal control over financial reporting as of the end of the fiscal year.

We evaluate our existing internal control over financial reporting based on the framework issued by the Committee of Sponsoring Organizations of the Treadway Commission. During the course of our ongoing evaluation of the internal controls, we may identify areas requiring improvement, and may have to design enhanced processes and controls to address issues identified through this review. Remedying any deficiencies, significant deficiencies or material weaknesses that we identify may require us to incur significant costs and expend significant time and management resources. We cannot assure you that any of the measures we implement to remedy any such deficiencies will effectively mitigate or remedy such deficiencies. Investors could lose confidence in our financial reports, and our stock price may be adversely affected, if our internal controls over financial reporting are found not to be effective by management or if we make disclosure of existing or potential significant deficiencies or material weaknesses in those controls.

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 new 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, 2020.

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 December 31, 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 own a 24,000 square foot facility in Danville, Virginia for use by certain groups in our Technology Development segment.

We lease approximately 28,000 square feet of space in Chino, California, for manufacture and support of our GP products.

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, 2018, $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

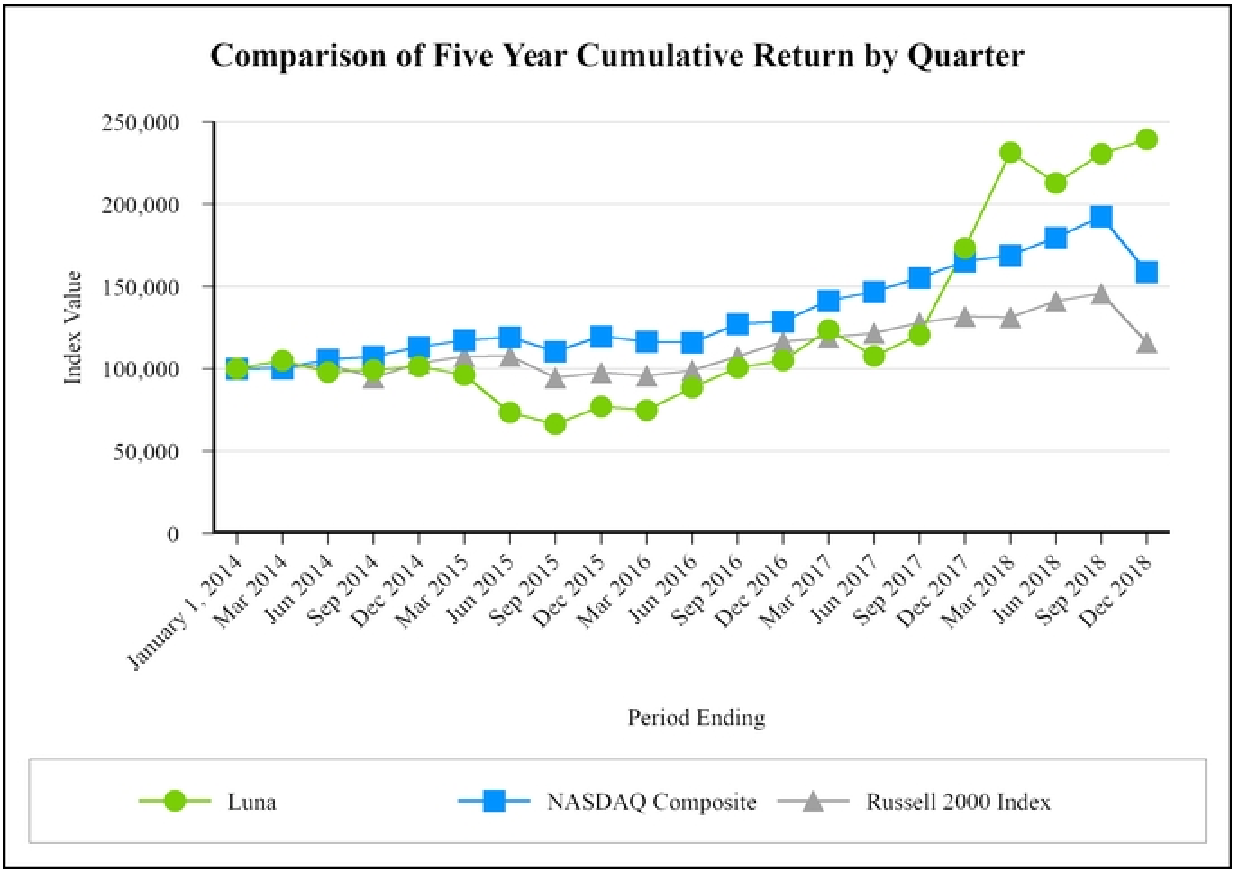
Our common stock is listed on the Nasdaq Capital Market under the symbol "LUNA." As of March 12, 2019, we had 28,125,598 shares of common stock outstanding held by 100 holders of record. The actual number of stockholders is greater than this number of record holders and includes stockholders who are 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, 2014, 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

Common Stock Dividend Payable to Carilion

We issued 1,321,514 shares of Series A Preferred Stock, par value $0.001 per share, to Carilion Clinic in January 2010, which shares were issued in reliance on the exemptions from registration under the Securities Act provided by Sections 3(a)(9) and 4 (a)(2) thereof. The Series A Preferred Stock accrues dividends at the rate of $0.2815 per share per annum, payable quarterly in arrears. Accrued dividends are payable in shares of our common stock, with the number of shares being equal to the quotient of (i) the cumulative aggregate balance of accrued but unpaid dividends on each share of Series A Preferred Stock divided by (ii) the conversion price of the Series A Preferred Stock, which is currently $4.69159 per share. For the period from January 12, 2010, the original issue date of the Series A Preferred Stock, through December 31, 2018, the Series A Preferred Stock issued to Carilion has accrued $1,417,633 in dividends. The accrued dividend as of December 31, 2018 will be paid by the issuance of 710,985 shares of our common stock, which we will issue at Carilion’s written request. As the Series A

Preferred Stock was issued in reliance on the exemption provided by Section 3(a)(9), the shares of common stock payable as dividends will also be exempt from registration in reliance on Section 3(a)(9) of the Securities Act.

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, 2018 and 2017 and the consolidated balance sheet data as of December 31, 2018 and 2017 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, 2016, 2015 and 2014 and the consolidated balance sheet data as of December 31, 2016, 2015 and 2014 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, 2018	2017	2016	2015	2014
Consolidated Statement of Operations Data:					
Revenues:					
Technology development	$ 20,968	$ 18,576	$ 16,281	$ 13,599	$ 12,206
Products and licensing	21,950	14,505	13,323	12,975	9,054
Total revenues	42,917	33,082	29,604	26,574	21,260
Cost of revenues:					
Technology development	15,400	13,988	12,473	10,379	9,376
Products and licensing	8,079	5,724	5,417	5,652	4,047
Total cost of revenues	23,479	19,713	17,890	16,031	13,423
Gross profit	19,438	13,369	11,714	10,543	7,837
Operating expense	18,560	15,577	15,840	17,359	12,342
Operating income/(loss)	878	(2,208)	(4,126)	(6,816)	(4,505)
Other (expense)/income, net	(17)	26	28	(53)	111
Interest income	550	—	—	—	—
Interest expense, net	(124)	(217)	(317)	(218)	(96)
Income/(loss) from continuing operations before income taxes	1,286	(2,399)	(4,414)	(7,087)	(4,490)
Income tax expense/(benefit)	48	(1,149)	(136)	(602)	(1,137)
Net income/(loss) from continuing operations	1,238	(1,250)	(4,279)	(6,484)	(3,353)
Income from discontinued operations, net of income taxes	9,766	15,866	1,909	8,801	9,347
Net income/(loss)	11,004	14,616	(2,369)	2,317	5,994
Preferred stock dividend	257	147	105	86	112
Net income/(loss) attributable to common stockholders	$ 10,747	$ 14,469	$ (2,475)	$ 2,231	$ 5,882
Net income/(loss) per share from continuing operations:					
Basic	$ 0.04	$ (0.05)	$ (0.16)	$ (0.28)	$ (0.23)
Diluted	$ 0.04	$ (0.05)	$ (0.16)	$ (0.28)	$ (0.23)
Net income per share from discontinued operations:					
Basic	$ 0.35	$ 0.58	$ 0.07	$ 0.38	$ 0.63
Diluted	$ 0.30	$ 0.58	$ 0.07	$ 0.38	$ 0.63
Net income/(loss) per share attributable to common stockholders:					
Basic	$ 0.39	$ 0.52	$ (0.09)	$ 0.10	$ 0.40
Diluted	$ 0.33	$ 0.52	$ (0.09)	$ 0.10	$ 0.40
Weighted-average shares:					
Basic	27,596,401	27,579,988	27,547,217	23,026,494	14,880,697
Diluted	32,452,228	27,579,988	27,547,217	23,026,494	14,880,697

In thousands	As of December 31, 2018	2017	2016	2015	2014
Consolidated Balance Sheet Data:					
Cash and cash equivalents	$ 42,460	$ 36,982	$ 17,464	$ 14,117	$ 7,779
Working capital	56,089	43,975	23,417	15,413	10,106
Total assets	75,599	66,223	58,132	27,584	19,704
Total current liabilities	12,139	14,826	15,334	8,473	7,206
Total debt	619	2,436	6,125	625	2,125

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 products for the telecommunications industry 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 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 advanced materials, sensing, and healthcare applications. 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 main operating 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, as well as communications test products. We are continuing 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 51% and 44% of our total revenues for the years ended December 31, 2018 and 2017, respectively.

Our Technology Development segment performs applied research principally in the areas of sensing & instrumentation, advanced materials, and health sciences. Our Technology Development segment comprised approximately 49% and 56% of our total revenues for the years ended December 31, 2018 and 2017, 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 Technology Development segment backlog was $26.0 million and $23.5 million at December 31, 2018 and 2017, respectively. The approximate value of our Products and Licensing segment backlog was $5.8 million and $6.9 million at December 31, 2018 and 2017, respectively.

Revenues from product sales are mostly derived from the sales of our sensing and test & measurement 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 technology in past years, we do not expect license revenues to represent a significant portion of future revenues. Over time, however, we do 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 fiber optic test & measurement and sensing platforms. In the long term, we expect that revenues from product sales will represent a larger portion of our total revenues and that as we develop and commercialize new products, these revenues will reflect a broader and more diversified mix of products.

We realized net income attributable to common stockholders of approximately $10.7 million for the year ended December 31, 2018 and net income attributable to common stockholders of approximately $14.5 million for the year ended December 31, 2017. Excluding the effects of our HSOR business and our optoelectronics business, which we sold in 2017 and 2018, respectively, we realized a net income from continuing operations of $1.2 million for the year ended December 31, 2018 and a net loss from continuing operations of $1.3 million for the year ended December 31, 2017.

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. 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 can 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 months following the closing.

Acquisition of Micron Optics, Inc.

On October 15, 2018, we acquired the assets of the United States 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 for total cash consideration of $5 million, including $4.0 million paid at closing and $1.0 million placed in escrow until the later of October 1, 2019, or the date that specified matters are resolved as agreed by us and MOI. The purchase price was subject to adjustment after closing based upon an analysis of final working capital compared to a target amount specified in the purchase agreement. In 2019, we expect to pay an additional $0.5 million to MOI in connection with the working capital adjustment. With the acquisition of MOI, we 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 adds a product suite of tunable optical filters, optical sensors, and swept lasers.

Sale of Luna Optoelectronics Business

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. In addition, the purchase price was subject to adjustment based upon an analysis of final working capital as of the acquisition date compared to a target amount specified in the purchase agreement. Following closing, we received and additional $0.7 million in connection with the working capital adjustment. We have been engaged since 2015 in the optoelectronic business as part of our acquisition of Advanced Photonix, Inc.

Sale of High Speed Optical Receiver Business

On August 9, 2017, we completed the sale of our high speed optical receivers ("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. As of December 31, 2018, $1.5 million of the escrow balance had been received. The remaining $2.5 million remains in the escrow account pending resolution of a dispute over certain indemnity claims by the buyer.

Description of Our Revenues, Costs and Expenses

Revenues

We generate revenues from technology development, product sales and commercial product development and licensing activities. 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. Our Technology Development segment revenues represented approximately 49% and 56% of our total revenues for the years ended December 31, 2018 and 2017, respectively.

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. Products and licensing revenues represented approximately 51% and 44% of our total revenues for the years ended December 31, 2018 and 2017, respectively.

Cost of Revenues

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.

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.

Operating Expense

Operating expense consists of selling, general and administrative expenses, 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.

Interest Expense, Net

We have a term loan with Silicon Valley Bank ("SVB") which is scheduled to mature in May 2019. The term loan carries interest at a variable rate of prime plus 2%. At December 31, 2018, we had $0.6 million in the aggregate outstanding on this term loan.

During the years ended December 31, 2018 and 2017, interest expense primarily included interest accrued on our outstanding SVB debt and interest incurred with respect to our capital lease obligations.

Critical Accounting Policies and Estimates

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 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 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 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. We have agreed on final billing rates with the government through December 31, 2017.

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 period. 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. In certain circumstances we may offer a "right of return" to a distributor of our products, in which case a contract liability is calculated based on the terms of the agreement and recorded as a reduction to revenue. In addition, a contract asset for the rights to recover products from customers and a reduction of cost of sales is also calculated and recorded.

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 carry forwards. 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 carry forwards, to the extent that realizing these benefits is considered more likely than not.

On December 22, 2017, the President of the United States signed into law the Tax Cuts and Jobs Act tax reform legislation. This legislation makes significant changes in U.S. tax law including a reduction in the corporate tax rates, changes to net operating loss carryforwards and carrybacks, and a repeal of the corporate alternative minimum tax. The legislation reduced the U.S. corporate tax rate from the current rate of 35% to 21%. As a result of the enacted law, we were required to revalue deferred tax assets and liabilities at the enacted rate. This revaluation resulted in a $1.9 million reduction in the deferred tax asset and a corresponding reduction in the valuation allowance in 2017. In 2018, we realized a benefit of $0.6 million in recovery of the alternative minimum tax credit from prior periods. The other provisions of the Tax Cuts and Jobs Act did not have a material impact on our financial statements.

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 estimated forfeitures of awards over the expense recognition period. Although we estimate the rate of future forfeitures based on historical experience, actual forfeitures may differ.

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.

Business Combinations

We account for business combinations under the acquisition method of accounting. Under this method, 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,	
	2018	2017
Revenues:		
Technology development	48.9%	56.2 %
Products and licensing	51.1	43.8
Total revenues	100.0	100.0
Cost of revenues:		
Technology development	35.9	42.3
Products and licensing	18.8	17.3
Total cost of revenues	54.7	59.6
Gross profit	45.3	40.4
Operating expense	43.2	47.1
Operating income/(loss)	2.1	(6.7)
Total other income/(expense)	1.0	(0.6)
Income/(loss) from continuing operations before income taxes	3.1	(7.3)
Income/(loss) from continuing operations, net of income taxes	2.9	(3.8)
Income from discontinued operations, net of income taxes	22.8	48.0
Net income	25.7%	44.2 %

Year Ended December 31, 2018 Compared to Year Ended December 31, 2017

Revenues

	Years ended December 31,			
	2018	2017	$ Difference	% Difference
Technology development revenues	$ 20,967,556	$ 18,576,383	$ 2,391,173	12.9%
Products and licensing revenues	21,949,689	14,505,482	7,444,207	51.3%
Total revenues	$ 42,917,245	$ 33,081,865	$ 9,835,380	29.7%

Our Technology Development segment revenues increased $2.4 million to $21.0 million for the year ended December 31, 2018 compared to $18.6 million for the year ended December 31, 2017. This increase was attributable primarily to growth in our intelligent systems and biomedical technologies groups. Revenues within these groups increased due to additional contract awards, including higher value Phase II SBIR contracts.

Our Products and Licensing segment revenues increased $7.4 million to $21.9 million for the year ended December 31, 2018 compared to $14.5 million for the year ended December 31, 2017. This increase was primarily driven by an increase in our sales of optical backscatter reflectometer instruments and ODiSI instruments. In addition, revenues associated with the operations of MOI, which we acquired on October 15, 2018, were $2.6 million for the period from the completion of the acquisition through December 31, 2018.

Cost of Revenues

	Years ended December 31,			
	2018	2017	$ Difference	% Difference
Technology development costs	$ 15,400,475	$ 13,988,378	$ 1,412,097	10.1%
Products and licensing costs	8,078,870	5,724,457	2,354,413	41.1%
Total costs of revenues	$ 23,479,345	$ 19,712,835	$ 3,766,510	19.1%

Our Technology Development segment costs increased $1.4 million, to $15.4 million for the year ended December 31, 2018 compared to $14.0 million for the year ended December 31, 2017. 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.

Our Products and Licensing segment costs increased $2.4 million to $8.1 million for the year ended December 31, 2018 compared to $5.7 million for the year ended December 31, 2017. The increase in product and licensing cost is attributable to the component costs associated with increased volume of optical backscatter reflectometer and ODiSI instrument sales. In addition, cost of revenues associated with the operations of MOI were $0.7 million for the period from the completion of the acquisition through December 31, 2018. Products and Licensing segment costs increased in accordance with the increase in Products and Licensing segment revenues over the same period taking into account the gross margin effect of the product mix.

Operating Expense

	Years ended December 31,			
	2018	2017	$ Difference	% Difference
Selling, general and administrative expense	$ 14,794,205	$ 12,923,841	$ 1,870,364	14.5%
Research, development and engineering expense	3,766,160	2,653,337	1,112,823	41.9%
Total operating expense	$ 18,560,365	$ 15,577,178	$ 2,983,187	19.2%

Selling, general and administrative expenses increased $1.9 million to $14.8 million for the year ended December 31, 2018 compared to$12.9 million for the year ended December 31, 2017. The increase in selling, general and administrative expenses included $0.8 million in transaction-related expenses associated with the acquisition of MOI and $0.5 million in expenses associated with the operations of MOI for the period from the completion of the acquisition through December 31, 2018.

Research, development and engineering expenses increased $1.1 million to $3.8 million for the year ended December 31, 2018 compared to $2.7 million for the year ended December 31, 2017. During 2018, we increased our headcount and other expenses in engineering within our Lightwave division in order to accelerate our product development roadmap to continue our growth in the areas of fiber optic-based sensing and communications testing. In addition, the operations of research development and engineering expense associated with the operations of MOI for the period from the completion of the acquisition through December 31, 2018 were $0.3 million.

Interest Expense, Net

Our net interest expense was $0.1 million for the year ended December 31, 2018 compared to $0.2 million for the year ended December 31, 2017. The average monthly loan balance for the year ended December 31, 2018 was $1.5 million as compared to $3.3 million for the year ended December 31, 2017, resulting in this decrease in interest expense.

Investment Income

Investment income was $0.5 million for the year ended December 31, 2018. During the year ended December 31, 2018, we invested a portion of our cash in funds holding U.S. treasury securities. We did not have any investment income for the year ended December 31, 2017.

Income Tax Expense/(Benefit) from Continuing Operations

For the year ended December 31, 2018, we recorded income tax expense of $47,818, or 3.7% of our income from continuing operations, compared to an income tax benefit of $1.1 million, or 47.9% of our loss from continuing operations for the year ended December 31, 2017. The change resulted from the recognition of income from continuing operations in 2018 compared to a loss from continuing operations in 2017. The income tax benefit recognized in 2017 was also driven by the discrete gain associated with the discontinued operations of our former HSOR and optoelectronic components business and the related intraperiod tax allocation requirements.

Net Income/(Loss) From Continuing Operations

For the year ended December 31, 2018, we recognized income from continuing operations before income taxes of $1.3 million compared to a loss from continuing operations before income taxes of $2.4 million for the year ended December 31, 2017. After tax, our net income from continuing operations was $1.2 million for the year ended December 31, 2018, compared to a net loss from continuing operations of $1.3 million for the year ended December 31, 2017.

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. For the year ended December 31, 2017, we recognized income from discontinued operations, net of income taxes, of $15.9 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. For the year ended December 31, 2017, our net income from discontinued operations included a $15.7 million after tax gain recognized on the sale of the HSOR business in addition to after-tax income of $0.2 million related to the operations of both the HSOR and optoelectronics businesses that were disposed of during 2017 and 2018, respectively.

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 carries an annual cumulative dividend of 6%, or approximately 79,292 shares of common stock per year. During each of 2018 and 2017, we accrued $0.3 million and $0.1 million, respectively, for the dividends payable to Carilion. The dividends are not payable in cash, but rather in shares of our common stock, until liquidation event occurs. During each of 2018 and 2017, 79,292 shares of common stock became issuable to Carilion as dividends and have been recorded in the statement of changes in stockholders' equity.

Liquidity and Capital Resources

At December 31, 2018, our total cash and cash equivalents were $42.5 million. As described elsewhere in this report, subsequent to year end, we used $19.0 million of cash to purchase GP.

We have a term loan with SVB which, at December 31, 2018, had a balance of $0.6 million and matures on May 1, 2019. We may prepay amounts due under the term loan at any time, subject to prepayment penalties of up to 2% of the amount of prepayment. Amounts due under the term loan are secured by substantially all of our assets, including intellectual property, personal property and bank accounts.

The term loan contains customary events of default, including nonpayment of principal, interest or other amounts, violation of covenants, material adverse change, an event of default under any subordinated debt documents, incorrectness of representations and warranties in any material respect, bankruptcy, judgments in excess of a threshold amount, and violations of other agreements in excess of a threshold amount. 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. The credit facility requires us to comply with certain operational and financial covenants, including maintaining a minimum cash balance of at least $4.0 million. As of December 31, 2018, we were in compliance with all covenants under the credit facility.

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, 2018 will provide adequate liquidity for us to meet our working capital needs over the next twelve months. 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,	
	2018	2017
Net cash (used in)/provided by operating activities	$ (3,308,825)	$ 915,042
Net cash provided by investing activities	10,037,123	26,181,400
Net cash used in financing activities	(1,249,564)	(2,917,367)
Net increase in cash and cash equivalents	$ 5,478,734	$ 24,179,075

During 2018, operations used $3.3 million of net cash, as compared to 2017, when operations provided $0.9 million of net cash. In 2018, our net income of $11.0 million included a gain on the sale of our optoelectronics business, net of income tax, of $8.6 million, and non-cash expenses which did not impact cash flow for the period. These non-cash expenses were depreciation and amortization of $1.2 million, and stock-based compensation of $0.6 million. Additionally, changes in working capital resulted in a net cash outflow of $7.6 million, principally driven by an increase in accounts receivable of $6.2 million, an increase in inventory of $1.0 million, an increase in contract assets of $0.8 million and decreases in accounts payable and accrued expenses of $0.5 million and contract liabilities of $1.0 million, partially offset by a decrease in prepaid expenses of $1.8 million.

In 2017, our net income of $14.6 million included after-tax income from discontinued operations of $15.7 million as well as charges for depreciation and amortization of $2.5 million and stock-based compensation of $0.7 million, each of which were non-cash items that do not impact cash flow for the period. Additionally, changes in working capital resulted in a net cash outflow of $1.4 million, principally driven by an increase in inventory of $1.9 million and an increase in accounts payable and accrued liabilities of $0.9 million partially offset by a decrease in accounts receivable of $1.2 million.

Cash provided by investing activities in 2018 consisted primarily of the proceeds from the sale of our optoelectronics business of $15.8 million, partially offset by payment of $5.0 million related to our acquisition of MOI along with $0.4 million of fixed asset additions and $0.4 million of capitalized intellectual property costs.

Cash provided by investing activities in 2017 consisted primarily of the proceeds from the sale of our HSOR business of $28.0 million, partially offset by a cash outflow of $2.0 million related to the purchase of property and equipment to expand our manufacturing capability as well as capitalized costs associated with securing intellectual property rights.

Cash used in financing activities for the year ended December 31, 2018 was $1.2 million, compared to cash used in financing activities of $2.9 million in 2017. During 2018, we repaid $1.8 million on our term loans with SVB. We also used $0.5 million to repurchase our common stock under our stock repurchase program and received $1.1 million from exercises of stock options and warrants. During 2017, we repaid $1.8 million on our outstanding term loan with SVB and also used $1.1 million to repurchase our common stock under our stock repurchase program.

Summary of Contractual Obligations

The following table sets forth information concerning our known contractual obligations as of December 31, 2018 that are fixed and determinable.

	Total	Less than 1 year	1 - 3 years	3 - 5 years	More than 5 years
Long-term debt obligations (1)	$ 625,000	$ 625,000	$ —	$ —	$ —
Operating facility leases (2)	4,608,720	1,216,124	1,758,484	1,089,408	544,704
Other leases (3)	147,076	53,052	72,664	21,360	—
Purchase order obligation (4)	752,448	752,448	—	—	—
MOI working capital adjustment (5)	542,983	542,983	—	—	—
Other liabilities (6)	440,000	440,000	—	—	—
Total	$ 7,116,227	$ 3,629,607	$ 1,831,148	$ 1,110,768	$ 544,704

(1) Amounts due under our debt obligations to SVB are payable in monthly installments, plus accrued interest, through May 2019.

(2) We lease our facilities in Blacksburg, Charlottesville and Roanoke, Virginia, Ann Arbor, Michigan, and Atlanta, Georgia under operating leases that as of December 31, 2018, are scheduled to expire between December 2018 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.

(3) In August 2013 and January 2016, we executed leases in the amounts of $51,000, and $207,000, respectively, for office equipment. These equipment leases expire in 2018 and 2021, respectively.

(4) Purchase order obligations included outstanding orders for inventory purchases. In 2017 and 2018, our Luna Technologies subsidiary executed non-cancelable purchase orders for a total amount of $2.3 million for multiple shipments of tunable lasers to be delivered over an 18-month period beginning in November 2017.

(5) The final working capital associated with the acquisition of MOI is estimated to be higher than the target value specified in the asset purchase agreement and therefore such excess amount is payable to the stockholders of MOI.

(6) 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 defined in Regulation S-K, Item 303(a)(4)(ii).

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.

We are exposed to interest rate fluctuations as a result of our SVB debt facility having a variable interest rate. We do not currently use derivative instruments to alter the interest rate characteristics of our debt. The principal amount of $0.6 million outstanding under the term loan as of December 31, 2018, is scheduled to amortize in monthly installments through May 2019. A change of 1% in the applicable interest rate during 2018 would have had an insignificant impact in our annual interest expense.

Foreign Currency Exchange Rate Risk

As of December 31, 2018, 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.

Table of Contents

ITEM 8. FINANCIAL STATEMENTS AND SUPPLEMENTARY DATA

Index to Consolidated Financial Statements

Report of Independent Registered Public Accounting Firm	42
Consolidated Balance Sheets at December 31, 2018 and 2017	43
Consolidated Statements of Operations for the years ended December 31, 2018 and 2017	44
Consolidated Statements of Changes in Stockholders' Equity for the years ended December 31, 2018 and 2017	46
Consolidated Statements of Cash Flows for the years ended December 31, 2018 and 2017	47
Notes to Consolidated Financial Statements	48

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, 2018 and 2017, 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, 2018, 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, 2018 and 2017, and the results of its operations and its cash flows for each of the two years in the period ended December 31, 2018, in conformity with accounting principles generally accepted in the United States of America.

Basis for opinion

These financial statements are the responsibility of the Company's management. Our responsibility is to express an opinion on the Company's financial statements based on our audits. We are a public accounting firm registered with the Public Company Accounting Oversight Board (United States) ("PCAOB") and are required to be independent with respect to the Company in accordance with the U.S. federal securities laws and the applicable rules and regulations of the Securities and Exchange Commission and the PCAOB.

We conducted our audits in accordance with the standards of the PCAOB. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free of material misstatement, whether due to error or fraud. The Company is not required to have, nor were we engaged to perform, an audit of its internal control over financial reporting. As part of our audits we are required to obtain an understanding of internal control over financial reporting but not for the purpose of expressing an opinion on the effectiveness of the Company's internal control over financial reporting. Accordingly, we express no such opinion.

Our audits included performing procedures to assess the risks of material misstatement of the financial statements, whether due to error or fraud, and performing procedures that respond to those risks. Such procedures included examining, on a test basis, evidence 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 14, 2019

CONSOLIDATED BALANCE SHEETS

	December 31, 2018	December 31, 2017
Assets		
Current assets:		
Cash and cash equivalents	$ 42,460,267	$ 36,981,533
Accounts receivable, net	13,037,068	5,929,042
Receivable from sale of HSOR business	2,500,000	4,000,976
Contract assets	2,422,495	1,778,142
Inventory	6,873,742	4,634,781
Prepaid expenses and other current assets	935,185	1,140,999
Current assets held for sale	—	4,336,105
Total current assets	68,228,757	58,801,578
Property and equipment, net	3,627,886	2,854,641
Intangible assets, net	3,302,270	1,727,390
Goodwill	101,008	—
Long term contract assets	336,820	209,699
Other assets	1,995	1,995
Non-current assets held for sale	—	2,627,333
Total assets	$ 75,598,736	$ 66,222,636
Liabilities and stockholders’ equity		
Current liabilities:		
Current portion of long term debt obligations	$ 619,315	$ 1,833,333
Current portion of capital lease obligations	40,586	43,665
Accounts payable	2,395,984	2,111,077
Accrued liabilities	6,597,458	6,547,230
Contract liabilities	2,486,111	3,318,379
Current liabilities held for sale	—	972,451
Total current liabilities	12,139,454	14,826,135
Long-term portion of deferred rent	1,035,974	1,184,438
Long-term debt obligations	—	603,007
Long-term capital lease obligations	68,978	71,275
Total liabilities	13,244,406	16,684,855
Commitments and contingencies		
Stockholders’ equity:		
Preferred stock, par value $0.001, 1,321,514 shares authorized, issued and outstanding at December 31, 2018 and 2017	1,322	1,322
Common stock, par value $0.001, 100,000,000 shares authorized, 29,209,506 and 28,354,822 shares issued, 27,956,401 and 27,283,918 shares outstanding at December 31, 2018 and 2017, respectively	30,120	29,186
Treasury stock at cost, 1,253,105 and 1,070,904 shares at December 31, 2018 and 2017, respectively	(2,116,640)	(1,649,746)
Additional paid-in capital	85,744,750	83,563,208
Accumulated deficit	(21,305,222)	(32,406,189)
Total stockholders’ equity	62,354,330	49,537,781
Total liabilities and stockholders’ equity	$ 75,598,736	$ 66,222,636

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

CONSOLIDATED STATEMENTS OF OPERATIONS

	Years ended December 31,	
	2018	2017
Revenues:		
Technology development	$ 20,967,556	$ 18,576,383
Products and licensing	21,949,689	14,505,482
Total revenues	42,917,245	33,081,865
Cost of revenues:		
Technology development	15,400,475	13,988,378
Products and licensing	8,078,870	5,724,457
Total cost of revenues	23,479,345	19,712,835
Gross profit	19,437,900	13,369,030
Operating expense:		
Selling, general and administrative	14,794,205	12,923,841
Research, development and engineering	3,766,160	2,653,337
Total operating expense	18,560,365	15,577,178
Operating income/(loss)	877,535	(2,208,148)
Other income/(expense):		
Other (expense)/income, net	(17,143)	26,106
Investment income	549,580	—
Interest expense, net	(124,344)	(217,352)
Total other income/(expense)	408,093	(191,246)
Income/(loss) from continuing operations before income taxes	1,285,628	(2,399,394)
Income tax (expense)/benefit	(47,818)	1,148,579
Net income/(loss) from continuing operations	1,237,810	(1,250,815)
Operating income from discontinued operations, net of income tax expense of $183,921 and $876,588	1,170,634	194,692
Gain on sale, net of $1,572,244 and $912,298 of related income taxes	8,595,797	15,671,028
Income from discontinued operations, net of income taxes	9,766,431	15,865,720
Net income	11,004,241	14,614,905
Preferred stock dividend	257,302	146,889
Net income attributable to common stockholders	$ 10,746,939	$ 14,468,016
Net income/(loss) per share from continuing operations:		
Basic	$ 0.04	$ (0.05)
Diluted	$ 0.04	$ (0.05)
Net income per share from discontinued operations:		
Basic	$ 0.35	$ 0.58
Diluted	$ 0.30	$ 0.58
Net income per share attributable to common stockholders:		
Basic	$ 0.39	$ 0.52
Diluted	$ 0.33	$ 0.52
Weighted average shares:		
Basic	27,596,401	27,579,988
Diluted	32,452,228	27,579,988

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

CONSOLIDATED STATEMENTS OF CHANGES IN STOCKHOLDERS' EQUITY

	Preferred Stock		Common Stock		Treasury Stock		Additional Paid in Capital	Accumulated Deficit	Total
	Shares	$	Shares	$	Shares	$	$	$	$
Balance—January 1, 2017	1,321,514	$ 1,322	27,541,277	$ 28,600	446,827	$ (517,987)	$ 82,451,958	$ (46,874,205)	$ 35,089,688
Exercise of stock option	—	—	83,888	84	—	—	99,769	—	99,853
Stock-based compensation	—	—	147,333	287	—	—	714,807	—	715,094
Non-cash compensation	—	—	135,497	136	—	—	149,864	—	150,000
Stock dividends (1)	—	—	—	79	—	—	146,810	(146,889)	—
Purchase of treasury stock	—	—	(624,077)	—	624,077	(1,131,759)	—	—	(1,131,759)
Net income	—	—	—	—	—	—	—	14,614,905	14,614,905
Balance—December 31, 2017	1,321,514	$ 1,322	27,283,918	$ 29,186	1,070,904	$ (1,649,746)	$ 83,563,208	$ (32,406,189)	$ 49,537,781
Impact of change in accounting policy	—	—	—	—	—	—	—	354,028	354,028
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

(1) The stock dividends payable in connection with the Series A Convertible Preferred Stock are issuable upon the request of Carilion.

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

Table of Contents

CONSOLIDATED STATEMENTS OF CASH FLOWS

	Years ended December 31, 2018	Years ended December 31, 2017
Cash flows (used in)/provided by operating activities:		
Net income	$ 11,004,241	$ 14,614,905
Adjustments to reconcile net income to net cash (used in)/provided by operating activities:		
Depreciation and amortization	1,218,559	2,526,609
Stock-based compensation	627,856	715,094
Loss on disposal of fixed assets	(1,000)	3,640
Gain on sale of discontinued operations, net of income taxes	(8,595,797)	(15,671,028)
Bad debt	6,000	99,888
Changes in operating assets and liabilities:		
Accounts receivable	(6,240,377)	1,152,055
Contract assets	(761,714)	—
Inventory	(967,797)	(1,902,311)
Other assets	1,849,630	83,428
Accounts payable and accrued expenses	(461,928)	(896,534)
Contract liabilities	(986,498)	—
Deferred revenue	—	189,296
Net cash (used in)/provided by operating activities	(3,308,825)	915,042
Cash flows provided by investing activities:		
Acquisition of property and equipment	(386,890)	(1,352,531)
Proceeds from sale of property and equipment	1,000	3,000
Intangible property costs	(374,766)	(495,597)
Acquisition of Micron Optics	(5,001,750)	—
Proceeds from sale of discontinued operations, net	15,799,529	28,026,528
Net cash provided by investing activities	10,037,123	26,181,400
Cash flows used in financing activities:		
Payments on debt obligations	(1,833,333)	(1,833,333)
Payments on capital lease obligations	(46,653)	(52,128)
Purchase of treasury stock	(466,894)	(1,131,759)
Proceeds from the exercise of options and warrants	1,097,316	99,853
Net cash used in financing activities	(1,249,564)	(2,917,367)
Net change in cash and cash equivalents	5,478,734	24,179,075
Cash and cash equivalents—beginning of period	36,981,533	12,802,458
Cash and cash equivalents—end of period	$ 42,460,267	$ 36,981,533
Supplemental disclosure of cash flow information		
Cash paid for interest	$ 117,616	$ 209,497
Cash paid for income taxes	$ 1,846,037	$ 377,907
Cash received for income tax refunds	$ 17,834	$ —
Common stock issued pursuant to restricted stock vesting	$ 200,202	$ 150,000
Dividend on preferred stock	$ 257,302	$ 146,889

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 products for the telecommunications industry 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 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 advanced materials, sensing, and healthcare applications. 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.

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.

Reclassifications

Certain amounts in the prior period have been reclassified to conform to current presentation. As a result of the adoption of Accounting Standards Codification ("ASC") 2014-09, Revenue from Contracts with Customers (Topic 606), we presented balances entitled contract assets and contract liabilities within the consolidated balance sheet as well as the impact of the changes in these balances within the consolidated statement of cash flows. We reclassified comparable balances within the December 31, 2017 consolidated balance sheet as well as the impact of changes in those balances within the consolidated statement of cash flows in order to enhance comparability. These reclassifications had no effect on our reported financial condition, results of operations, or cash flows. Any other reclassifications were immaterial to the consolidated interim financial statements taken as a whole.

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.

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 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.

Product Sales 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 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.

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 period. 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. In certain circumstances we may offer a "right of return" to a distributor of our products, in which case a contract liability is calculated based on the terms of the agreement and recorded as a reduction to revenue. In addition, a contract asset for the rights to recover products from customers and a reduction of cost of sales is also calculated and recorded.

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 $0.3 million at each of December 31, 2018 and 2017.

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, 2018 and 2017 included $38.3 million and $25.2 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, 2018 and 2017, we had approximately $4.0 million and $11.5 million, respectively, in excess of FDIC insured limits.

We have outstanding term loans that require us to comply with certain financial covenants, including maintaining a minimum cash balance of at least $4.0 million.

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 and accounts payable approximate fair value because of the short-term nature of these instruments. We consider the terms of the Silicon Valley Bank ("SVB") debt facility including its interest rate of prime plus 2%, to be at market based upon similar instruments that would be available to us.

Property and Equipment

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") and Micron Optics, Inc. ("MOI"). We amortize our identified intangible assets over their estimated useful lives ranging between one and eleven 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 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.

Research, Development and Engineering

Research, development and engineering expenses not related to contract performance are expensed as incurred. We expensed $3.8 million and $2.7 million of non-contract related research, development and engineering expenses for the year ended December 31, 2018 and 2017, respectively.

Valuation 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/(Loss) per Share

Basic per share data is computed by dividing net income/(loss) 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/(loss) 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 4.9 million common stock equivalents (which include outstanding warrants, preferred stock, accrued stock dividends, and stock options) are included for the diluted per share data for the year ended December 31, 2018. The effect of 4.3 million common stock equivalents (which include outstanding warrants, preferred stock and stock options) are not included for the year ended December 31, 2017, as they are anti-dilutive to earnings per share due to us having a net loss from continuing operations.

Stock-Based Compensation

We have two stock-based compensation plans, which are described further in Note 10. 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 employees' expected exercise. We reduce stock-based compensation expense for the value of any forfeitures of vested awards as such forfeitures occur.

We recognize expense for equity instruments issued to non-employees based upon the fair value of the equity instruments issued.

Advertising

We expense the cost of advertising as incurred. Advertising expenses were $0.1 million for each of the years ended December 31, 2018 and 2017.

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.

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.

Recent Accounting Pronouncements

Effective January 1, 2018, we adopted *Revenue from Contracts with Customers* (Topic 606), using the modified retrospective transition method. Under the modified retrospective approach, we apply the standards to new contracts and those that were not completed as of January 1, 2018. For those contracts not completed as of January 1, 2018, this method resulted in a cumulative adjustment to decrease the accumulated deficit in the net amount of $0.4 million. Prior periods will not be retrospectively adjusted, but we will maintain dual reporting for the year of initial application in order to maintain comparability of the periods presented. The cumulative effect of the changes made to our January 1, 2018 consolidated balance sheet for the adoption of Topic 606 was as follows:

	Balance at December 31, 2017	Adjustment for Topic 606	Adjusted balance at January 1, 2018
Assets:			
Current assets held for sale	$ 4,336,105	$ 379,891	$ 4,715,996
Liabilities:			
Contract liabilities	$ 3,318,379	$ 2,250	$ 3,320,629
Current liabilities held for sale	$ 862,205	$ 23,613	$ 885,818
Stockholders' equity:			
Accumulated deficit	$ (32,406,189)	$ 354,028	$ (32,052,161)

Contract assets were formerly reported as unbilled accounts receivable. Contract liabilities were formerly reported as accrued liabilities or deferred revenue. Inventory was also impacted by the adoption of the new guidance. The titles have been changed in the table below to be consistent with accounts currently used under the new standard.

	December 31, 2017	
	As Reported	As Adopted
Accounts receivables, net	$ 9,857,009	$ 5,929,042
Contract assets	—	1,778,142
Current assets held for sale	—	1,940,126
Long-term contract assets	—	209,699
Accrued liabilities	8,959,935	6,547,230
Contract liabilities	—	3,318,379
Current liabilities held for sale	—	120,665
Deferred revenue	1,026,339	—

Under the new standard, contracts in our Technology Development segment, which primarily provide research services, are not materially impacted upon the adoption of Topic 606 as revenue will continue to be recognized over time using an input model. Contracts in our Products and Licensing segment generally provide for the following revenue sources: standard product sales, custom product development and sales, product rental, extended warranties, training/service, and certain royalties. Revenues for this segment are recognized using either the “point in time” or “over time” methods of Topic 606, depending upon the revenue source. The major change in revenue recognition for the Products and Licensing segment related to custom optoelectronic products which changed from “point in time” to “over time” upon the adoption of Topic 606. This change results in the acceleration of revenue when compared to existing standards with the cumulative adjustment relating to contracts that are not complete as of December 31, 2017 recognized as an adjustment to opening accumulated deficit on January 1, 2018. The revenue received from our custom optoelectronic products segment is included as part of our discontinued operations (Note 17) and shown above in the current assets and liabilities held for sale as of December 31, 2017. Our revenue for our standard products will continue to be recognized using the "point in time" model of Topic 606, and the timing of such revenue recognition is not expected to differ materially from our historical revenue recognition. Other immaterial adjustments related to the Products and Licensing segment that are sometimes offered to customers include discounts on future purchases related to rental agreements, customer rights of return, and volume discounts.

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 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 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. We have agreed on final billing rates with the government through December 31, 2017.

Products and Licensing Revenues

We produce standard and customized products for commercial organizations, educational institutions, and U.S. Federal government agencies. In addition we will also offer extended warranties, product rentals, and services which include testing, training, or repairs for specific products. Customers also pay royalties as agreed based on sales or usage. We account for product and related items 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.

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 period. 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. In certain circumstances we may offer a "right of return" to a distributor of our products, in which case a contract liability is calculated based on the terms of the agreement and recorded as a reduction to revenue. In addition, a contract asset for the rights to recover products from customers and a reduction of cost of sales is also calculated and recorded.

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, representing firm orders for which funding has not yet been appropriated. The approximate value of our Technology Development segment unfulfilled performance obligations was $26.0 million at December 31, 2018. We expect to satisfy 87% of the performance obligations in 2019, 9% in 2020 and the remaining by 2022. The approximate value of our Products and Licensing segment unfulfilled performance obligations was $5.8 million at December 31, 2018. We expect to satisfy 95% of the performance obligations in 2019, 4% in 2020 and the remaining by 2023.

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. See details in the tables below.

	Three Months Ended December 31, 2018 (unaudited)			Year Ended December 31, 2018		
	Technology Development	Products and Licensing	Total	Technology Development	Products and Licensing	Total
Total Revenue by Geographic Location						
United States	$ 5,548,639	$ 3,624,247	$ 9,172,886	$ 20,967,556	$ 11,585,296	$ 32,552,852
Asia	—	2,697,215	2,697,215	—	5,977,563	5,977,563
Europe	—	1,331,145	1,331,145	—	3,873,161	3,873,161
Canada, Central and South America	—	282,990	282,990	—	382,797	382,797
All Others	—	54,089	54,089	—	130,872	130,872
Total	$ 5,548,639	$ 7,989,686	$ 13,538,325	$ 20,967,556	$ 21,949,689	$ 42,917,245
Total Revenue by Major Customer Type						
Sales to the U.S. government	$ 5,418,679	$ 469,534	$ 5,888,213	$ 20,703,338	$ 1,834,289	$ 22,537,627
U.S. direct commercial sales and other	129,960	3,154,714	3,284,674	264,218	9,737,720	10,001,938
Foreign commercial sales & other	—	4,365,438	4,365,438	—	10,377,680	10,377,680
Total	$ 5,548,639	$ 7,989,686	$ 13,538,325	$ 20,967,556	$ 21,949,689	$ 42,917,245
Total Revenue by Contract Type						
Fixed-price contracts	$ 2,777,012	$ 7,989,686	$ 10,766,698	$ 9,388,770	$ 21,949,689	$ 31,338,459
Cost-type contracts	2,771,627	—	2,771,627	11,578,786	—	11,578,786
Total	$ 5,548,639	$ 7,989,686	$ 13,538,325	$ 20,967,556	$ 21,949,689	$ 42,917,245
Total Revenue by Timing of Recognition						
Goods transferred at a point in time	$ —	$ 7,824,102	$ 7,824,102	$ —	$ 21,329,999	$ 21,329,999
Goods/services transferred over time	5,548,639	165,584	5,714,223	20,967,556	619,690	21,587,246
Total	$ 5,548,639	$ 7,989,686	$ 13,538,325	$ 20,967,556	$ 21,949,689	$ 42,917,245
Total Revenue by Major Products/Services						
Technology development	$ 5,548,639	$ —	$ 5,548,639	$ 20,967,556	$ —	$ 20,967,556
Optical test and measurement systems	—	7,625,325	7,625,325	—	19,641,434	19,641,434
Optical components and sub-assemblies	—	—	—	—	—	—
Other	—	364,361	364,361	—	2,308,255	2,308,255
Total	$ 5,548,639	$ 7,989,686	$ 13,538,325	$ 20,967,556	$ 21,949,689	$ 42,917,245

The following tables summarize the impacts of adopting Topic 606 on our consolidated financial statements as of and for the three months and year ended December 31, 2018.

	Impact of changes in accounting policies		
	December 31, 2018		
	As Reported	Adjustments	Balances without adoption of Topic 606
Assets			
Current assets:			
Cash and cash equivalents	$ 42,460,267	$ —	$ 42,460,267
Accounts receivable, net	13,037,068	—	13,037,068
Receivable from sale of HSOR business	2,500,000	—	2,500,000
Contract assets	2,422,495	—	2,422,495
Inventory	6,873,742	—	6,873,742
Prepaid expenses and other current assets	935,185	—	935,185
Total current assets	68,228,757	—	68,228,757
Long-term contract assets	336,820	—	336,820
Property and equipment, net	3,627,886	—	3,627,886
Intangible assets, net	3,302,270	—	3,302,270
Goodwill	101,008	—	101,008
Other assets	1,995	—	1,995
Total assets	$ 75,598,736	$ —	$ 75,598,736
Liabilities and stockholders' equity			
Current liabilities:			
Current portion of long-term debt obligations	$ 619,315	$ —	$ 619,315
Current portion of capital lease obligations	40,586	—	40,586
Accounts payable	2,395,984	—	2,395,984
Accrued liabilities	6,597,458	—	6,597,458
Contract liabilities	2,486,111	(3,880)	2,482,231
Total current liabilities	12,139,454	(3,880)	12,135,574
Long-term deferred rent	1,035,974	—	1,035,974
Long-term capital lease obligations	68,978	—	68,978
Total liabilities	13,244,406	(3,880)	13,240,526
Commitments and contingencies			
Stockholders' equity:			
Preferred stock, par value $0.001, 1,321,514 shares authorized, issued and outstanding at December 31, 2018 and December 31, 2017, respectively	1,322	—	1,322
Common stock, par value $0.001, 100,000,000 shares authorized, 29,209,506 and 28,354,822 shares issued, 27,956,401 and 27,283,918 shares outstanding at December 31, 2018 and 2017, respectively	30,120	—	30,120
Treasury stock at cost, 1,253,105 and 1,070,904 shares at December 31, 2018 and December 31, 2017, respectively	(2,116,640)	—	(2,116,640)
Additional paid-in capital	85,744,750	—	85,744,750
Accumulated deficit	(21,305,222)	3,880	(21,301,342)
Total stockholders' equity	62,354,330	3,880	62,358,210
Total liabilities and stockholders' equity	$ 75,598,736	$ —	$ 75,598,736

	Impact of changes in accounting policies					
	Three Months Ended December 31, 2018			Year Ended December 31, 2018		
	As reported	Adjustments	Balances without adoption of Topic 606	As reported	Adjustments	Balances without adoption of Topic 606
Revenues:						
Technology development	$ 5,548,639	$ —	$ 5,548,639	$ 20,967,556	$ —	$ 20,967,556
Products and licensing	7,989,686	—	7,989,686	21,949,689	1,630	21,951,319
Total revenues	13,538,325	—	13,538,325	42,917,245	1,630	42,918,875
Cost of revenues:						
Technology development	4,268,509	—	4,268,509	15,400,475	—	15,400,475
Products and licensing	2,697,538	—	2,697,538	8,078,870	—	8,078,870
Total cost of revenues	6,966,047	—	6,966,047	23,479,345	—	23,479,345
Gross profit	6,572,278	—	6,572,278	19,437,900	1,630	19,439,530
Operating expense:						
Selling, general and administrative	4,896,136	—	4,896,136	14,794,205	—	14,794,205
Research, development and engineering	1,252,663	—	1,252,663	3,766,160	—	3,766,160
Total operating expense	6,148,799	—	6,148,799	18,560,365	—	18,560,365
Operating income	423,479	—	423,479	877,535	1,630	879,165
Other income:						
Other expense	(1,070)	—	(1,070)	(17,143)	—	(17,143)
Investment income	198,525	—	198,525	549,580	—	549,580
Interest expense	(21,136)	—	(21,136)	(124,344)	—	(124,344)
Total other income	176,319	—	176,319	408,093	—	408,093
Income from continuing operations before income taxes	599,798	—	599,798	1,285,628	1,630	1,287,258
Income tax expense	722,148	—	722,148	47,818	—	47,818
Net (loss)/income from continuing operations	$ (122,350)	$ —	$ (122,350)	$ 1,237,810	$ 1,630	$ 1,239,440

Effective January 1, 2018, we adopted Accounting Standards Update ("ASU") No. 2016-15, *Statement of Cash Flows (Topic 230)*, which addresses eight specific cash flow issues with the objective of reducing the existing diversity in practice in how cash receipts and cash payments are presented in the statement of cash flows. The adoption of ASU No. 2016-15 did not have a significant impact on our consolidated financial statements.

In February 2016, the FASB issued ASU No. 2016-02, *Leases (Topic 842).* This standard revises the accounting for leases and requires lessees to recognize, for all leases with terms greater than one year, a right-of-use asset and liability which depicts the rights and obligations arising from a lease. This standard also requires qualitative and quantitative disclosures designed to provide information regarding the nature, amount and timing of lease expense. The new guidance is not expected to significantly change the recognition and measurement of lease expense. It is effective for the first interim and annual periods beginning after December 15, 2018, with early adoption permitted. In July 2018, the FASB issued ASU 2018-11, *Leases (Topic 842): Targeted Improvements*, permitting the recognition of a cumulative-effect adjustment to retained earnings on the date of adoption. We adopted the standard beginning January 1, 2019 using the alternative transition method. We are finalizing the value as of the adoption date of the right-of-use asset and lease liabilities and estimate that the right-of-use asset will be between $4 million and $5 million and that the lease liability will be reasonably consistent with the right-of-use asset amounts. We do not expect a material impact from adopting the new standard on our results of operations or cash flows.

In January 2017, the Financial Accounting Standards Board ("FASB") issued ASU No. 2017-04, *Intangibles—Goodwill and Other (Topic 350): Simplifying the Test for Goodwill Impairment.* This update simplifies the subsequent measurement of goodwill. The guidance removes Step 2 of the goodwill impairment test, which requires a hypothetical purchase price allocation. A goodwill impairment will now be the amount by which a reporting unit's carrying value exceeds its fair value, not to exceed the carrying amount of goodwill. The accounting standard will be effective for reporting periods beginning after December 15, 2019. We do not expect ASU 2017-04 will have a material impact on our financial statements.

In February 2018, the FASB issued ASU 2018-02: *Income Statement – Reporting Comprehensive Income (Topic 220)*. Under current accounting guidance, the income tax effects for changes in income tax rates and certain other transactions are recognized in income from continuing operations resulting in income tax effects recognized in AOCI that do not reflect the current tax rate of the entity (“stranded tax effects”). The new guidance allows us the option to reclassify these stranded tax effects to accumulated deficit that relate to the change in the federal tax rate resulting from the passage of the Tax Cuts and Jobs Act. This update is effective for fiscal years beginning after December 15, 2018, including interim periods therein, and early adoption is permitted. We do not expect the adoption of this standard will 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 all entities for fiscal years beginning after December 15, 2019 including interim periods within those fiscal years. We do not expect ASU 2018-13 will have a material impact on our financial statements.

2. 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,	
	2018	**2017**
Finished goods	$ 1,339,832	$ 762,394
Work-in-process	643,420	288,165
Raw materials	4,890,490	3,584,222
	$ 6,873,742	$ 4,634,781

3. Contract Balances

Our contract assets consist of unbilled amounts for technology development contracts, custom product contracts, royalty revenue receivable and the 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 following table shows the significant changes in contract balances for the year ended December 31, 2018:

	Contract Assets	Contract Liabilities
Opening Balance as of January 1, 2018	$ 1,987,841	$ 3,320,629
Revenue recognized that was included in the contract liabilities balance at the beginning of the period	—	(878,402)
Transferred to payables from contract liabilities recognized at the beginning of the period	—	(2,078,640)
Increases due to cash received or adjustment of estimates, excluding amounts recognized as revenue during the period	—	2,122,524
Transferred to receivables from contract assets recognized at the beginning of the period	(1,679,363)	—
Increases as a result of cumulative catch-up adjustment arising from changes in the estimate of the stage of completion	2,450,837	—
Balance as of December 31, 2018	$ 2,759,315	$ 2,486,111

4. Debt

Silicon Valley Bank Facility

We currently have a Loan and Security Agreement with SVB (the "Credit Facility") under which, as amended on May 8, 2015, we have a term loan with an original borrowing amount of $6.0 million (the “Original Term Loan”). The Original Term Loan is repayable in 48 monthly installments of $125,000, plus accrued interest payable monthly in arrears, and unless earlier terminated, is scheduled to mature in May 2019. The Original Term Loan carries a floating annual interest rate equal to SVB’s prime rate then in effect plus 2%. We may prepay amounts due under the Original Term Loan at any time, subject to an early termination fee of up to 2% of the amount of prepayment.

In September 2015, we entered into the Waiver and Seventh Loan Modification Agreement, which provided an additional $1.0 million of available financing for purchases of equipment through December 31, 2015, which we fully borrowed in December 2015 (the "Second Term Loan" and, together with the Original Term Loan, the "Term Loans"). The Second Term Loan was repaid in December 2018.

The Credit Facility requires us to maintain a minimum cash balance of $4.0 million and to maintain at each month end a ratio of cash plus 60% of accounts receivable greater than or equal to 1.5 times the outstanding principal of the Term Loans. The Credit Facility also requires us to observe a number of additional operational covenants, including protection and registration of intellectual property rights, and certain customary negative covenants. As of December 31, 2018, we were in compliance with all covenants under the Credit Facility.

Amounts due under the Credit Facility are secured by substantially all of our assets, including intellectual property, personal property and bank accounts. In addition, the Credit Facility contains customary events of default, including nonpayment of principal, interest or other amounts, violation of covenants, material adverse change, an event of default under any subordinated debt documents, incorrectness of representations and warranties in any material respect, bankruptcy, judgments in excess of a threshold amount, and violations of other agreements in excess of a threshold amount. 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, 2018 there were no events of default on the Credit Facility.

The aggregate balance under the Term Loans at December 31, 2018 and December 31, 2017 was $0.6 million and $2.5 million, respectively. The remaining term loan, with a balance of $0.6 million as of December 31, 2018, matures on May 1, 2019. The effective rate of our Term Loan at December 31, 2018 was 7%.

The following table presents a summary of debt outstanding:

	December 31,	
	2018	2017
Silicon Valley Bank Term Loans	$ 625,000	$ 2,458,333
Less: unamortized debt issuance costs	5,685	21,993
Less: current portion	619,315	1,833,333
Total long-term debt obligations	$ —	$ 603,007

Debt issuance costs associated with the issuance of the SVB Term Loans totaled $55 thousand. Amortization of debt issuance costs is computed using the effective interest method and is included in interest expense. Amortization of the debt issuance costs totaled $16 thousand for the year ended December 31, 2018.

Maturities on outstanding debt are as follows:

Year	Amount
2019	$ 625,000
Total	$ 625,000

Interest expense for the years ended December 31, 2018 and 2017 consisted of the following:

	Years ended December 31,	
	2018	2017
Interest expense on Term Loans	$ 108,062	$ 201,696
Amortization of debt issuance costs	16,308	16,308
Other interest income	(26)	(652)
Total interest expense	$ 124,344	$ 217,352

5. Accounts Receivable, Net

Accounts receivable, net consist of the following:

	December 31,	
	2018	2017
Billed	$ 13,289,790	$ 6,189,625
Other	31,361	20,000
	13,321,151	6,209,625
Less: allowance for doubtful accounts	(284,083)	(280,583)
	$ 13,037,068	$ 5,929,042

6. Property and Equipment

Property and equipment, net, consists of the following:

	December 31, 2018	December 31, 2017
Building	$ 69,556	$ 69,556
Equipment	9,341,007	8,213,626
Furniture and fixtures	640,890	565,885
Software	1,122,231	1,122,231
Leasehold improvements	4,950,510	4,840,510
	16,124,194	14,811,808
Less—accumulated depreciation	(12,496,308)	(11,957,167)
	$ 3,627,886	$ 2,854,641

Depreciation for the years ended December 31, 2018 and 2017 was approximately $0.5 million and $0.7 million, respectively.

7. Intangible Assets

Intangible assets, net consist of the following:

	Estimated Life	December 31, 2018	December 31, 2017
Patent costs	1 - 18 years	$ 4,991,460	$ 4,658,198
Developed technology	5 years	2,600,000	1,400,000
In-process research and development	N/A	200,000	—
Customer base	7 years	100,000	—
Trade names	3 years	150,000	—
		8,041,460	6,058,198
Accumulated amortization		(4,739,190)	(4,330,808)
		$ 3,302,270	$ 1,727,390

Amortization for the years ended December 31, 2018 and 2017 was approximately $0.4 million and $0.5 million, respectively. Estimated aggregate amortization, based on the net value of intangible assets at December 31, 2018, for each of the next five years and beyond is as follows:

Year Ending December 31,	
2019	$ 591,120
2020	558,156
2021	535,288
2022	480,219
2023	279,631
2023 and beyond	857,856
	$ 3,302,270

8. Accrued Liabilities

Accrued liabilities consist of the following:

	December 31,	
	2018	2017
Accrued compensation	$ 4,467,587	$ 5,274,005
Accrued professional fees	198,062	117,445
Accrued income tax	236,636	403,547
Deferred rent	146,542	144,740
Royalties	302,428	290,235
Accrued liabilities-other	404,752	317,258
Working capital payable	542,983	—
Liability to related party	298,468	—
Total accrued liabilities	$ 6,597,458	$ 6,547,230

Table of Contents

9. Income Taxes

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

	Years ended December 31, 2018	2017
Current:		
Federal	$ (44,727)	$ (1,154,105)
State	92,545	5,526
Deferred federal	—	—
Deferred state	—	—
Income tax expense/(benefit)	$ 47,818	$ (1,148,579)

Deferred tax assets consist of the following components:

	December 31, 2018 Long-Term	December 31, 2017 Long-Term
Bad debt and inventory reserve	$ 332,721	$ 226,358
Inventory adjustment	(21,785)	405,242
UNICAP	2,804	32,579
Deferred revenue	115,676	84,669
Deferred rent	288,017	340,199
Depreciation and amortization	(838,540)	(1,238,458)
Charitable contributions	—	3,385
Net operating loss carryforwards- Luna	349,421	349,421
Net operating loss carryforwards- API	1,265,538	1,436,568
Net operating loss carryforwards - state	179,149	534,194
Net operating loss carryforwards- Canada	10,503	10,503
Research and development credits	—	235,613
California manufacturing credit	—	15,554
Accrued liabilities	394,118	504,472
Deferred compensation	216,944	223,607
Stock-based compensation	803,757	1,275,372
Restricted stock	60,681	—
State bonus	44,861	—
AMT credit	—	581,467
Transaction costs	63,668	—
Total	3,267,533	5,020,745
Valuation allowance	(3,267,533)	(5,020,745)
Net deferred tax asset	$ —	$ —

The expense/(benefit) 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,	
	2018	2017
Income tax expense at federal statutory rate	21.00 %	34.00 %
State taxes, net of federal tax effects	— %	(10.84)%
Change in tax rate from Tax Cuts and Jobs Act	— %	(79.17)%
Change in valuation allowance	(27.65)%	113.86 %
Incentive stock options	(1.05)%	(9.65)%
Provision to return adjustments	21.16 %	3.87 %
Meals and entertainment	0.97 %	(0.65)%
Capitalized merger costs	— %	— %
AMT Carryover	(9.83)%	— %
Other permanent differences	(0.88)%	(3.55)%
Income tax expense/(benefit)	3.72 %	47.87 %

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 no U.S. federal income tax net operating loss carryforwards at December 31, 2018 for Luna and net operating loss carryforwards of approximately $6.0 million for API expiring at varying dates through 2025.

In 2015, we performed a formal section 382 study and determined that we do not have a limitation on our net operating loss available to offset future income for the Luna net operating losses. As a result of the acquisition of API, the API net operating loss carryover and research and development credits will be subject to the Section 382 limitation. A formal Section 382 study was prepared in 2017, and it was determined that there was no ownership changes in 2017 resulting in a limitation on NOLs, but a portion of the net operating losses will expire unutilized. As there is a full valuation allowance against all of the API deferred tax assets, there will not be a statement of operations impact to any expiration of the net operating losses or research and development credits.

The U.S. federal statute of limitations remains open for the year 2015 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.

We currently have no positions for which we expect that the amount of unrecognized tax benefit will increase or decrease significantly within twelve months of the reporting date or for which we believe there is significant risk of disallowance upon audit. We have no tax interest or penalties reported in either our statement of operations or statement of financial position for any year reported herein. Management believes it is not more likely than not that the deferred tax assets at December 31, 2018 or December 31, 2017 will not be realized, and as a result a valuation allowance was established against all such deferred tax assets.

Effective January 1, 2018, we adopted ASC Topic 606, *Revenue from Contracts with Customers*, which changes the timing of contract revenue recognition from recognizing at customer delivery to recognizing over a period of time. The adoption of ASC Topic 606 did not have a significant impact on our consolidated financial statements.

On December 22, 2017, the President of the United States signed into law the Tax Cuts and Jobs Act tax reform legislation. This legislation makes significant changes in U.S. tax law including a reduction in the corporate tax rates, changes to net operating loss carryforwards and carrybacks, and a repeal of the corporate alternative minimum tax. The legislation reduced the U.S. corporate tax rate from the current rate of 35% to 21%. As a result of the enacted law, we were required to revalue deferred tax assets and liabilities at the enacted rate. This revaluation resulted in a $1.9 million reduction in the deferred tax asset and a corresponding reduction in the valuation allowance. In 2018, we realized a benefit of $0.7 million in recovery of the alternative minimum tax credit from prior periods. The other provisions of the Tax Cuts and Jobs Act did not have a material impact on our consolidated financial statements.

10. 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. As of December 31, 2018, 710,985 shares of common stock were issuable to Carilion as dividends and have been recorded in the statement of stockholders' equity. These dividends are issuable on demand. Each share of Series A Convertible Preferred Stock may be converted into one share of our common stock at the option of the holder. We recorded the fair value of the Series A Convertible Preferred Stock, determined based upon the conversion value immediately prior to the exchange, the fair value of the new warrant issued to Carilion, determined using the Black-Scholes valuation model, and the incremental fair value of the prior warrant due to the re-pricing and extension of maturity to stockholders' equity.

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 for employees 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, 2017	2,857,114	$0.61 - 6.83	$ 1.89	$ 107,063	2,367,630	$ 1.93	$ 101,071
Forfeited	(178,665)	$1.27 - 6.83	$ 2.24				
Exercised	(83,888)	$0.82 - 1.40	$ 1.19				
Granted	120,000	$1.51 - 2.40	$ 1.82				
Balance at December 31, 2017	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

(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,	
	2018	2017
Risk-free interest rate range	3.0%	2.05%
Expected life of option-years	7	6.5
Expected stock price volatility	67%	69%
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 Exercise Price of Options Exercisable
Year ended December 31, 2017	$0.61 - 6.55	2,714,561	4.23	$1.88	2,590,030	$1.89
Year ended December 31, 2018	$0.61 - 6.55	3,108,868	5.72	$2.26	1,986,740	$1.81

	Total Intrinsic Value of Options Exercised	Total Fair Value of Options Vested
Year ended December 31, 2017	$ 62,549	$ 3,962,746
Year ended December 31, 2018	$ 112,213	$ 2,980,110

For the years ended December 31, 2018 and 2017, the weighted average grant date fair value of options granted was $2.07 and $1.18 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, 2018, the weighted average remaining service period is 3.6 years.

Unamortized stock option expense at December 31, 2018 that will be amortized over the weighted-average remaining service period of 3.6 years totaled $2.2 million.

Restricted Stock and Restricted Stock Units

In 2018 and 2017, we issued 280,000 and 349,000 shares of restricted stock, respectively, to certain employees. Shares issued to employees vest in three equal annual installments on the anniversary dates of their grant. In 2018 and 2017, 182,500 and 530,542 shares of restricted stock vested, respectively.

In addition, in 2018 and 2017, we issued 16,286 and 129,865, respectively, restricted stock units to members of our Board of Directors in respect of the annual equity compensation under our non-employee director compensation policy. Restricted stock units 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 2018 and 2017, 129,865 and 86,956 restricted stock units, respectively, vested.

The following table summarizes our aggregate restricted stock awards and restricted stock unit activity in 2018 and 2017:

	Number of Unvested Shares	Weighted Average Grant Date Fair Value	Aggregate Value of Unvested Shares
Balance at January 1, 2017	829,998	$1.19	$ 988,763
Granted	478,865	$1.63	$ 780,252
Vested	(617,498)	$1.23	$ (758,653)
Forfeitures	(201,667)	$1.35	$ (272,017)
Balance at December 31, 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

We recognized $0.6 million and $0.7 million in stock-based compensation expense, which is recorded in selling, general and administrative expenses on the consolidated statement of operations for the years ended December 31, 2018 and 2017, respectively, and we will recognize $0.9 million over the remaining requisite service period.

Unamortized restricted stock and restricted stock units expense at December 31, 2018 that will be amortized over the weighted-average remaining service period of 2 years totaled $1.0 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 of the compensation that they receive for serving on our board and board committees. During the years ended December 31, 2018 and 2017, the Deferred Compensation Plan permitted the participants to elect to defer cash fees to which they were entitled for board and committee service. For 2018, the Deferred Compensation Plan also permitted 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 immediately, in the case of stock units in lieu of cash fees, and upon the earlier of the one year anniversary date of the grant or next annual meeting of stockholders, in the case of annual equity compensation, 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 2018 and 2017 is as follows.

	Number of Stock Units	Weighted Average Grant Date Fair Value per Share	Intrinsic Value Outstanding
January 1, 2017	393,012	$1.37	
Granted	73,690	$1.54	
Vested	—	$1.15	
Converted	—	$0.00	
December 31, 2017	466,702	$1.40	$ 1,134,086
Granted	40,588	$2.99	
Vested	—	$1.15	
Converted	—	$0.00	
December 31, 2018	507,290	$1.40	$1,699,422

Stock Repurchase Program

In May 2016, our board of directors authorized us to repurchase up to $2.0 million of our common stock through May 31, 2017. As of May 31, 2017, we had repurchased a total of 205,500 shares for an aggregate purchase price of $0.2 million under this stock repurchase program, after which this stock repurchase program expired.

In September 2017, our board of directors authorized a new stock repurchase program and 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 December 31, 2018 and 2017, we had repurchased a total of 565,629 and 433,179 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.

11. Commitments and Contingencies

Obligation under Operating Leases

We lease facilities in Virginia, Michigan, and Georgia under operating leases that as of December 31, 2018 were scheduled to expire between March 2020 and December 2024. Certain of the leases are subject to fixed escalations and provide for possible termination prior to their expiration dates. We recognize rent expense on such leases on a straight-line basis over the lease term. The difference between the straight line method and cash paid is reflected in changes to the deferred rent balance in our consolidated balance sheets. Deferred rent primarily resulted from recognition of the value of certain leasehold improvements associated with our Blacksburg, Virginia facility at the inception of the lease. Rent expense under these leases recorded in selling, general and administrative expense on our statements of operations totaled approximately $1.0 million and $1.1 million, respectively, for the years ended December 31, 2018 and 2017.

Minimum future payments, as of December 31, 2018, under the aforementioned operating leases for each of the next five years and thereafter are:

2019	1,216,124
2020	1,117,684
2021	640,800
2022	544,704
2023	544,704
Thereafter	544,704
	$ 4,608,720

Purchase Commitment

We executed a non-cancelable purchase order totaling $0.5 million in the fourth quarter of 2017, a non-cancelable purchase order totaling $1.1 million in the first quarter of 2018, and a non-cancelable purchase order totaling $0.7 million in the second quarter of 2018 for multiple shipments of tunable lasers to be delivered over an 18-month period. At December 31, 2018, approximately $0.8 million of these commitments remained and is expected to be delivered by July 30, 2019.

Royalty Agreement

We have licensed certain third-party technologies from vendors for which we owe minimum royalties aggregating $0.4 million payable over the remaining patent terms of the underlying technology.

12. 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 of our permanent employees. We contribute 25% of the salary deferral elected by each employee up to a maximum deferral of 10% of annual salary.

We contributed approximately $0.3 million to the plan for each of the years ended December 31, 2018 and 2017.

13. 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, 2018, $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, 2018. 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.

14. Relationship with Major Customers

During the years ended December 31, 2018 and 2017, approximately 53% and 48%, respectively, of our consolidated revenues were attributable to contracts with the U.S. government.

At December 31, 2018 and 2017, receivables with respect to contracts with the U.S. government represented 23% and 20% of total trade receivables, respectively.

15. Financial Information About Segments

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

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 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, 2018 and 2017.

During the years ended December 31, 2018 and 2017, 24% and 19%, respectively, of our total sales took place outside the United States. No single country, outside of the United States, represented more than 10% of total revenues during the years ended December 31, 2018 or 2017.

	Years ended December 31,	
	2018	2017
Technology Development revenue	$ 20,967,556	$ 18,576,383
Products and Licensing revenue	21,949,689	14,505,482
Total revenue	42,917,245	33,081,865
Technology Development operating income/(loss)	378,212	(120,417)
Products and Licensing operating income/(loss)	499,323	(2,087,731)
Total operating income/(loss)	$ 877,535	$ (2,208,148)
Depreciation, Technology Development	$ 379,952	$ 359,626
Depreciation, Products and Licensing	$ 273,185	$ 747,216
Amortization, Technology Development	$ 130,765	$ 139,067
Amortization, Products and Licensing	$ 418,349	$ 1,280,699

Products and licensing depreciation includes amounts from discontinued operations of $0.1 million and $0.4 million for the years ended December 31, 2018 and 2017, respectively. Products and licensing amortization includes amounts from discontinued operations of $0.1 million and $0.9 million for the years ended December 31, 2018 and 2017, respectively.

Additional segment information is as follows:

	December 31, 2018	December 31, 2017
Total segment assets:		
Technology Development	$ 34,823,525	$ 32,011,084
Products and Licensing	40,775,211	34,211,552
Total	$ 75,598,736	$ 66,222,636
Property plant and equipment and intangible assets, Technology Development	$ 2,103,711	$ 2,361,663
Property plant and equipment and intangible assets, Products and Licensing	$ 4,927,453	$ 4,831,671

For December 31, 2017, the products and licensing segment assets include assets held for sale in the amount of $7.0 million. Property plant and equipment, and intangible assets as of December 31, 2017 excludes assets associated with the optoelectronic components business sold during 2018.

16. Quarterly Results (unaudited)

The following table sets forth our unaudited historical revenues, operating loss and net (loss)/income by quarter during 2018 and 2017.

(Dollars in thousands, except per share amounts)	Quarter Ended March 31, 2018	June 30, 2018	September 30, 2018	December 31, 2018	March 31, 2017	June 30, 2017	September 30, 2017	December 31, 2017
Revenues:								
Technology development	$ 4,637	$ 5,466	$ 5,316	$ 5,549	$ 4,235	$ 4,602	$ 4,591	$ 5,549
Products and licensing	4,131	4,457	5,371	7,990	2,398	3,681	3,713	4,637
Total revenues	8,768	9,923	10,687	13,538	6,633	8,283	8,304	10,186
Gross margin	4,929	5,693	5,998	6,572	1,770	2,414	2,385	4,384
Operating income/(loss)	(373)	205	581	423	(1,374)	(237)	(150)	(61)
Net income/(loss) from continuing operations	(272)	299	1,293	(122)	(1,254)	(195)	194	257
Income/(loss) from discontinued operations net of income taxes	421	768	7,556	1,062	(102)	(26)	15,563	749
Net (loss)/income	149	1,067	8,849	940	(1,356)	(221)	15,757	1,006
Net (loss)/income attributable to common stockholders	$ 84	$ 1,004	$ 8,785	$ 873	$ (1,390)	$ (251)	$ 15,723	$ 939
Net income/(loss) per share from continuing operations:								
Basic	$ (0.01)	$ 0.01	$ 0.05	$ —	$ (0.05)	$ (0.01)	$ 0.01	$ 0.01
Diluted	$ (0.01)	$ 0.01	$ 0.04	$ —	$ (0.05)	$ (0.01)	$ 0.01	$ 0.01
Net income/(loss) per share from discontinued operations:								
Basic	$ 0.02	$ 0.03	$ 0.27	$ 0.04	$ —	$ —	$ 0.56	$ 0.03
Diluted	$ 0.02	$ 0.02	$ 0.23	$ 0.04	$ —	$ —	$ 0.48	$ 0.02
Net income/(loss) attributable to common stockholders:								
Basic	$ —	$ 0.04	$ 0.31	$ 0.03	$ (0.05)	$ (0.01)	$ 0.57	$ 0.03
Diluted	$ —	$ 0.03	$ 0.27	$ 0.03	$ (0.05)	$ (0.01)	$ 0.48	$ 0.03
Weighted average shares:								
Basic	27,204,989	27,531,361	27,901,631	28,067,348	27,541,356	27,600,147	27,692,539	27,485,278
Diluted	27,204,989	31,506,745	33,055,881	28,067,348	27,541,356	27,600,147	32,714,389	31,790,418

17. Discontinued Operations

On August 9, 2017, we completed the sale of our high speed optical receivers ("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 (the "Transaction"). The purchase price is subject to adjustment in the future based upon a determination of final working capital, as defined in the asset purchase agreement. The HSOR business was a component of the operations of Advanced Photonix, Inc., which we acquired in May 2015. As part of the Transaction, the buyer also hired approximately 49 of our employees who were engaged in the development, manufacture, and sale of HSOR products in addition to certain corporate administrative functions. The buyer provided certain transition services to us with respect to infrastructure and administration for which we paid $0.3 million per month for a period of five months, for a total of $1.5 million. We recorded this obligation as a reduction of the value of the purchase price. In assessing the fair value of the services expected to be received by us in relation to those we expected to deliver to the buyer, we concluded that the transition service payments were more closely aligned with the fair value of the assets sold than the services received and, thus, should be accounted for as part of the consideration reconciliation rather than operating activities. Our HSOR business accounted for 16.1% of revenues and 18.5% of our costs of revenues for the year ended December 31, 2017.

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 in accordance with GAAP 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 purchase price is subject to adjustment in the future based upon a determination of final working capital, as defined in the asset purchase agreement. 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 both our HSOR and Opto businesses as discontinued operations in our consolidated financial statements. We allocated a portion of the consolidated tax expense to discontinued operations based on the ratio of the discontinued business's loss before allocations. We allocated a portion of the consolidated tax (benefit)/expense to discontinued operations based on the ratio of the discontinued business's loss/(income) before allocations.

The following table presents a summary of the transactions related to the sales of Opto in the year ended December 31, 2018 and HSOR in the year ended December 31, 2017:

	Year Ended December 31, 2018	Year Ended December 31, 2017
Sale price	$ 17,500,000	$ 33,500,000
Less: transition services payments	—	(1,500,000)
Adjusted purchase price	17,500,000	32,000,000
Assets held for sale	(8,193,184)	(16,851,540)
Liabilities held for sale	989,453	2,330,052
Transaction costs	(858,227)	(895,186)
Return of working capital	730,000	—
Income tax expense	(1,572,245)	(912,298)
Gain on sale of discontinued operations	$ 8,595,797	$ 15,671,028

Assets and liabilities held for sale as of December 31, 2017 were as follows:

		December 31, 2017
Assets		
Current assets:		
Accounts receivable, net	$	1,940,125
Inventory		2,316,329
Prepaid expenses and other current assets		79,651
Total current assets		4,336,105
Property and equipment, net		599,102
Intangible assets, net		1,510,203
Goodwill		502,000
Other assets		16,028
Total non-current assets		2,627,333
Total assets held for sale	$	6,963,438
Liabilities		
Current liabilities:		
Accounts payable	$	851,785
Accrued liabilities		120,666
Deferred revenue		—
Total current liabilities		972,451
Long-term deferred rent		—
Total non-current liabilities		—
Total liabilities held for sale	$	972,451

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

	Year Ended December 31,			
		2018		2017
Net revenues	$	8,363,606	$	19,511,646
Cost of revenues		5,294,268		12,994,656
Operating expenses		1,728,113		5,413,952
Other (income)/expenses		(13,330)		31,758
Income before income taxes		1,354,555		1,071,280
Allocated tax expense		183,921		876,588
Operating income from discontinued operations		1,170,634		194,692
Gain on sale, net of related income taxes		8,595,797		15,671,028
Net income from discontinued operations	$	9,766,431	$	15,865,720

For the years ended December 31, 2018 and 2017, depreciation and amortization from discontinued operations were $0.2 million and $1.3 million, respectively. For the years ended December 31, 2018 and 2017, the acquisition of property plant and equipment for discontinued operations were $0.1 million in each period. For the years ended December 31, 2018 and 2017, intangible property costs associated with discontinued operations were $0.01 million and $0.1 million, respectively. Proceeds from the sale of the Opto business which were included in cash flows from investing activities in 2018 were $16.0 million and proceeds from the sale of the HSOR business which are included in cash flows from investing activities for 2017 were $28.0 million. The gain on sale of discontinued operations included in non-cash adjustments to cash flows from operating activities for 2018 and 2017 was $8.6 million and $15.7 million, respectively.

18. Business Acquisitions

On October 15, 2018, we acquired substantially all of the assets, other than cash, the United States operations of Micron Optics, Inc. ("MOI") for cash consideration of $5.5 million, of which $5.0 million was paid during 2018, with the remaining $0.5 million reflected in accrued liabilities. The transaction has been accounted for under the acquisition method of accounting in accordance with ASC 805. We incurred approximately $0.8 million of costs associated with the acquisition during 2018, which are included in selling, general and administrative expenses in our consolidated statement of operations. For the period from the closing of the acquisition through December 31, 2018, we recognized revenues of $2.6 million and income of $1.1 million associated with the operations of MOI.

Under the acquisition method of accounting, 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 a preliminary allocation of the purchase consideration with the assistance of a third-party valuation expert. The following allocation of the purchase consideration is subject to revision as additional information becomes known in the future.

	Preliminary Allocation
Accounts receivable	$ 1,742,693
Inventory	1,435,606
Other current assets	69,951
Property and equipment	996,460
Identifiable intangible assets	1,650,000
Goodwill	101,008
Accounts payable and accrued expenses	(450,985)
Total purchase consideration	$ 5,544,733

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

	Estimated Fair Value	Estimated Useful Life
Developed technology	$ 1,200,000	5.0 years
In process research and development	200,000	7.0 years
Trade names	150,000	3.0 years
Customer base	100,000	7.0 years
	$ 1,650,000	

Developed technologies acquired primarily consists of MOI's existing technologies related to fiber optic sensing instruments, modules, and components. 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. A discount rate of 24.5% was used to discount the cash flows to present value.

In process research and development represents the fair value of incomplete MOI research and development projects that had not reached technological feasibility as of the closing date of the acquisition. In the future, the fair value of such project at the closing date of the acquisition will be either amortized or impaired depending on whether the project is completed or abandoned. 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 the 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 MOI's existing customers as of the closing date of the acquisition. 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. A discount rate of 24.5% was used to discount cash flows 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 brand. 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. A discount rate of 17% was used to discount the cash flows 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.

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 acquisition of MOI had been completed on January 1, 2017. The pro forma information includes adjustments to depreciation expense for property and equipment acquired, to amortize expense for the intangible assets acquired, and to eliminate the acquisition transaction expenses recognized in each period. Transaction-related expenses associated with the acquisition and excluded from the pro forma income/(loss) from continuing operations were $0.8 million. 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 acquisition of MOI actually occurred on January 1, 2017, 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.

	Year ended December 31,	
	2018	2017
	(unaudited)	(unaudited)
Revenue	$ 49,494,358	$ 40,954,093
Income/(loss) from continuing operations	$ 1,579,318	$ (2,778,487)

On March 1, 2019, we acquired the outstanding stock of General Photonics Corporation 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 can become obligated to pay additional cash consideration of up to $1.0 million if certain revenue targets for the General Photonics Corporation historical business are met for the twelve month period following the closing. The purchase price is also subject to adjustment based upon the determination of final working capital as of the closing date compared to a target working capital valued specified in the stock purchase agreement. We have not yet completed its analysis of the fair market value of the assets acquired and liabilities assumed as of the closing date and the associated allocation of the purchase price.

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, 2018, 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, 2018 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, 2018. 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. This evaluation excluded the internal control over financial reporting of the United States operations of Micron Optics, Inc. ("MOI"), which were acquired on October 15, 2018. The total acquired assets, based on the preliminary purchase allocation is approximately 8% of our consolidated assets. Revenues and income from continuing operations from MOI for the period from October 16, 2018 through December 31, 2018, were approximately 6% and 83%, 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, 2018 to provide reasonable assurance regarding the reliability of financial reporting and the preparation of financial statements for external purposes in accordance with GAAP.

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 2019 Annual Meeting of Stockholders, (the "2019 Proxy Statement"), anticipated to be filed with the SEC within 120 days after December 31, 2018, 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 2019 Proxy Statement.

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

Other than the information below relating to securities authorized for issuance under our equity compensation plans, 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 2019 Proxy Statement.

EQUITY COMPENSATION PLANS

The following table summarizes our equity compensation plans as of December 31, 2018:

Plan category	Number of securities to be issued upon exercise of outstanding options, warrants and rights (a)	Weighted-average exercise price of outstanding options, warrants and rights (b)	Number of securities remaining available for future issuance under equity compensation plans (excluding securities reflected in column (a)) (c)
Equity compensation plans approved by security holders	3,316,888 (1)	2.16 (2)	2,702,667
Total	3,316,888 (1)	2.16 (2)	2,702,667

(1) Consists of 3,035,238 shares underlying stock options and 281,650 shares underlying restricted stock units.

(2) Does not take into account restricted stock units, which have no exercise price.

Our 2016 Equity Incentive Plan allows for forfeited awards to be added back to our pool of available awards, including awards forfeited from the 2006 Plan after the expiration date of our 2006 Plan.

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 2019 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 2019 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	Column C	Column D	Column E
	Balance at beginning of Period	Additions	Deductions	Balance at end of period
Year Ended December 31, 2017				
Reserves deducted from assets to which they apply:				
Deferred tax valuation allowance	$ 21,309,546	$ —	$ (16,288,802)	$ 5,020,744
Allowances for doubtful accounts	247,239	99,888	(60,410)	286,717
	$ 21,556,785	$ 99,888	$ (16,349,212)	$ 5,307,461
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
	$ 5,307,461	$ 3,500	$ (1,759,345)	$ 3,551,616

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

Exhibit No.	Exhibit Document
2.1(2)#	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. (Exhibit 2.1)
2.2(32)#	Asset Purchase Agreement, dated July 31, 2018 by and among Luna Innovations Incorporated, Advanced Photonix, Inc., Advanced Photonix Canada, Inc. and OSI Optoelectronics, Inc. (Exhibit 2.1)
2.3(33)#	Asset Purchase Agreement, dated October 15, 2018 by and among Luna Innovations Incorporated, Luna Technologies, Inc. and Micron Optics, Inc. (Exhibit 2.1)
2.4(34)+#	Stock Purchase Agreement, dated March 1, 2019 by and among Luna Innovations Incorporated, Luna Technologies, Inc., Steve Yao and General Photonics Corporation (Exhibit 2.1)
3.1(3)	Amended and Restated Certificate of Incorporation of the Registrant (Exhibit 3.2)
3.2(4)	Certificate of Designations of the Series A Convertible Preferred Stock (Exhibit 3.1)
3.3(5)	Amended and Restated Bylaws of the Registrant (Exhibit 3.4)
3.4(6)	Amendment to Amended and Restated Bylaws (Exhibit 3.1)
3.4(2)	Amendment to Amended and Restated Bylaws (Exhibit 3.1)
4.1(7)	Specimen Common Stock certificate of the Registrant (Exhibit 4.1)
4.2(8)	2006 Equity Incentive Plan (Exhibit 10.9)
4.3(5)	Form of Stock Option Agreement under 2006 Equity Incentive Plan (Exhibit 4.7)
4.4(29)	2016 Equity Incentive Plan (Exhibit 4.7)
4.5(29)	Form of Stock Option Grant Notice and Stock Option Agreement under 2016 Equity Incentive Plan (Exhibit 4.8)
4.6(35)	Form of Restricted Stock Unit Grant Notice and Restricted Stock Unit Award Agreement under 2016 Equity Incentive Plan (Exhibit 4.1)
4.7(30)	Form of Restricted Stock Award Grant Notice and Restricted Stock Award Agreement under 2016 Equity Incentive Plan (Exhibit 10.1)
10.1(9)	Form of Indemnification Agreement for directors and executive officers (Exhibit 10.1)
10.2(7)**	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 (Exhibit 10.22)
10.3(7)**	License Agreement No. DN-951, dated December 20, 2000, by and between NASA and Luna Technologies, Inc. (Exhibit 10.23)
10.4(7)**	Amended and Restated License Agreement, dated March 19, 2004, by and between Virginia Tech Intellectual Properties, Inc. and Luna Innovations Incorporated (Exhibit 10.26)
10.5(10)	Asset Transfer and License Agreement by and between Luna Innovations Incorporated and Coherent, Inc. (Exhibit 10.21)
10.6(11)**	Development and Supply Agreement, dated December 12, 2006, by and between Luna Innovations Incorporated and Intuitive Surgical, Inc. dated June 11, 2007 (Exhibit 10.1)
10.8(12)	Amendment to Commercial Lease, by and between Luna Innovations Incorporated and Canvasback Real Estate & Investments LLC dated March 18, 2008 (Exhibit 10.5)
10.9(4)	Securities Purchase and Exchange Agreement, dated January 12, 2010, by and between Luna Innovations Incorporated and Carilion Clinic (Exhibit 10.1)
10.10(4)	Warrant No. 1 to Purchase Common Stock, dated January 13, 2010, issued to Carilion Clinic (Exhibit 10.2)
10.11(4)	Warrant No. 2 to Purchase Common Stock, dated January 13, 2010, issued to Carilion Clinic (Exhibit 10.3)
10.12(4)	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 (Exhibit 10.4)
10.13(36)	Non-Employee Directors' Deferred Compensation Plan (Exhibit 10.13)
10.14(13)**	License Agreement, effective January 12, 2010, by and among Luna Innovations Incorporated, Luna Technologies, Inc. and Hansen Medical, Inc. (Exhibit 10.6)
10.15(13)**	License Agreement, effective January 12, 2010, by and among Luna Innovations Incorporated, Luna Technologies, Inc. and Intuitive Surgical, Inc. (Exhibit 10.8)
10.16(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 (Exhibit 10.14)
10.17(13)	Loan and Security Agreement, dated February 18, 2010, by and between Luna Innovations Incorporated, Luna Technologies, Inc. and Silicon Valley Bank (Exhibit 10.5)

10.18(14)	Third Amendment to Commercial Lease dated June 21, 2010, by and between Canvasback Real Estate & Investments, LLC and Luna Innovations, Incorporated (Exhibit 10.5)
10.19(15)	First Loan Modification Agreement, dated as of March 7, 2011, by and between Luna Innovations Incorporated and Silicon Valley Bank (Exhibit 10.1)
10.20(16)	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 (Exhibit 10.3)
10.21(17)	Second Loan Modification Agreement, dated as of May 18, 2011, by and between Luna Innovations Incorporated, Luna Technologies, Inc. and Silicon Valley Bank (Exhibit 10.1)
10.22(18)	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 (Exhibit 10.39)
10.23(36)	Employment Agreement dated December 5, 2017, by and between Scott A. Graeff and Luna Innovations Incorporated (Exhibit 10.25)
10.24(19)	Fourth Amendment to Commercial Lease, dated as of April 15, 2012, by and between Canvasback Real Estate & Investments, LLC and Luna Innovations Incorporated (Exhibit 10.3)
10.25(20)	Third Loan Modification Agreement, dated as of May 17, 2012, by and between Luna Innovations Incorporated, Luna Technologies, Inc. and Silicon Valley Bank (Exhibit 10.1)
10.28(21)	Fourth Loan Modification Agreement, dated March 21, 2013, by and between Luna Innovations Incorporated, Luna Technologies, Inc. and Silicon Valley Bank (Exhibit 10.1)
10.27(1)**	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 (Exhibit 10.2)
10.28(1)**	Consent, Release and Fifth Loan Modification Agreement between Luna Innovations incorporated and Silicon Valley Bank dated as of January 21, 2014 (Exhibit 10.3)
10.29(22)	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 (Exhibit 10.47)
10.30(22)	Industrial Lease Agreement by and between The Economic Development Authority of Montgomery County, Virginia and Luna Innovations Incorporated dated October 1, 2014 (Exhibit 10.48)
10.31(22)	Lease Agreement by and between SBA Tenant, LLC and Luna Innovations Incorporated dated November 2014 (Exhibit 10.49)
10.32(23)	Joinder, Consent, and Sixth Loan Modification Agreement between Luna Innovations Incorporated, Luna Technologies, Inc., Advanced Photonix, LLC and Silicon Valley Bank, dated as of May 8, 2015 (Exhibit 10.1)
10.33(24)	Joinder, Consent, and Seventh Loan Modification Agreement between Luna Innovations Incorporated, Luna Technologies, Inc., Advanced Photonix, LLC and Silicon Valley Bank, dated as of September 29, 2015 (Exhibit 10.1)
10.34(25)	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 (Exhibit 10.3)
10.35(26)	Amended and Restated Non-Employee Director Compensation Policy, dated June 30, 2015 (Exhibit 10.1)
10.36(27)	Fifth Amendment to Commercial Lease by and between Canvasback Real Estate and Investments, LLC and the Registrant, dated as of August 5, 2015 (Exhibit 10.2)
10.37(28)	Eighth Loan Modification Agreement, dated December 15, 2016, by and between Luna Innovations Incorporated, Luna Technologies, Inc., Advanced Photonix, LLC and Silicon Valley Bank (Exhibit 10.54)
10.38(31)	Employment Agreement, dated May 1, 2018 by and between the Registrant and Dale E. Messick (Exhibit 10.1)
21.1	List of Subsidiaries
23.1	Consent of Grant Thornton LLP, Independent Registered Public Accounting Firm
24.1	Power of Attorney (see signature page)
31.1	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.
31.2	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.
32.1***	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.
32.2***	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.

101	The following materials from the Registrant's Annual Report on Form 10-K for the year ended December 31, 2018, are formatted in XBRL (eXtensible Business Reporting Language): (i) Consolidated Balance Sheets at December 31, 2018 and 2017, (ii) Consolidated Statements of Operations for the years ended December 31, 2018 and 2017, (iii) Consolidated Statements of Changes in Stockholder's Equity for the years ended December 31, 2018 and 2017 (iv) Consolidated Statements of Cash Flows for the years ended December 31, 2018 and 2017, and (v) Notes to Audited Consolidated Financial Statements.

(1) Incorporated by reference to the exhibit to the Registrant's Quarterly Report on Form 10-A, Commission File No. 000-52008, filed on May 13, 2014. The number given in parentheses indicates the corresponding exhibit number in such Form 10-Q.

(2) Incorporated by reference to the exhibit to the Registrant's Current Report on Form 8-K, Commission File No. 000-52008, filed on February 2, 2015. The number given in parentheses indicates the corresponding exhibit number in such Form 8-K.

(3) Incorporated by reference to the exhibit to the Registrant's Current Report on Form 8-K, Commission File No. 000-52008, filed on June 8, 2006. The number given in parentheses indicates the corresponding exhibit number in such Form 8-K.

(4) Incorporated by reference to the exhibit to the Registrant's Current Report on Form 8-K, Commission File No. 000-52008, filed on January 15, 2010 (reporting under Items 1.01, 3.02, 3.03, 5.03 and 9.01). The number given in parentheses indicates the corresponding exhibit number in such Form 8-K.

(5) Incorporated by reference to the exhibit to the Registrant's Registration Statement on Form S-1, Commission File No. 333-131764, filed on February 10, 2006. The number given in parentheses indicates the corresponding exhibit number in such Form S-1.

(6) Incorporated by reference to the exhibit to the Registrant's Current Report on Form 8-K, Commission File No. 000-52008, filed with the Securities and Exchange Commission on May 10, 2010. The number in parentheses indicates the corresponding exhibit number in such Form 8-K.

(7) Incorporated by reference to the exhibit to Amendment No. 5 of the Registrant's Registration Statement on Form S-1, Commission File No. 333-131764, filed on May 19, 2006. The number given in parentheses indicates the corresponding exhibit number in such Form S-1.

(8) Incorporated by reference to the exhibit to Amendment No. 3 of the Registrant's Registration Statement on Form S-1, Commission File No. 333-131764, filed on April 28, 2006. The number given in parentheses indicates the corresponding exhibit number in such Form S-1.

(9) Incorporated by reference to the exhibit to the Registrant's Current Report on Form 8-K, Commission File No. 000-52008, filed on July 17, 2009 (reporting under Items 1.01, 5.02 and 9.01). The number given in parentheses indicates the corresponding exhibit number in such Form 8-K.

(10) Incorporated by reference to the exhibit to Amendment No. 1 to Registrant's Annual Report on Form 10-K, Commission File No. 000-52008, filed on April 6, 2007. The number given in parentheses indicates the corresponding exhibit number in such Form 10-K/A.

(11) Incorporated by reference to the exhibit to the Registrant's Current Report on Form 8-K, Commission File No. 000-52008, filed on June 14, 2007. The number given in parentheses indicates the corresponding exhibit number in such Form 8-K.

(12) Incorporated by reference to the exhibit to Registrant's Quarterly Report on Form 10-Q, Commission File No. 000-52008, filed on May 9, 2008. The number given in parentheses indicates the corresponding exhibit number in such Form 10-Q.

(13) Incorporated by reference to the exhibit to Registrant's Quarterly Report on Form 10-Q, Commission File No. 000-52008, filed on May 17, 2010. The number given in parentheses indicates the corresponding exhibit number in such Form 10-Q.

(14) Incorporated by reference to the exhibit to Registrant's Quarterly Report on Form 10-Q, Commission File No. 000-52008, filed on August 16, 2010. The number given in parentheses indicates the corresponding exhibit number in such Form 10-Q.

(15) Incorporated by reference to the exhibit to the Registrant's Current Report on Form 8-K, Commission File No. 000-52008, filed on March 9, 2011. The number given in parentheses indicates the corresponding exhibit number in such Form 8-K.

(16) Incorporated by reference to the exhibit to Registrant's Quarterly Report on Form 10-Q, Commission File No. 000-52008, filed on May 16, 2011. The number given in parentheses indicates the corresponding exhibit number in such Form 10-Q.

(17) Incorporated by reference to the exhibit to Registrant's Quarterly Report on Form 10-Q, Commission File No. 000-52008, filed on August 12, 2011. The number given in parentheses indicates the corresponding exhibit number in such Form 10-Q.

(18) Incorporated by reference to the exhibit to the Registrant’s Annual Report on Form 10-K, Commission File No. 000-52008, filed on March 29, 2012. The number given in parentheses indicates the corresponding exhibit number in such Form 10-K.
(19) Incorporated by reference to the exhibit to the Registrant’s Quarterly Report on Form 10-Q, Commission File No. 000-52008, filed on August 9, 2012. The number given in parentheses indicates the corresponding exhibit number in such Form 10-Q.
(20) Incorporated by reference to the exhibit to the Registrant’s Current Report on Form 8-K, Commission File No. 000-52008, filed on July 11, 2012. The number given in parentheses indicates the corresponding exhibit number in such Form 8-K.
(21) Incorporated by reference to the Registrant’s Current Report on Form 8-K, Commission File No. 000-52008, filed on March 27, 2013. The number given in parentheses indicates the corresponding exhibit number in such Form 8-K.
(22) Incorporated by reference to the exhibit to the Registrant's Quarterly Report on Form 10-K, Commission File No. 000-52008, filed on March 16, 2015. The number given in parentheses indicates the corresponding exhibit number in such Form 10-K.
(23) Incorporated by reference to the exhibit to the Registrant’s Current Report on Form 8-K, Commission File No. 000-52008, filed on May 11, 2015. The number given in parentheses indicates the corresponding exhibit number in such Form 8-K.
(24) Incorporated by reference to the exhibit to the Registrant’s Current Report on Form 8-K, Commission File No. 000-52008, filed on October 5, 2015. The number given in parentheses indicates the corresponding exhibit number in such Form 8-K.
(25) Incorporated by reference to the exhibit to the Registrant’s Quarterly Report on Form 10-Q, Commission File No. 000-52008, filed on May 14, 2015. The number given in parentheses indicates the corresponding exhibit number in such Form 10-Q.
(26) Incorporated by reference to the exhibit to the Registrant’s Current Report on Form 10-Q, Commission File No. 000-52008, filed on August 14, 2015. The number given in parentheses indicates the corresponding exhibit number in such Form 10-Q.
(27) Incorporated by reference to the exhibit to the Registrant's Quarterly Report on Form 10-Q, Commission File No. 000-52008, filed on November 13, 2015. The number given in parentheses indicates the corresponding exhibit number in such Form 10-Q.
(28) Incorporated by reference to the exhibit to the Registrant's Annual Report on Form 10-K, Commission File No. 000-52008, filed on March 20, 2017. The number given in parentheses indicates the corresponding exhibit number in such Form 10-K.
(29) Incorporated by reference to the exhibit to the Registrant’s Registration Statement on Form S-8, Commission File No. 333-211802, filed on June 3, 2016. The number given in parentheses indicates the corresponding exhibit number in such Form S-8.
(30) Incorporated by reference to the exhibit to the Registrant’s Quarterly Report on Form 10-Q, Commission File No. 000-52008, filed on August 10, 2016. The number given in parentheses indicates the corresponding exhibit number in such Form 10-Q.
(31) Incorporated by reference to the exhibit to the Registrant's Current Report on Form 8-K, Commission File No. 000-52008, filed on August 1, 2018. The number given in parentheses indicates the corresponding exhibit number in such Form 8-K.
(32) Incorporated by reference to the exhibit to the Registrant's Quarterly Report on Form 10-Q, Commission File No. 000-52008, filed on August 1, 2018. The number given in parentheses indicates the corresponding exhibit number in such Form 10-Q.
(33) Incorporated by reference to the exhibit to the Registrant's Current Report on Form 8-K, Commission File No. 000-52008, filed on October 16, 2018. The number given in parentheses indicates the corresponding exhibit number in such Form 8-K.
(34) Incorporated by reference to the exhibit to the Registrant's Current Report on Form 8-K, Commission File No. 000-52008, filed on March 4, 2018. The number given in parentheses indicates the corresponding exhibit number in such Form 8-K.
(35) Incorporated by reference to the exhibit to the Registrant's Current Report on Form 8-K, Commission File No. 000-52008, filed on January 14, 2019. The number given in parentheses indicates the corresponding exhibit number in such Form 8-K.
(36) Incorporated by reference to the exhibit to the Registrant's Annual Report on Form 10-K, Commission File No. 000-52008, filed on March 21, 2018. The number given in parentheses indicates the corresponding exhibit number in such Form 10-K.

\+ Confidential treatment has been requested with respect to portions of this exhibit, indicated by asterisks, which has been filed separately with the Securities and Exchange Commission.

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.

Table of Contents

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/ Dale E. Messick

Dale E. Messick
Chief Financial Officer

March 14, 2019

KNOW ALL PERSONS BY THESE PRESENTS, that each person whose signature appears below hereby constitutes and appoints Scott A. Graeff and Dale E. Messick, 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.

Signature	Title	Date
/s/ Scott A. Graeff **Scott A. Graeff**	President, Chief Executive Officer and Director (Principal Executive Officer)	March 14, 2019
/s/ Dale E. Messick **Dale E. Messick**	Chief Financial Officer (Principal Financial Officer and Principal Accounting Officer)	March 14, 2019
/s/ Michael W. Wise **Michael W. Wise**	Director	March 14, 2019
/s/ Donald Pastor **Donald Pastor**	Director	March 14, 2019
/s/ John B. Williamson III **John B. Williamson III**	Director	March 14, 2019
/s/ N. Leigh Anderson **N. Leigh Anderson**	Director	March 14, 2019
/s/ Warren B. Phelps, III **Warren B. Phelps, III**	Director	March 14, 2019
/s/ Gary Spiegel **Gary Spiegel**	Director	March 14, 2019
/s/ Richard W. Roedel **Richard W. Roedel**	Chairman of the Board of Directors	March 14, 2019

EXHIBIT 10.13

LUNA INNOVATIONS INCORPORATED

NON-EMPLOYEE DIRECTORS’ DEFERRED COMPENSATION PLAN

As Amended and Restated Through December 2017

TABLE OF CONTENTS

		Page
ARTICLE 1	INTRODUCTION	1
ARTICLE 2	ELIGIBILITY	1
ARTICLE 3	DEFERRAL ELECTIONS	1
ARTICLE 4	DEFERRED COMPENSATION ACCOUNTS	2
ARTICLE 5	DISTRIBUTION OF DEFERRED COMPENSATION	2
ARTICLE 6	UNFUDED STATUS	3
ARTICLE 7	DESIGNATION OF BENEFICIARY	4
ARTICLE 8	ADMINISTRATION	4
ARTICLE 9	TAXES	4
ARTICLE 10	SECURITIES LAWS COMPLIANCE	5
ARTICLE 11	GENERAL PROVISIONS	5
ARTICLE 12	DEFINITIONS	6

ARTICLE 1

INTRODUCTION

1.1 *Establishment*. Luna Innovations Incorporated (the "**Company**") established this Non-Employee Directors' Deferred Compensation Plan (the "**Plan**") for those members of the Company's Board of Directors who are not employees of the Company or any of its subsidiaries or affiliates. The Plan allows such Eligible Directors to defer the receipt of their Director Fees and to receive settlement of the right to receive payment of such amounts in the form of an issuance of Company Shares. Capitalized terms used in the Plan have the definitions set forth in Article 12.

1.2 *Purpose*. This Plan is intended to advance the interests of the Company and its stockholders by providing a means to attract and retain qualified persons to serve as Eligible Directors and to promote Company equity ownership by Eligible Directors, thereby aligning such Eligible Directors' interests more closely with the interests of the stockholders of the Company.

1.3 *Effective Date*. This Plan originally became effective as of August 9, 2007 (the "**Effective Date**"). This amendment and restatement of the Plan is effective December 28, 2017.

ARTICLE 2

ELIGIBILITY

2.1 *Effective Date Eligibility*. Each person who was an Eligible Director on the Effective Date became eligible to participate in the Plan on the Effective Date.

2.2 *Initial Board Appointment Eligibility*. Each person who becomes an Eligible Director following the Effective Date shall become eligible on the date of his or her initial appointment to the Board.

2.3 *Change in Employment Status*. If any Participant subsequently becomes an employee of the Company or any of its subsidiaries or affiliates such Participant shall not be eligible to defer any Director Fees earned during any calendar year that commences following such change in status, if applicable. Such change in status shall not otherwise impact the Participant's Stock Unit Account, which will continue to be administered in accordance with the terms of the Plan and the Participant's Deferral Election.

ARTICLE 3

DEFERRAL ELECTIONS

3.1 *Deferral Elections*. Each Eligible Director may elect to defer a whole percentage (in increments of 1%) of up to 100% of his or her Cash Director Fees and/or Stock Director Fees by submitting a completed Deferral Election form to the Administrator in accordance with the procedures set forth in this Article 3.

3.2 *Timing of Deferral Election*. An Eligible Director may make a Deferral Election within thirty (30) days after the date on which he or she initially becomes eligible to participate in the Plan (the "**Initial Election Period**"). An Eligible Director who does not make a Deferral Election within the Initial Election Period may make a Deferral Election in accordance with administrative procedures established by the Administrator.

3.3 *Effect and Duration of Deferral Election*. A Deferral Election shall apply only to Director Fees earned after the date such election is made and is irrevocable consistent with the requirements of Section 409A. Any Deferral Election made within the Initial Election Period will be irrevocable upon expiration of the Initial Election Period and will apply to any Director Fees earned during calendar quarters that commence following expiration of such Initial Election Period, including calendar quarters in any subsequent calendar year. Any Deferral Election made after expiration of the Initial Election Period will be irrevocable as of December 31st of the calendar year in which it was made and will apply to any Director Fees earned in any subsequent calendar year. Deferral Elections shall evergreen so that they will continue in effect and will be applicable to Director Fees earned in all subsequent calendar years, unless and until such Deferral Election is modified as provided in Section 3.4.

3.4 *Modifications to Deferral Elections*. A Participant may revoke or modify a prior Deferral Election by submitting a new Deferral Election to the Administrator at such time before the first day of any subsequent calendar year in accordance with procedures established by the Administrator. Any modified Deferral Election will commence effectiveness with respect to such subsequent calendar year and will evergreen and remain effective for calendar years commencing thereafter.

3.5 *Form of Deferral Election*. A Deferral Election shall be made in a form approved by the Administrator (including in the form attached to the Plan as Appendix I).

ARTICLE 4

DEFERRED COMPENSATION ACCOUNTS

4.1 *Establishment of Stock Unit Account*. The Company shall establish a Stock Unit Account for each Participant. All Director Fees deferred pursuant to Article 3 shall be converted to Stock Units which are credited to the Participant's Stock Unit Account on the Deferral Date. Stock Director Fees deferred under the Plan will have the number of Shares subject to such deferral election converted into an equivalent number of Stock Units credited to the Participant's Stock Unit Account. With respect to any Cash Director Fees deferred under the Plan, the number of Stock Units credited to a Participant's Stock Unit Account as of a Deferral Date shall equal the amount of the deferred Director Fees divided by the Fair Market Value of a Share on such Deferral Date, with fractional Stock Units calculated to three decimal places. Fractional Stock Units shall be credited cumulatively, but any fractional Stock Unit credited to a Participant's Stock Unit Account at the time of a distribution under Article 5 shall be converted into the right to receive a cash amount equal to the Fair Market Value of a corresponding fractional Share on the date of distribution.

4.2 *Crediting of Dividend Equivalents*. As of each dividend payment date with respect to Shares, if any, each Participant shall have credited to his or her Stock Unit Account a dollar amount equal to the amount of cash dividends that would have been paid on the number of Shares equal to the number of Stock Units credited to the Participant's Stock Unit Account as of the close of business on the record date for such dividend. Such dollar amount shall then be converted into a number of Stock Units equal to the number of whole and fractional Shares that could have been purchased with such dollar amount at Fair Market Value on the dividend payment date.

4.3 *Adjustment Provisions*. In the event of a reorganization, recapitalization, stock split, stock dividend, spin off, combination, corporate exchange, merger, consolidation or other change in the Shares that does not qualify as a Change in Control, or any distribution to holders of Shares other than cash dividends or any transaction determined in good faith by the Administrator to be similar to the foregoing but, the Administrator shall make appropriate equitable changes in the number of Stock Units credited to the Participant's Stock Unit Account.

ARTICLE 5

DISTRIBUTION OF DEFERRED COMPENSATION

5.1 *Share Settlement and Source of Shares*. Settlement of a Participant's Stock Unit Account will be effected by delivering to the Participant a number of Shares equal to the number of whole Stock Units credited to the Participant's Stock Unit Account. The source of Shares distributed pursuant to this Plan shall be the Company's 2016 Equity Incentive Plan or any successor equity incentive plan adopted by the Company. Any fractional Stock Units credited to a Participant's Stock Unit Account at the time of a distribution shall be paid in cash at the time of such distribution.

5.2 *Timing and Form of Distribution*. The Participant shall specify on the Deferral Election form the timing of distribution in settlement of the Participant's Stock Unit Account as specified on the Deferral Election form, which may commence on any of the following permissible distribution events, with such distribution to be made in either (i) a lump sum, or (ii) substantially equal annual installments over a period not to exceed five (5) years:

(a) The Participant's Separation from Service;

(b) Change in Control; or

(c) A Specified Date.

5.3 *Default Form of Distribution*. If a Participant submits a Deferral Election form but fails to specify a distribution event or form of distribution on the Deferral Election form, the Participant's Stock Unit Account will be distributed in a single lump sum upon Separation from Service.

5.4 *Specified Employee Delay in Distribution Upon Separation from Service*. The provisions of this Section 5.4 shall apply to the extent necessary to avoid adverse tax consequences to a Participant under Section 409A of the Code. If a Participant is a Specified Employee no distribution to such Participant which is triggered by a Separation from Service will be made any earlier than six months and one day following the date of the Separation from Service. If a Participant is a Specified Employee and is scheduled to receive payments in the form of annual installments upon a Separation from Service, the first annual installment payment will be made six months and one day following the date of the Separation from Service, and the remaining annual installment payments shall be made as originally scheduled.

5.5 *Distribution upon Death*. In the event of a Participant's death at any time prior to distribution of the Participant's entire Stock Unit Account, whether before or after such distribution had commenced, as soon as administratively feasible after the Participant's death the entire balance of the Participant's Stock Unit Account shall be immediately settled in an issuance of Shares with a cash payment for any fractional Stock Unit to the beneficiary designated by the Participant under Article 7.

5.6 *Unforeseeable Emergency*. In the event the Participant experiences an unforeseeable emergency as defined in Treas. Reg. § 1.409A-3(i)(3), the Administrator may, at the request of the Participant, make a distribution from the Participant's Stock Unit Account equivalent to the amount reasonably necessary to satisfy the emergency need. The balance of the Stock Unit Account will not be distributed until the occurrence of the earliest distribution event as provided in the Participant's Deferral Election. Unforeseeable emergency distributions will be administered in manner compliant with the requirements of Section 409A.

5.7 *Specified Date Distribution Downstream Election Changes*. A Participant who had elected to receive distribution in settlement of his or her Stock Unit Account on a Specified Date is permitted to elect to delay a distribution or change the form of a distribution in accordance with procedures established by the Administrator so long as the following conditions are met:

(a) Such election does not take effect until at least twelve (12) months after the date on which the election is made;

(b) Such election must defer the distribution for a period of at least five (5) years from the date such distribution would otherwise have been made; and

(c) If the distribution is scheduled to begin at specified time or pursuant to a fixed schedule, then such election must be made no less than twelve (12) months before the date the distribution is scheduled to be made.

Any subsequent deferral election shall become irrevocable as of the last permissible date for making such subsequent deferral election.

ARTICLE 6

UNFUNDED STATUS

6.1 *General*. The interest of each Participant in any Director Fees deferred under the Plan (and any Stock Units or Stock Unit Account relating thereto) shall be that of a general creditor of the Company. Stock Unit Accounts, and Stock Units credited thereto, shall at all times be maintained by the Company as bookkeeping entries evidencing unfunded and unsecured general obligations of the Company. Except as provided in Section 6.2, no money or other assets shall be set aside for any Participant.

6.2 *Trust*. To the extent determined by the Board, the Company may, but shall not be required to, transfer funds necessary to fund all or part of the payments under the Plan to a trust; provided, the assets held in such trust shall remain at all times subject to the claims of the general creditors of the Company. No participant or beneficiary shall have any interest in the assets held in such trust or in the general assets of the Company other than as a general, unsecured creditor. Accordingly, the Company shall not grant a security interest in the assets held by the trust in favor of any Participant, beneficiary or creditor.

ARTICLE 7

DESIGNATION OF BENEFICIARY

7.1 *Beneficiary Designation*. Each Participant may designate one or more beneficiaries to receive settlement of the Participant's Stock Unit Account in the event of such Participant's death. The Company may rely upon the beneficiary designation filed with the Administrator, provided that such form was executed by the Participant or his or her legal representative and filed with the Administrator prior to the Participant's death. If a Participant has not designated a beneficiary, or if the designated beneficiary is not surviving when a payment is to be made to such person under the Plan, the beneficiary with respect to such payment shall be the Participant's surviving spouse, or if there is no surviving spouse, the Participant's estate.

ARTICLE 8

ADMINISTRATION

8.1 *Administrator*. The Plan shall be administered by the Administrator appointed by the Board. Unless the Board determines otherwise, the Administrator shall be a committee of Company employees consisting of the Company's Chief Financial Officer, Corporate Secretary and one or more Company employees selected by the Chief Financial Officer. The Administrator shall have the authority to make all determinations it deems necessary or advisable for administering the Plan, subject to the express provisions of the Plan, and to delegate its authority to one or more Company employees.

8.2 *Binding Effect of Decisions*. The decision or action of the Administrator with respect to any question arising out of or in connection with the administration, interpretation and application of the Plan and the rules and regulations promulgated hereunder shall be final and conclusive and binding upon the Participants and any other persons having any interest in the Plan.

8.3 *Indemnification of Administrator*. The Company shall indemnify and hold harmless the members of the committee comprising the Administrator, and any Company employee to whom the duties of the Administrator are delegated, against any and all claims, losses, damages, expenses or liabilities arising from any action or failure to act with respect to this Plan, except in the case of willful misconduct.

ARTICLE 9

TAXES

9.1 *Withholding Taxes*. By electing to make a deferral under this Plan, each Participant authorizes any required withholding from, at the Company's election, distributions and any other amounts payable to the Participant, and the Participant otherwise agrees to make adequate provision for any sums required to satisfy the federal, state, local and foreign tax withholding obligations of the Company if any, which arise in connection with payments or distributions from this Plan. Unless the tax withholding obligations of the Company are satisfied, the Company shall have no obligation to make distributions under this Plan. Any tax withholding obligation triggered by a distribution of Shares will be satisfied by an automatic reduction in the number of Shares issued to the Participant or the Participant's beneficiary.

9.2 *409A Savings*. This Plan is intended to comply with the requirements of Section 409A of the Code. The Administrator shall interpret the Plan provisions in a manner consistent with the requirements of Section 409A of the Code. To the extent one or more provisions of this Plan do not comply with Section 409A of the Code, such provision shall be automatically and immediately voided, and shall be amended as soon as administratively feasible and shall be administered to so comply. Notwithstanding the foregoing or anything else to the contrary in the Plan, the Company shall have no liability to any Participant should any provision of the Plan fail to satisfy the requirements of Section 409A.

ARTICLE 10

SECURITIES LAWS COMPLIANCE

10.1 *Action by Administrator*. With respect to any Participant who is then subject to Section 16 of the Exchange Act, notwithstanding anything to the contrary set forth herein, any function of the Administrator under the Plan relating to such Participant shall be performed solely by the Board or its Compensation Committee, if and to the extent required to ensure the availability of an exemption under Section 16 of the Exchange Act for any transaction relating to such Participant under the Plan.

10.2 *Compliance with Section 16*. Notwithstanding any other provision of the Plan or any rule, instruction, election form or other form, the Plan and any such rule, instruction or form shall be subject to any additional conditions or limitations set forth in any applicable exemptive rule under Section 16 of the Exchange Act (including any amendment to Rule 16b-3) that are requirements for the application of such exemptive rule. To the extent permitted by applicable law, such provision, rule, instruction or form shall be deemed amended to the extent necessary to conform to such applicable exemptive rule.

ARTICLE 11

GENERAL PROVISIONS

11.1 *No Stockholder Rights Conferred*. Nothing contained in the Plan will confer upon any Participant or beneficiary any rights of a stockholder of the Company, unless and until Shares are in fact issued or transferred to such Participant or beneficiary in accordance with Article 5.

11.2 *Changes to The Plan*. The Administrator may amend, alter, suspend, discontinue, extend, or terminate the Plan without the consent of Participants; provided, no action taken without the consent of an affected Participant may materially impair the rights of such Participant with respect to any Stock Units credited to his or her Stock Unit Account at the time of such change or termination except that the Administrator may without the consent of any Participant terminate the Plan and distribute Shares in settlement of Stock Units then credited to Participant's Stock Unit Account upon a Change in Control.

11.3 *Compliance With Laws and Obligations*. The Company will not be obligated to issue or deliver Shares in connection with the Plan in a transaction subject to the registration requirements of the Securities Act of 1933, as amended, or any other federal or state securities law, any requirement under any listing agreement between the Company and any national securities exchange or automated quotation system or any other laws, regulations, or contractual obligations of the Company, until the Company is satisfied that such laws, regulations and other obligations of the Company have been complied with in full. Certificates representing Shares delivered under the Plan will be subject to such restrictions as may be applicable under such laws, regulations and other obligations of the Company.

11.4 *Limitations on Transferability*. Stock Units and other rights under the Plan may not be pledged, mortgaged, hypothecated or otherwise encumbered, and shall not be subject to the claims of creditors of any Participant.

11.5 *Governing Law*. The validity, construction and effect of the Plan and any agreement hereunder will be determined in accordance with laws of the State of Delaware.

11.6 *Plan Termination*. The Administrator reserves the right to terminate the Plan at any time to the extent such termination is in compliance with the requirements of Section 409A. Unless earlier terminated by action of the Board, the Plan will remain in effect until such time as the Company and the Participants have no further rights or obligations under the Plan.

11.7 *Acceleration of Plan Distributions*. The Administrator reserves the right to accelerate the distribution of Shares in settlement of Stock Unit Accounts to the extent compliant with the requirements of Section 409A, including any accelerated distribution permitted by Treas. Reg. § 1.409A-3(j)(4).

ARTICLE 12

DEFINITIONS

Wherever used herein, the following terms shall have the meanings set forth below:

"**Administrator**" means the committee appointed to administer the Plan under Article 8.

"**Board**" means the Board of Directors of the Company.

"Cash Director Fees" means all or part of any annual or quarterly retainer or meeting fees payable in cash to a Non-Employee Director as consideration for services provided as a Director in the form of cash.

"**Change in Control**" means a change in the ownership or effective control of the Company, or in the ownership of a substantial portion of the assets of the Company, as defined in Section 409A(a)(2)(A)(v) of the Code. Whether a Change in Control has occurred will be determined in manner consistent with the requirements of Section 409A.

"Code" means the Internal Revenue Code of 1986, as amended.

"**Company**" means Luna Innovations Incorporated, a Delaware corporation, or any successor thereto.

"**Deferral Date**" means the date Director Fees would otherwise have been paid to the Participant in the absence of a Deferral Election.

"**Deferral Election**" means a written election by a Participant to defer Director Fees under the Plan.

"**Director**" means any individual who is a member of the Board.

"**Director Fees**" means Cash Director Fees and/or Stock Director Fees. Director Fees shall not include any expenses paid directly or through reimbursement.

"**Eligible Director**" means a Director who is not an employee of the Company or any of its subsidiaries or affiliates.

"Exchange Act" means the Securities Exchange Act of 1934, as amended.

"**Fair Market Value**" of a Share means on a given date (a) if the principal market for the Shares is the Nasdaq stock market, a national securities exchange or other recognized national market or service reporting sales, the closing price of a Share on the date of the determination on the principal market on which the Shares are then listed or admitted to trading, (b) if the Shares are not listed on the Nasdaq stock market, a national securities exchange or other recognized national market or service reporting sales, the closing price of a Share on the date of the determination as reported by the system then regarded as the most reliable source of such quotations, (c) if Shares are listed on a domestic stock exchange or market or quoted in a domestic market or service, but there are not reported sales or quotations, as the case may be, on the given date, the value determined pursuant to (a) or (b) above using the reported sale prices or quotations on the last previous day on which so reported, or (d) if none of the foregoing clauses apply, the fair market value of a Share as determined in good faith by the Administrator.

"Specified Employee" means a "specified employee" as defined in Treas. Reg. § 1.409A-1(i).

"**Participant**" means an Eligible Director who elects to defer Director Fees under the Plan.

“Section 409A” shall mean Section 409A of the Code and the regulations and other guidance thereunder.

“**Separation from Service”** means the termination of an individual’s service as a Director for any reason within the meaning of Treas. Reg. § 1.409A-1(h). Whether a Separation from Service has occurred will be determined in manner consistent with the requirements of Section 409A.

“**Shares**” means shares of the Company’s common stock, par value $0.001 per share, or, in the event that the outstanding shares of the Company’s common stock are recapitalized, converted into or exchanged for different stock or securities of the Company, such other stock or securities..

“Specified Date” means the date elected by the Participant on the Deferral Form for commencement of distribution of Shares in settlement of the Participant’s Stock Unit Account.

“**Stock Units**” means the credits made to a Participant’s Stock Unit Account under Article 4 of the Plan. Each Stock Unit represents the right to receive one Share upon settlement of the Stock Unit Account.

“**Stock Unit Account**” means the bookkeeping account established by the Company pursuant to Section 4.1.

“Stock Director Fees” means all or part of any award providing for an issuance of Shares granted to a Non-Employee Director as consideration for services provided as a Director, but excluding any stock option.

APPENDIX I

FORM OF NOTICE OF ELECTION TO DEFER DIRECTOR FEES

[Date]

Corporate Secretary
Luna Innovations Incorporated
301 1st Street, SW Suite 200
Roanoke, VA 24011

RE: Notice of Election to Defer Board of Director Compensation

Dear Mr. Graeff:

Pursuant to the Luna Innovations Incorporated Non-Employee Directors' Deferred Compensation Plan, as amended (the "Plan"), I hereby elect to defer receipt of my Director fees that I earn in future periods, whether otherwise payable to me in cash ("Cash Director Fees") or in an issuance of shares of common stock or restricted stock units ("Stock Director Fees" and, collectively with the Cash Director Fees, the "Director Fees"), commencing with the Director Fees that I earn on or after January 1, 2018 in accordance with my elections below. I understand that this election will remain in effect with respect to any Director Fees that I earn in future taxable years unless and until changed by me in a manner permitted by Section 409A of the Internal Revenue Code.

I elect to have my Director Fees credited as follows (fill in appropriate percentages for options a, b, c and d below):

Cash Director Fees (percentages should total to 100%):

(a) _____% of my aggregate Cash Director Fees shall be credited to my Stock Unit Account as provided for in the Plan;

(b) _____% of my aggregate Cash Director Fees shall not be deferred;

Stock Director Fees (percentages should total to 100%):

(c) _____% of my aggregate Stock Director Fees shall be credited to my Stock Unit Account as provided for in the Plan; and

(d) _____% of my aggregate Stock Director Fees shall not be deferred.

I understand that application of any elected deferral percentage to Stock Director Fees will be rounded up the nearest whole share to avoid any fractional share deferral.

Further, I elect to receive any future payments to be made from my Stock Unit Account under the Plan in the following method (check one desired method below):

☐ in one lump sum; or

☐ in ______ (insert number) of equal annual installments.

I elect to receive (in the case of a lump sum) or begin to receive (in the case of installments) payment from my Stock Unit Account on the first day of the month next following the earlier of the following to occur:

(a) My Separation of Service (as defined by the Plan);
(b) My _______ birthday, which is ____________, 20___ (indicate the age you would like to trigger the distribution and the date upon which you will be that age);
(c) ____________ (indicate date that you would like to trigger distribution); or
(d) A Change in Control (as defined by the Plan).

I understand an election to defer my Director Fees is irrevocable as of each December 31 with respect to fees earned for services performed in the immediately following calendar year.

In the event of my death prior to the receipt of all or any amount of the balance of my Stock Unit Account so accumulated. I designate the following one or more individuals; ____; as my beneficiary or beneficiaries to receive any accumulated but unpaid funds from my Stock Unit Account.

Sincerely,

____
Signature of Director

____
Printed Name of Director

____
Date

EXHIBIT 21.1

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 report dated March 14, 2019, with respect to the consolidated financial statements included in the Annual Report of Luna Innovations Incorporated on Form 10-K for the year ended December 31, 2018. We consent to the incorporation by reference of said report 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 14, 2019

Exhibit 31.1

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 14, 2019

/S/ Scott A. Graeff

Scott A. Graeff
President and Chief Executive Officer
(principal executive officer)

Exhibit 31.2

CERTIFICATION OF PRINCIPAL FINANCIAL OFFICER PURSUANT TO SECTION 302 OF THE SARBANES-OXLEY ACT OF 2002

I, Dale E. Messick, 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 14, 2019

/S/ DALE E. MESSICK

Dale E. Messick

Chief Financial Officer
(principal financial officer)

Exhibit 32.1

**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, 2018 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 14, 2019

Exhibit 32.2

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, 2018 as filed with the Securities and Exchange Commission on the date hereof (the "Report"), I, Dale E. Messick, 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/ DALE E. MESSICK

Dale E. Messick
Chief Financial Officer
(principal financial officer)

March 14, 2019